FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 1 — Computer Systems

CHAPTER TEST — 1

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. A single binary digit (0 or 1) is called a:

A. Byte
B. Bit
C. Nibble
D. Word

2. In a digital computer, when current flows through an electronic switch, it represents:

A. Binary 0
B. Binary 1
C. LOW state
D. No signal

3. ASCII uses how many bits to represent a character?

A. 4 bits
B. 7 or 8 bits
C. 16 bits
D. 32 bits

4. Which of the following is an example of an analog signal?

A. MP3 audio file
B. JPEG image
C. Human speech
D. Binary code

5. Which logic gate produces a HIGH (1) output only when ALL inputs are HIGH (1)?

A. OR gate
B. AND gate
C. NOT gate
D. NAND gate

6. The Boolean expression F = x + y represents which logic gate?

A. AND gate
B. OR gate
C. NAND gate
D. NOR gate

7. Which principle states that a dual expression can be obtained by interchanging AND and OR operators while complementing variables?

A. Absorption Law
B. Principle of Duality
C. Identity Law
D. Distributive Law

8. Which phase of SDLC involves assessing whether a system is technically, financially, legally, and operationally feasible?

A. Analysis Phase
B. Design Phase
C. Feasibility Study Phase
D. Testing Phase

9. Which software development model follows a sequential approach where phases do not overlap?

A. Agile Model
B. Waterfall Model
C. Spiral Model
D. Prototype Model

10. In which network topology are all devices connected to a single central cable?

A. Star Topology
B. Ring Topology
C. Bus Topology
D. Mesh Topology

11. Which network topology provides the highest level of redundancy?

A. Bus Topology
B. Star Topology
C. Ring Topology
D. Mesh Topology

12. Which type of malware encrypts files and demands payment for decryption?

A. Virus
B. Worm
C. Ransomware
D. Spyware

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Differentiate between analog and digital signals with two examples of each.

Q14. Draw the truth table for a two-input NAND gate and write its Boolean expression.

Q15. List any FOUR phases of the Software Development Life Cycle (SDLC).

Q16. Define network topology. Name any FOUR common network topologies.

Q17. What is the difference between a virus and a worm?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the Waterfall Model and the Agile Model of software development. Discuss the advantages and disadvantages of each. Also state which model is more suitable for projects with changing requirements.

Q19. Explain the following terms in detail:
(a) Alphanumeric codes
(b) ASCII
(c) Binary code
(d) Bit

Also explain why binary digits are used in computers to represent data.

SECTION D — NUMERICAL / LOGIC QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Simplify the following Boolean function using a Karnaugh Map (K-Map):

F1 = $\bar{A}B + A\bar{B} + AB$

Show all steps:

- Plot the terms on the K-Map
- Group the cells
- Eliminate the variable that appears in both normal and complemented form
- Write the simplified result

Also draw the truth table for the simplified function.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Bit
2	B	Binary 1
3	B	7 or 8 bits
4	C	Human speech
5	B	AND gate
6	B	OR gate
7	B	Principle of Duality
8	C	Feasibility Study Phase
9	B	Waterfall Model
10	C	Bus Topology
11	D	Mesh Topology
12	C	Ransomware

SECTION B — SHORT ANSWER KEY

Q13. Analog vs Digital Signals

Analog Signals	Digital Signals
Continuous waveform	Discrete values (0s and 1s)
Can take any value in a range	Limited discrete values
Susceptible to noise	More resistant to noise
Degrades over long distances	Transmits over long distances with less degradation
Examples: Human speech, analog audio cassette tapes	Examples: MP3 files, digital images (JPEG), binary code

Q14. NAND Gate

Boolean expression: $F = \overline{(x \cdot y)}$

Truth Table:

x	y	F

0	0	1
0	1	1
1	0	1
1	1	0

Q15. Four Phases of SDLC

Any FOUR of the following:

1. Defining the Problem Phase
2. Planning Phase
3. Feasibility Study Phase
4. Analysis Phase
5. Requirement Engineering Phase
6. Design Phase
7. Development/Coding Phase
8. Testing/Verification Phase
9. Deployment/Implementation Phase
10. Documentation Phase
11. Maintenance/Support Phase

Q16. Network Topology

Definition: Network topology is the systematic arrangement of computers and other devices in a network. It defines how computers,

servers, switches, routers, and other network-related devices are connected with each other to effectively share data and resources.

Four types: Bus, Star, Ring, Mesh (also acceptable: Tree, Hybrid)

Q17. Virus vs Worm

Virus	Worm
Attaches itself to legitimate programs	Self-replicating
Spreads when the infected program is executed	Spreads across networks without user intervention
Requires a host program	Does not require a host program

SECTION C — LONG ANSWER KEY

Q18. Waterfall Model vs Agile Model

Waterfall Model:

- Sequential/linear development approach
- Phases: Requirements → Design → Development → Testing → Deployment → Maintenance
- Phases do not overlap; each must be completed before the next
- Used when requirements are well-defined

Advantages:

- Easy to understand and implement
- Clear milestones
- Well-documented
- Cost and timeline estimated early

Disadvantages:

- Inflexible to changes
- Long delivery times
- Late defect detection
- High risk of failure

Agile Model:

- Iterative and incremental approach
- Breaks tasks into small iterations (sprints)
- Emphasizes flexibility, collaboration, customer feedback
- Phases: Requirements Gathering Planning Design Implementation Testing Deployment Maintenance

Advantages:

- Flexible and adaptable
- Continuous client involvement
- Early and incremental delivery
- Continuous improvement

Disadvantages:

- Dependency on customer availability
- Scope creep possible

- Coordination challenges with large teams
- Limited documentation

Suitability: Agile Model is more suitable for projects with changing requirements because it allows adjustments and refinements throughout the development process.

Q19. Explanation of Terms

(a) Alphanumeric codes: Codes that represent numbers, letters, and special characters. They include lower-case letters (a-z), upper-case letters (A-Z), numeric digits (0-9), and special characters (%, $, #, +, etc.).

(b) ASCII: American Standard Code for Information Interchange. It is the most commonly used alphanumeric code. It uses 7 or 8 bits to represent a character and represents 128 characters in total.

(c) Binary code: Groups of 1s and 0s used in computers to represent data. For example, the binary code 1000100 may represent the letter D.

(d) Bit: A single binary digit (0 or 1).

Why binary digits are used:

- A digital computer is made of millions of electronic switches.
- Each switch has only two states: ON (current flows) and OFF (no current).
- Binary digits 0 and 1 correspond directly to these two states.
- 1 represents ON (current flows), 0 represents OFF (no current).
- Since the switch has exactly two states, the binary system (which also has two digits) is a natural fit.

SECTION D — NUMERICAL / LOGIC ANSWER

Q20. K-Map Simplification

Function: F1 = $\bar{A}B + A\bar{B} + AB$

Step 1: Plot on K-Map

Two-variable K-Map:

	$\bar{B}$	B
$\bar{A}$	0	1
A	1	1

(1s placed at: $\bar{A}B$, $A\bar{B}$, AB)

Step 2: Group the cells

- Horizontal group: $A\bar{B}$ + AB (covers B and $\bar{B}$ in row A)
- Vertical group: $\bar{A}B$ + AB (covers A and $\bar{A}$ in column B)

Step 3: Eliminate variables

- Horizontal group: B appears in both normal and complemented form □ B eliminated □ A remains
- Vertical group: A appears in both normal and complemented form □ A eliminated □ B remains

Step 4: Simplified result

F1 = A + B

Truth Table for F1 = A + B

A	B	F1
0	0	0
0	1	1
1	0	1
1	1	1

END OF ANSWER KEY

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 1 — Computer Systems

CHAPTER TEST — 2

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Which of the following is NOT included in alphanumeric codes?

A. Lower-case letters
B. Numeric digits
C. Special characters
D. Mathematical formulas

2. In a digital signal, the value 0 usually represents:

A. High voltage
B. Presence of signal
C. Low voltage
D. Continuous waveform

3. Which logic gate is also known as an inverter?

A. AND gate
B. OR gate
C. NOT gate
D. NAND gate

4. The Boolean expression $F = \overline{(x \cdot y)}$ represents which logic gate?

A. AND gate
B. OR gate
C. NAND gate
D. NOR gate

5. In a three-variable K-map, how many cells are there?

A. 4 cells
B. 6 cells
C. 8 cells
D. 16 cells

6. Which of the following is a use of logic gates in digital electronics?

A. Memory circuits
B. Traffic light control
C. Data encryption
D. All of the above

7. Which phase of SDLC focuses on gathering, analyzing, documenting, and managing requirements?

A. Design Phase
B. Requirement Engineering Phase
C. Testing Phase
D. Deployment Phase

8. In the Agile Model, what are short development cycles called?

A. Phases
B. Sprints
C. Stages
D. Milestones

9. Which deployment method involves running both the old and new systems concurrently?

A. Direct method

B. Parallel method
C. Phased method
D. Pilot method

10. In which network topology does data travel in one direction around a circular loop?

A. Bus Topology
B. Star Topology
C. Ring Topology
D. Mesh Topology

11. Which of the following is a type of phishing attack targeted at specific individuals?

A. Email Phishing
B. Spear Phishing
C. DDoS
D. Spyware

12. In asymmetric encryption, which key is used for encryption?

A. Private key
B. Public key
C. Shared key
D. Secret key

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12

Attempt any THREE questions.

Q13. Explain the difference between a closed switch and an open switch in terms of binary representation.

Q14. Write the truth table for a two-input NOR gate and write its Boolean expression.

Q15. Differentiate between Black Box Testing and White Box Testing.

Q16. Compare Bus Topology and Star Topology. Give one advantage and one disadvantage of each.

Q17. What is the difference between symmetric and asymmetric encryption? Give one advantage of each.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the different phases of the Software Development Life Cycle (SDLC). Discuss why the Feasibility Study Phase is important and describe any FOUR types of feasibility studies.

Q19. Explain the following network topologies in detail:
(a) Mesh Topology
(b) Ring Topology
(c) Hybrid Topology

For each topology, state ONE advantage and ONE disadvantage.

SECTION D — LOGIC / APPLICATION QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Consider the following Boolean function:

$F = \bar{A}B\bar{C} + \bar{A}BC + A\bar{B}\bar{C} + A\bar{B}C$

(a) Draw the truth table for this function.
(b) Simplify the function using a Karnaugh Map (K-Map).
(c) Write the simplified Boolean expression.
(d) Draw the truth table for the simplified expression and verify that it matches the original.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer

1	D	Mathematical formulas
2	C	Low voltage
3	C	NOT gate
4	C	NAND gate
5	C	8 cells
6	D	All of the above
7	B	Requirement Engineering Phase
8	B	Sprints
9	B	Parallel method
10	C	Ring Topology
11	B	Spear Phishing
12	B	Public key

SECTION B — SHORT ANSWER KEY

Q13. Closed Switch vs Open Switch

Closed Switch	Open Switch
Current flows	No current flows
Represents binary 1	Represents binary 0
Also called ON state	Also called OFF state

Q14. NOR Gate

Boolean expression: $F = \overline{(x + y)}$

Truth Table:

x	y	F
0	0	1
0	1	0

1	0	0
1	1	0

Q15. Black Box Testing vs White Box Testing

Black Box Testing	**White Box Testing**
Internal workings not known to tester	Tester has knowledge of internal code
Focus on outputs based on inputs	Evaluates internal structures and code paths
No access to source code	Access to source code
Tests functionality	Tests internal logic and quality

Q16. Bus Topology vs Star Topology

Bus Topology	**Star Topology**
All devices connected to one cable	All devices connected to central hub/switch

Advantage: Easy to install and maintain	Advantage: If one node fails, rest of network still works
Disadvantage: Single cable failure affects entire network	Disadvantage: If hub/switch fails, entire network is affected

Q17. Symmetric vs Asymmetric Encryption

Symmetric Encryption	**Asymmetric Encryption**
Uses a single shared key	Uses a pair of public and private keys
Advantage: Faster and more efficient	Advantage: Solves key distribution problem
Key distribution is a challenge	Non-repudiation provided

SECTION C — LONG ANSWER KEY

Q18. Phases of SDLC and Feasibility Study

Phases of SDLC:

1. Defining the Problem Phase — Problem clearly defined
2. Planning Phase — Goals, resources, and alternatives assessed
3. Feasibility Study Phase — Viability of the system evaluated

4. Analysis Phase — End-user requirements determined
5. Requirement Engineering Phase — Requirements gathered, validated, managed
6. Design Phase — System architecture and specifications created
7. Development/Coding Phase — Actual coding of the software
8. Testing/Verification Phase — Testing for functionality and performance
9. Deployment/Implementation Phase — Software made available for use
10. Documentation Phase — User manuals and system documentation created
11. Maintenance/Support Phase — Ongoing monitoring, maintenance, and enhancement

Importance of Feasibility Study Phase:
It determines whether the proposed system is viable within the estimated cost and time. It prevents investment in impractical projects.

Four types of feasibility studies:

1. Technical Feasibility: Whether the necessary technology and resources are available.
2. Economic Feasibility: Comparison of costs and benefits.
3. Operational Feasibility: Whether the system aligns with organizational processes and goals.
4. Legal Feasibility: Whether the system complies with laws and regulations.
5. Schedule Feasibility: Whether the system can be completed within the specified timeframe.

Q19. Network Topologies

(a) Mesh Topology:

- Every node connects to all other nodes
- Advantage: High redundancy and reliability
- Disadvantage: Costly and complex to set up

(b) Ring Topology:

- Devices connected in a circular loop
- Data travels in one direction (or both in dual ring)
- Uses Token Ring protocol
- Advantage: High reliability (alternate route in dual ring)
- Disadvantage: Limited bandwidth; single break can disrupt entire network

(c) Hybrid Topology:

- Combines elements of multiple topologies
- Advantage: Flexible, scalable, and reliable
- Disadvantage: Complex to set up and maintain

SECTION D — LOGIC / APPLICATION ANSWER

Q20. Boolean Function Solution

Function: F = $\bar{A}B\bar{C} + \bar{A}BC + A\bar{B}\bar{C} + A\bar{B}C$

(a) Truth Table:

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1

0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

(b) K-Map Simplification:

Three-variable K-Map:

	$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
$\bar{A}$	0	0	1	1
A	1	1	0	0

Group 1: $\bar{A}BC + \bar{A}B\bar{C}$ (horizontal group in row $\bar{A}$) □ Eliminates C □ $\bar{A}B$ remains
Group 2: $A\bar{B}\bar{C} + A\bar{B}C$ (horizontal group in row A) □ Eliminates C □ $A\bar{B}$ remains

(c) Simplified Expression:

$F = \bar{A}B + A\bar{B}$

(d) Truth Table for Simplified Expression:

A	B	$F = \bar{A}B + A\bar{B}$
0	0	0
0	1	1
1	0	1
1	1	0

Verification: The truth table for $F = \bar{A}B + A\bar{B}$ matches the original function's truth table.

END OF ANSWER KEY

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Subject: Computer Science
Chapter: Unit 1 — Computer Systems

CHAPTER TEST — 3

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. The circuit of a digital computer works on which type of voltage?

A. AC voltage
B. DC voltage
C. Both AC and DC
D. High-frequency voltage

2. Which of the following is an example of a digital signal?

A. Human speech
B. Analog audio cassette tape
C. MP3 audio file
D. Analog temperature reading

3. Which logic gate produces a 0 output only when all inputs are 1?

A. AND gate
B. OR gate
C. NAND gate
D. NOR gate

4. The Boolean expression $F = \bar{x}$ represents which logic gate?

A. AND gate
B. OR gate
C. NOT gate
D. NAND gate

5. In a Karnaugh Map, groups may be:

A. Diagonal only
B. Horizontal or vertical
C. Circular only
D. Random

6. Which of the following is NOT a use of logic gates?

A. Memory circuits
B. Traffic light control
C. Word processing
D. Data encryption

7. In the Waterfall Model, what happens if requirements change mid-project?

A. The model adapts easily
B. It becomes difficult and costly to accommodate changes
C. The project automatically switches to Agile
D. Changes are ignored

8. What is the primary goal of the Testing/Verification Phase in SDLC?

A. Writing code
B. Detecting and eliminating bugs
C. Designing the user interface
D. Documenting the system

9. Which of the following is a characteristic of a strong password?

A. Short and simple

B. Uses only lowercase letters
C. At least 12 characters with a mix of cases, numbers, and symbols
D. Based on your name and birthday

10. Which network topology is most commonly used in large office buildings and campus networks?

A. Bus Topology
B. Star Topology
C. Ring Topology
D. Mesh Topology

11. In cloud computing, which deployment model is shared by several organizations with common interests?

A. Public Cloud
B. Private Cloud
C. Community Cloud
D. Hybrid Cloud

12. Which type of attack involves multiple compromised devices flooding a target?

A. DoS
B. DDoS
C. Phishing
D. Spyware

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12

Attempt any THREE questions.

Q13. Explain why binary digits are used in computers to represent data.

Q14. Write the truth table for a two-input XOR gate and write its Boolean expression.

Q15. Differentiate between Verification and Validation in the context of SDLC.

Q16. Compare Mesh Topology and Tree Topology. Give one advantage and one disadvantage of each.

Q17. Define cryptography. How is it different from encryption?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the importance of cybersecurity in today's interconnected world. Discuss any FOUR methods used to protect systems against cyber threats, explaining how each method works.

Q19. Explain the following in detail:
(a) Digital Logic and Logic Gates
(b) Truth Table
(c) Principle of Duality in Boolean Algebra

Provide examples where applicable.

SECTION D — LOGIC / APPLICATION QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Simplify the following Boolean function using a Karnaugh Map (K-Map):

$F = \bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C + ABC$

(a) Draw the truth table for the original function.
(b) Plot the terms on a three-variable K-Map.
(c) Form the largest possible groups.
(d) Eliminate the variables that appear in both normal and complemented form.
(e) Write the simplified Boolean expression.
(f) Verify the simplified expression with a truth table.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	DC voltage
2	C	MP3 audio file
3	C	NAND gate
4	C	NOT gate
5	B	Horizontal or vertical
6	C	Word processing
7	B	It becomes difficult and costly to accommodate changes
8	B	Detecting and eliminating bugs
9	C	At least 12 characters with a mix of cases, numbers, and symbols
10	B	Star Topology
11	C	Community Cloud
12	B	DDoS

SECTION B — SHORT ANSWER KEY

Q13. Why Binary Digits Are Used in Computers

- A digital computer is made of millions of electronic switches.
- Each switch has only two states: ON (current flows) and OFF (no current).
- Binary digits 0 and 1 correspond directly to these two states.
- 1 represents ON (current flows), 0 represents OFF (no current).
- Since the switch has exactly two states, the binary system (which also has two digits) is a natural fit.
- This makes representation, storage, and processing of data simple and reliable.

Q14. XOR Gate

Boolean expression: $F = x \oplus y$ (or $F = \bar{x}y + x\bar{y}$)

Truth Table:

x	y	F
0	0	0
0	1	1
1	0	1
1	1	0

Q15. Verification vs Validation

Verification	Validation
Checks if the system is built correctly	Checks if the right system is built
Takes place after requirements are accepted	Takes place during requirements analysis
Focuses on completeness and accuracy of requirements	Focuses on alignment with stakeholder intentions
"Are we building the product right?"	"Are we building the right product?"

Q16. Mesh Topology vs Tree Topology

Mesh Topology	Tree Topology
Every node connects to all other nodes	Hierarchical layout with root node and multiple hubs/switches
Advantage: High redundancy and reliability	Advantage: Scalable; allows addition/removal of nodes without disrupting entire network
Disadvantage: Costly and complex to set up	Disadvantage: Complex to install and troubleshoot

Q17. Cryptography vs Encryption

Cryptography: The science of securing information by transforming it into an unreadable format using mathematical algorithms. It provides confidentiality, integrity, and authentication.

Encryption: The process of converting plaintext data into ciphertext using encryption algorithms and keys.

Cryptography	**Encryption**
Broader science of concealing messages	Specific process of encrypting and decrypting data
Includes symmetric and asymmetric keys	A subset of cryptography
Studies methods to keep messages secret	The actual process itself

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SECTION C — LONG ANSWER KEY

Q18. Importance of Cybersecurity and Protection Methods

Importance of Cybersecurity:

1. Protecting sensitive data (personal, financial, intellectual property)
2. Prevention of cyber attacks (malware, ransomware, phishing, DDoS)
3. Safeguarding critical infrastructure (power grids, transportation, healthcare)
4. Maintaining business continuity

5. Compliance with regulations
6. Protecting national security
7. Preserving privacy

Four Protection Methods:

1. Strong Passwords: Long (at least 12 characters), complex (mix of cases, numbers, symbols), unpredictable, and unique for each account. Harder to crack.
2. Two-Factor Authentication (2FA): Requires two different forms of verification — something the user knows (password) and something they have (OTP from mobile app). Provides an extra layer of security.
3. Firewalls: Network security devices or software that monitor and control incoming and outgoing network traffic. They establish a barrier between a trusted internal network and untrusted external networks.
4. Antivirus and Anti-malware Software: Designed to detect, quarantine, and remove malicious software. Provide real-time scanning of files and applications.

(Other acceptable methods: Encryption, Backup and Disaster Recovery, Cryptography, Keeping Software Updated, Educating Yourself, Being Wary of Suspicious Emails)

Q19. Detailed Explanation

(a) Digital Logic and Logic Gates:

- Digital logic is fundamental in creating electronic devices like calculators, computers, and digital watches.
- It is used to create digital circuits, which consist of a large number of logic gates.
- Logic gates are the building blocks of digital circuits.
- A logic gate performs a particular logical function.
- It has two or more logic inputs (LOW or HIGH) and produces a single output which may be LOW (0) or HIGH (1).
- The output is determined by the logic levels present at the inputs.

(b) Truth Table:

- A truth table represents a Boolean function or digital logic circuit in table form.
- It shows how a logic circuit's output responds to all possible combinations of inputs.
- Uses logic '1' for true and logic '0' for false.

- Properties:
    - Consists of rows and columns
    - Shows relationship between inputs and output
    - Input combinations listed in binary counting order
    - Working shown in the middle
    - Output shown in the rightmost column

(c) Principle of Duality:

- For any given Boolean expression/function, a dual expression can be obtained.
- The dual is obtained by interchanging AND (.) and OR (+) operators.
- The variables are complemented (negated).
- Duality preserves the logic and truth of expressions.
- Highlights symmetry between AND and OR, and between 0 and 1.

Example:

- Expression: 1 = 0
- Dual: 0 = 1
- Expression: A.B = B.A
- Dual: A + B = B + A

SECTION D — LOGIC / APPLICATION ANSWER

Q20. Boolean Function Solution

Function: F = $\bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C + ABC$

(a) Truth Table:

A	B	C	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

(b) K-Map Plot:

Three-variable K-Map:

	$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
$\bar{A}$	0	1	1	0
A	0	1	1	0

(c) Groups Formed:

Group 1: $\bar{B}C$ and BC in row $\bar{A}$ (horizontal group) → $\bar{B}C + BC$ → Eliminates B → C remains
Group 2: $\bar{B}C$ and BC in row A (horizontal group) → $\bar{B}C + BC$ → Eliminates B → C remains

Combined groups form a group of four: $\bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C + ABC$

All four 1s form one group of four (column C = 1)

(d) Eliminate Variables:

In the group of four, both A and B appear in normal and complemented form ($\bar{A}$, A, $\bar{B}$, B) → both eliminated. C remains.

(e) Simplified Expression:

F = C

(f) Truth Table for Simplified Expression:



A	B	C	F = C
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Verification: The truth table for F = C matches the original function's truth table. □

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 2 — Computational Thinking & Algorithms

CHAPTER TEST — 1

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Which of the following is a computational artifact in software development?

A. Only the final source code
B. Meeting notes, diagrams, source code, documentation, and prototypes
C. Only the database
D. Only the user manual

2. Which computational thinking step involves breaking a complex problem into smaller, manageable sub-problems?

A. Abstraction
B. Decomposition
C. Pattern Recognition
D. Algorithmic Design

3. What is the primary purpose of pseudocode?

A. To run directly on the computer
B. To replace the compiler
C. To represent the algorithm in a structured, semi-formal way before coding
D. To display the output

4. In a flowchart, which symbol is used for a decision?

A. Oval
B. Parallelogram
C. Diamond
D. Rectangle

5. In a two-variable Karnaugh Map, how many cells are there?

A. 2 cells

B. 4 cells
C. 8 cells
D. 16 cells

6. Which of the following is the correct typical sequence of artifacts?

A. Code → Algorithm → Flowchart → Pseudocode
B. Algorithm → Flowchart → Pseudocode → Code
C. Flowchart → Code → Algorithm → Pseudocode
D. Pseudocode → Algorithm → Code → Flowchart

7. The process of hand-simulating an algorithm step by step is called:

A. Compilation
B. Execution
C. Tracing (dry run / desk check)
D. Debugging

8. A trace table is used to:

A. Store the final program
B. Show how variables change at each stage of an algorithm
C. Display the flowchart
D. Compile the code

9. In Insertion Sort, how is each new element handled?

A. It is swapped repeatedly with its neighbour
B. It is inserted into its correct position in the already sorted part

C. It is discarded if smaller
D. It is moved to the end of the list

10. In Bubble Sort, after one full pass, which element is guaranteed to be in its correct place?

A. The smallest element at the start
B. The largest element at the end
C. The middle element
D. None

11. Binary Search can only be applied to:

A. Any list
B. A sorted list
C. A list of strings
D. A list of size less than 10

12. Which search algorithm checks each element one by one until the target is found?

A. Binary Search
B. Linear Search
C. Divide and Conquer Search
D. Hash Search

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Define a computational artifact. Name any FOUR computational artifacts used in software development.

Q14. Differentiate between an Algorithm and Pseudocode.

Q15. Explain the purpose of a Truth Table in digital logic. What does it show?

Q16. Write a short note on Linear Search. When is it preferred over Binary Search?

Q17. Explain the concept of Sorting Algorithms. Why is sorting useful in computing?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the planning and development process of a computational artifact. Describe the five steps in detail:
(a) Define the problem
(b) List inputs and outputs
(c) Plan
(d) Development
(e) Test the algorithm

Q19. Explain the Insertion Sort algorithm in detail with a suitable example. Also, describe the computational thinking properties (Abstraction, Decomposition, Pattern Recognition) applied to Insertion Sort.

SECTION D — ALGORITHM / DRY RUN QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Consider the following array of unsorted elements:

Array: [12, 31, 25, 8, 32, 17]

(a) Sort the array in ascending order using Insertion Sort. Show all steps.
(b) Sort the array in ascending order using Bubble Sort. Show all iterations.
(c) Compare the number of swaps required in both methods.
(d) State one advantage of Insertion Sort over Bubble Sort.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Meeting notes, diagrams, source code, documentation, and prototypes

2	B	Decomposition
3	C	To represent the algorithm in a structured, semi-formal way before coding
4	C	Diamond
5	B	4 cells
6	B	Algorithm Flowchart Pseudocode Code
7	C	Tracing (dry run / desk check)
8	B	Show how variables change at each stage of an algorithm
9	B	It is inserted into its correct position in the already sorted part
10	B	The largest element at the end
11	B	A sorted list
12	B	Linear Search

SECTION B — SHORT ANSWER KEY

Q13. Computational Artifact

Definition: A computational artifact is an object or byproduct created during the software development process that helps to describe the architecture, design, and function of software.

Four artifacts:

1. Meeting notes / Images
2. Diagrams
3. Source code
4. Software documentation
5. Prototypes

Q14. Algorithm vs Pseudocode

Algorithm	**Pseudocode**
Step-by-step instructions in natural language	Semi-formal, structured representation using programming-like constructs
High-level description	Intermediate step between algorithm and code
No programming syntax	Uses simplified programming constructs
Easier for non-programmers to understand	Closer to actual code

Q15. Truth Table

Definition: A truth table represents a Boolean function or digital logic circuit in table form. It shows how a logic circuit's output responds to all possible combinations of inputs.

What it shows:

- Relationship between inputs and output
- All possible input combinations (binary counting order)
- Output for each combination (0 for LOW, 1 for HIGH)

Q16. Linear Search

Definition: Linear Search checks each element one by one from the start until the target is found or the list ends.

When preferred:

- When the list is not sorted
- When the list is small
- When searching only once
- When the list changes frequently

Q17. Sorting Algorithms

Definition: Sorting algorithms arrange data in a useful manner (ascending or descending order).

Why sorting is useful:

- Makes searching faster (especially Binary Search)
- Makes data easier to understand
- Helps in finding duplicates
- Makes data easier to analyze
- Required for many other algorithms

SECTION C — LONG ANSWER KEY

Q18. Planning and Developing a Computational Artifact

(a) Define the Problem:
State the problem clearly and concisely. Without a clear problem, the solution will be wrong.

(b) List Inputs and Outputs:
Identify what information is needed (inputs) and what the algorithm will produce (outputs).

(c) Plan:

- Outline the logic: Break down the problem into smaller parts
- Choose data structures: Decide how to store data (array, stack, queue, etc.)
- Choose control structures: Decide flow (sequential, conditional, loops)

(d) Development:
Describe steps to convert inputs to outputs. Start at a high level and refine until steps are computable. Number of steps should be finite.

(e) Test the Algorithm:
Choose test inputs and verify the output. Check for generalization and simplification. Ensure algorithm works correctly for all cases.

Q19. Insertion Sort with Example

Insertion Sort:

- Compares adjacent elements

- Inserts each element into its correct position in the sorted part
- Continues until all elements are sorted

Example: [12, 31, 25, 8, 32, 17]

Step 1: 12 is sorted.
Step 2: 31 > 12, no change.
Step 3: 25 < 31, swap [12, 25, 31, 8, 32, 17]
Step 4: 25 > 12, no change.
Step 5: 8 < 31, swap [12, 25, 8, 31, 32, 17]
Step 6: 8 < 25, swap [12, 8, 25, 31, 32, 17]
Step 7: 8 < 12, swap [8, 12, 25, 31, 32, 17]
Step 8: 32 > 31, no change.
Step 9: 17 < 32, swap [8, 12, 25, 31, 17, 32]
Step 10: 17 < 31, swap [8, 12, 25, 17, 31, 32]
Step 11: 17 < 25, swap [8, 12, 17, 25, 31, 32]
Step 12: 17 > 12, no change.

Final sorted array: [8, 12, 17, 25, 31, 32]

Computational Thinking Properties:

- Abstraction: Organize a collection by repeatedly inserting each item into its correct position.
- Decomposition: Pick and insert, correct position logic.
- Pattern Recognition: Repetition, building order, ordered comparison.

SECTION D — ALGORITHM / DRY RUN ANSWER

Q20. Sorting the Array [12, 31, 25, 8, 32, 17]

(a) Insertion Sort Steps:

Step	Array	Action
1	[12, 31, 25, 8, 32, 17]	12 sorted
2	[12, 31, 25, 8, 32, 17]	31 > 12, no change
3	[12, 25, 31, 8, 32, 17]	25 < 31, swap
4	[12, 25, 31, 8, 32, 17]	25 > 12, no change
5	[12, 25, 8, 31, 32, 17]	8 < 31, swap
6	[12, 8, 25, 31, 32, 17]	8 < 25, swap
7	[8, 12, 25, 31, 32, 17]	8 < 12, swap
8	[8, 12, 25, 31, 32, 17]	32 > 31, no change
9	[8, 12, 25, 31, 17, 32]	17 < 32, swap
10	[8, 12, 25, 17, 31, 32]	17 < 31, swap
11	[8, 12, 17, 25, 31, 32]	17 < 25, swap

12	[8, 12, 17, 25, 31, 32]	17 > 12, no change

Final sorted array: [8, 12, 17, 25, 31, 32]

(b) Bubble Sort Steps:

Iteration 1:

- Compare 12 and 31: no swap → [12, 31, 25, 8, 32, 17]
- Compare 31 and 25: swap → [12, 25, 31, 8, 32, 17]
- Compare 31 and 8: swap → [12, 25, 8, 31, 32, 17]
- Compare 31 and 32: no swap → [12, 25, 8, 31, 32, 17]
- Compare 32 and 17: swap → [12, 25, 8, 31, 17, 32]

Iteration 2:

- Compare 12 and 25: no swap → [12, 25, 8, 31, 17, 32]
- Compare 25 and 8: swap → [12, 8, 25, 31, 17, 32]
- Compare 25 and 31: no swap → [12, 8, 25, 31, 17, 32]
- Compare 31 and 17: swap → [12, 8, 25, 17, 31, 32]

Iteration 3:

- Compare 12 and 8: swap → [8, 12, 25, 17, 31, 32]
- Compare 12 and 25: no swap → [8, 12, 25, 17, 31, 32]
- Compare 25 and 17: swap → [8, 12, 17, 25, 31, 32]

Iteration 4:

- Compare 8 and 12: no swap → [8, 12, 17, 25, 31, 32]

- Compare 12 and 17: no swap [8, 12, 17, 25, 31, 32]

Final sorted array: [8, 12, 17, 25, 31, 32]

(c) Comparison of Swaps:

- Insertion Sort: 6 swaps (or shifts)
- Bubble Sort: 6 swaps

(d) Advantage of Insertion Sort:
Insertion Sort generally performs fewer swaps than Bubble Sort and is more efficient for small or nearly sorted data.

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 2 — Computational Thinking & Algorithms

CHAPTER TEST — 2

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Which computational thinking step involves focusing on the most relevant aspects while ignoring unnecessary details?

A. Decomposition
B. Abstraction
C. Pattern Recognition
D. Algorithmic Design

2. Which of the following is an intermediate step between an algorithm and actual programming code?

A. Flowchart
B. Pseudocode
C. Machine code
D. Debugger

3. In a flowchart, which symbol is used to represent input/output operations?

A. Oval
B. Diamond
C. Parallelogram
D. Rectangle

4. In a three-variable Karnaugh Map, how many cells are there?

A. 4 cells
B. 6 cells
C. 8 cells
D. 16 cells

5. Which of the following is a computational artifact in software development?

A. Only the compiled binary
B. Source code, diagrams, meeting notes, prototypes
C. Only the user manual
D. Only the flowchart

6. Binary Search follows which problem-solving approach?

A. Sequential
B. Divide and Conquer
C. Random
D. Linear

7. In a trace table, what is typically shown?

A. Only the final output
B. How variables change at each step of an algorithm
C. Only the flowchart symbols
D. Only the error messages

8. Which algorithm compares adjacent elements and swaps them if they are in the wrong order?

A. Insertion Sort
B. Bubble Sort
C. Binary Search
D. Linear Search

9. In Insertion Sort, the first element of the array is:

A. Ignored

B. Considered already sorted
C. Moved to the end
D. Deleted

10. Which search algorithm works on an unsorted list?

A. Binary Search
B. Linear Search
C. Divide and Conquer Search
D. Hash Search

11. For an array of 1000 elements, approximately how many comparisons does Binary Search need in the worst case?

A. 10
B. 100
C. 500
D. 1000

12. If a searching algorithm reaches the end of the array without finding the target, what does it return?

A. 0
B. -1
C. NULL
D. The last element

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12

Attempt any THREE questions.

Q13. Define decomposition and pattern recognition in the context of computational thinking. Give one example of each.

Q14. Draw a flowchart to check whether a given number is even or odd. Use appropriate symbols.

Q15. What is a trace table? Explain how it helps in testing an algorithm.

Q16. Describe the working of Bubble Sort with a simple example.

Q17. Compare Linear Search and Binary Search. State TWO differences.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the concept of Computational Solution Design. Describe the three main computational artifacts (Algorithm, Flowchart, Pseudocode) used in solution design, and discuss how they differ from each other.

Q19. Explain the Binary Search algorithm in detail. Describe its working with a suitable example. Also state:
(a) The requirement for Binary Search
(b) How many comparisons are needed in the worst case for n elements
(c) What it returns if the target is not found

SECTION D — ALGORITHM / TRACE TABLE QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Consider the following pseudocode:

```
1. sum = 0
2. FOR i = 1 TO 5
3. sum = sum + i
4. PRINT sum
5. END FOR
6. PRINT "Done"
```

(a) Construct a complete trace table for this pseudocode, showing each iteration.
(b) State the final output of the algorithm.
(c) What is the value of sum after the loop ends?
(d) Modify the algorithm to calculate the sum of the first 10 positive numbers instead.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Abstraction
2	B	Pseudocode
3	C	Parallelogram
4	C	8 cells
5	B	Source code, diagrams, meeting notes, prototypes
6	B	Divide and Conquer
7	B	How variables change at each step of an algorithm
8	B	Bubble Sort
9	B	Considered already sorted
10	B	Linear Search
11	A	10
12	C	NULL

SECTION B — SHORT ANSWER KEY

Q13. Decomposition and Pattern Recognition

Decomposition: Breaking down a complex problem into smaller, manageable sub-problems.
Example: Developing a mobile app break into UI design, login feature, navigation, data storage.

Pattern Recognition: Identifying patterns or trends within data, problems, or solutions.
Example: Analyzing user behavior on a website to identify which pages are visited most.

Q14. Flowchart — Even or Odd

text

```
[Start]
   
[Input num]
   
<num % 2 == 0?>
   Yes        No
[Output Even]  [Output Odd]
   
[End]          [End]
```

Symbols used:

- Oval: Start/End
- Parallelogram: Input/Output
- Diamond: Decision

Q15. Trace Table

Definition: A trace table shows how variables change at each stage of an algorithm.

Purpose:

- Helps check if the logic is correct
- Finds logical errors
- Generates output for a given set of inputs
- Verifies that the algorithm works as expected

Q16. Bubble Sort Working

Definition: Bubble Sort repeatedly compares and swaps adjacent elements if they are not in correct order.

Example: [13, 32, 26, 35, 10]

Iteration 1:

- 13 and 32: no swap
- 32 and 26: swap [13, 26, 32, 35, 10]
- 32 and 35: no swap
- 35 and 10: swap [13, 26, 32, 10, 35]

Iteration 2: ... (continues until sorted)

Final sorted array: [10, 13, 26, 32, 35]

Q17. Linear Search vs Binary Search

Linear Search	**Binary Search**

Works on any list (sorted or unsorted)	Requires a sorted list
Checks each element one by one	Divides the list in half each time
Slower for large lists	Faster for large lists
Also called sequential search	Uses divide and conquer

SECTION C — LONG ANSWER KEY

Q18. Computational Solution Design

Definition: Computational solution design is the process of planning and representing a computational solution using standard artifacts.

Three main artifacts:

(a) Algorithm:

- Step-by-step instructions written in natural language
- High-level description of the solution
- No implementation details
- Example: Add two numbers

(b) Flowchart:

- Visual representation of flow and logic using defined symbols
- Helpful for complex loops and decision-making
- Uses standard symbols: Oval, Parallelogram, Diamond, Rectangle, Arrows, Circle

(c) Pseudocode:

- Intermediate step between algorithm and actual code
- Combination of natural language and simplified programming constructs
- More structured than algorithm, closer to code

Differences:

Algorithm	**Flowchart**	**Pseudocode**
Natural language	Visual symbols	Semi-formal code-like
Step-by-step	Diagrammatic	Structured text
High-level	Graphical	Intermediate

Typical sequence: Algorithm Flowchart Pseudocode Code

Q19. Binary Search

Definition: Binary Search works on sorted lists. It follows the divide and conquer approach — the sorted list is divided into two parts,

and the target is compared with the middle element.

Working with example [10, 12, 24, 29, 39, 40, 51, 56, 69] — Find 56:

- Middle = 39. 56 > 39 go right.
- Right part: [40, 51, 56, 69]. Middle = 51. 56 > 51 go right.
- Right part: [56, 69]. Middle = 56. Match found.

Output: Location 7

(a) Requirement: The list must be sorted.

(b) Comparisons for n elements: At most $\log_2(n)$ comparisons.

(c) If target not found: Returns NULL.

SECTION D — ALGORITHM / TRACE TABLE ANSWER

Q20. Trace Table

(a) Trace Table:

Step	i	sum	Output
1	-	0	-
2	1	0	-

3	1	1	-
4	1	1	1
2	2	1	-
3	2	3	-
4	2	3	3
2	3	3	-
3	3	6	-
4	3	6	6
2	4	6	-
3	4	10	-
4	4	10	10
2	5	10	-
3	5	15	-

4	5	15	15
6	-	15	Done

(b) Final Output:

```
text
```

```
1
3
6
10
15
Done
```

(c) Value of sum after loop ends: 15

(d) Modified Algorithm (sum of first 10 positive numbers):

```
text
```

```
1. sum = 0
2. FOR i = 1 TO 10
3. sum = sum + i
4. PRINT sum
5. END FOR
6. PRINT "Done"
```

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 2 — Computational Thinking & Algorithms

CHAPTER TEST — 3 (Comprehensive & High-Difficulty)

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12

Attempt all questions. Choose the best option.

1. A computational artifact describes software behavior using:

A. Source code only
B. Control sequences
C. Machine language
D. Compiler output

2. In the artifact sequence Algorithm Flowchart Pseudocode Code, which artifact is most useful for explaining complex loops to non-technical stakeholders?

A. Algorithm
B. Flowchart
C. Pseudocode
D. Code

3. In a flowchart, the connector symbol is used to:

A. Show decisions
B. Connect different parts of the flowchart
C. Show input/output
D. Mark start/end

4. While constructing a trace table, which step comes immediately after "Initialization"?

A. Choose Test Input
B. Understand the Algorithm
C. Trace Each Step

D. Verify Output

5. In a K-Map simplification, two 1s placed in diagonal cells:

A. Form a valid group of two
B. Form a valid group of four
C. Cannot form a group
D. Always form a group of one

6. In Insertion Sort, the variable `key` is used to:

A. Store the index of the smallest element
B. Temporarily hold the current element being inserted
C. Count the number of swaps
D. Store the sorted array

7. For an array of n elements, how many iterations does Bubble Sort require in the worst case?

A. n
B. $n - 1$
C. n^2
D. $\log_2(n)$

8. Binary Search requires at most how many comparisons for 1,000,000 elements?

A. 10
B. 20
C. 100
D. 1000

9. A Linear Search finds the target at the last position of an array of n elements. How many comparisons were made?

A. 1
B. n/2
C. n
D. $\log_2(n)$

10. Which of the following is NOT a valid condition for terminating Linear Search?

A. Target found
B. End of array reached
C. Array index out of range
D. Middle element compared

11. In the context of computational thinking, "building order incrementally" is an example of:

A. Abstraction
B. Decomposition
C. Pattern Recognition
D. Algorithm Evaluation

12. If Binary Search is applied on the array [5, 3, 8, 1, 9] to find 8, what will happen?

A. It will find 8 at index 2
B. It will find 8 at index 3
C. It will return NULL
D. It will produce incorrect results because the array is not sorted

---

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the relationship between Computational Artifacts and "control sequences." Give one example of how a diagram artifact can define behavior without reading code.

Q14. Draw a complete flowchart to find the largest of three numbers (A, B, C). Use all appropriate symbols.

Q15. Explain the difference between a Trace Table and a Dry Run. Are they the same thing? Justify your answer.

Q16. For the array [29, 10, 14, 37, 13], show the state of the array after each pass of Bubble Sort (ascending order).

Q17. Explain why Binary Search cannot be applied directly to an unsorted array. What must be done first? What is the impact on overall time efficiency?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. (a) Define Computational Thinking and describe its four main properties.
(b) For the task of "Designing a Library Management System," explain how each of the four properties would be applied.

Q19. (a) Explain the working of Binary Search with a detailed example on the array [2, 4, 5, 6, 8, 9, 10] to find the element 9.
(b) Calculate the number of comparisons performed.
(c) Compare the efficiency of Binary Search and Linear Search for this same array when searching for 9. Show the comparison count for

Linear Search as well.

SECTION D — COMPREHENSIVE ALGORITHM QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Consider the following unsorted array of 9 elements:

[64, 25, 12, 22, 11, 90, 45, 33, 78]

(a) Sort this array using Insertion Sort. Show all steps of the algorithm (each pass).
(b) State the total number of shifts/swaps performed.
(c) Sort this same array using Bubble Sort. Show the state after each full pass.
(d) State the total number of swaps performed in Bubble Sort.
(e) Compare the performance of both algorithms on this dataset.
(f) Which algorithm would you prefer if the dataset were already almost sorted? Justify.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Control sequences
2	B	Flowchart
3	B	Connect different parts of the flowchart
4	C	Trace Each Step
5	C	Cannot form a group
6	B	Temporarily hold the current element being inserted
7	B	n − 1
8	B	20
9	C	n
10	D	Middle element compared
11	C	Pattern Recognition

12	D	It will produce incorrect results because the array is not sorted

---

SECTION B — SHORT ANSWER KEY

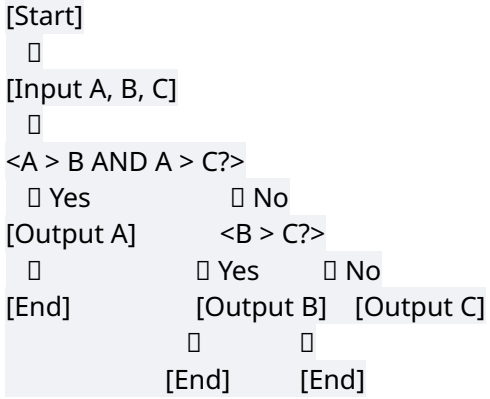
Q13. Computational Artifacts and Control Sequences

Relationship: Computational artifacts define the behavior of software using control sequences — the logical steps that determine how the software responds to different inputs and situations.

Example: A flowchart showing the sequence of steps when a user logs in — it demonstrates what happens at each decision point (valid credentials / invalid credentials) without reading a single line of code.

Q14. Flowchart — Largest of Three Numbers

text



Q15. Trace Table vs Dry Run

Dry Run	Trace Table
The overall process of hand-simulating an algorithm	A specific technique/tool used during the dry run
Includes understanding the algorithm, choosing input, tracing steps, verifying output	A tabular record showing how variables change at each stage
Conceptual process	Physical table representation

Conclusion: They are not exactly the same. Dry run is the process; trace table is a tool used within that process.

Q16. Bubble Sort Passes on [29, 10, 14, 37, 13]

Pass 1:

- 29, 10 → swap → [10, 29, 14, 37, 13]
- 29, 14 → swap → [10, 14, 29, 37, 13]
- 29, 37 → no swap → [10, 14, 29, 37, 13]
- 37, 13 → swap → [10, 14, 29, 13, 37]

Pass 2:

- 10, 14 → no swap → [10, 14, 29, 13, 37]
- 14, 29 → no swap → [10, 14, 29, 13, 37]
- 29, 13 → swap → [10, 14, 13, 29, 37]

Pass 3:

- 10, 14 → no swap → [10, 14, 13, 29, 37]
- 14, 13 → swap → [10, 13, 14, 29, 37]

Pass 4:

- 10, 13 → no swap → [10, 13, 14, 29, 37] (Sorted)

Final: [10, 13, 14, 29, 37]

Q17. Binary Search on Unsorted Array

Why it cannot be applied: Binary Search relies on the fact that the array is sorted. If the array is not sorted, comparing the target with the middle element does not tell us which half contains the target.

What must be done first: The array must be sorted first.

Impact on efficiency: Sorting takes extra time (O(n log n) for efficient sorting). For a single search, sorting first may be less efficient than using Linear Search. Binary Search is beneficial only when the sorted array will be used for multiple searches.

SECTION C — LONG ANSWER KEY

Q18. Computational Thinking and Properties

(a) Definition: Computational thinking is a thought process that helps us understand the problem and solve it in a way that computers do. It requires understanding the capabilities of computers.

Four properties:

1. Abstraction: Simplifying a problem by focusing on the most relevant aspects while ignoring unnecessary details.
    - Example: Focus on main design and functionality of a website without getting into coding details.
2. Decomposition: Breaking down a complex problem into smaller, more manageable sub-problems or tasks.
    - Example: Developing a mobile app by breaking into UI design, coding features, and data handling.
3. Pattern Recognition: Identifying patterns or trends within data, problems, or solutions.
    - Example: Analyzing user behavior to identify which pages users visit most.
4. Algorithmic Design: Developing a step-by-step solution to solve a problem.

(b) Application to Library Management System:

- Abstraction: Focus on what the library system should do (issue books, return books, search catalog) without worrying about implementation details.
- Decomposition: Break the system into smaller modules: Book Management, Member Management, Issue/Return System, Search Module.
- Pattern Recognition: Identify patterns, such as peak borrowing times, popular genres, or common book categories.
- Algorithmic Design: Develop step-by-step procedures for each module, e.g., the algorithm to issue a book.

Q19. Binary Search on [2, 4, 5, 6, 8, 9, 10] to Find 9

(a) Working:

Array: [2, 4, 5, 6, 8, 9, 10]
Low = 0, High = 6

Step 1: Mid = (0 + 6) / 2 = 3. Value at index 3 = 6.
9 > 6 search right half. Low = 4, High = 6.

Step 2: Mid = (4 + 6) / 2 = 5. Value at index 5 = 9.
9 == 9 Match found at location 5.

(b) Number of comparisons: 2

(c) Comparison with Linear Search:

Linear Search for 9:

- Compare 2: No
- Compare 4: No
- Compare 5: No
- Compare 6: No
- Compare 8: No
- Compare 9: Yes (found)

Linear Search comparisons: 6

Conclusion: Binary Search (2 comparisons) is much more efficient than Linear Search (6 comparisons) for this search.

SECTION D — COMPREHENSIVE ALGORITHM ANSWER

Q20. Sorting [64, 25, 12, 22, 11, 90, 45, 33, 78]

(a) Insertion Sort — Step by Step:

Initial: [64, 25, 12, 22, 11, 90, 45, 33, 78]

Pass 1: [64, 25, 12, 22, 11, 90, 45, 33, 78]
Pass 2: [25, 64, 12, 22, 11, 90, 45, 33, 78]
Pass 3: [12, 25, 64, 22, 11, 90, 45, 33, 78]
Pass 4: [12, 22, 25, 64, 11, 90, 45, 33, 78]
Pass 5: [11, 12, 22, 25, 64, 90, 45, 33, 78]
Pass 6: [11, 12, 22, 25, 64, 90, 45, 33, 78]
Pass 7: [11, 12, 22, 25, 45, 64, 90, 33, 78]
Pass 8: [11, 12, 22, 25, 33, 45, 64, 90, 78]
Pass 9: [11, 12, 22, 25, 33, 45, 64, 78, 90]

Final sorted array: [11, 12, 22, 25, 33, 45, 64, 78, 90]

(b) Total shifts/swaps: 24

(c) Bubble Sort — State After Each Pass:

Initial: [64, 25, 12, 22, 11, 90, 45, 33, 78]

Pass 1: [25, 12, 22, 11, 64, 45, 33, 78, 90]
Pass 2: [12, 22, 11, 25, 45, 33, 64, 78, 90]
Pass 3: [12, 11, 22, 25, 33, 45, 64, 78, 90]
Pass 4: [11, 12, 22, 25, 33, 45, 64, 78, 90]
Pass 5: [11, 12, 22, 25, 33, 45, 64, 78, 90] (sorted)

(d) Total swaps in Bubble Sort: 27

(e) Performance Comparison:

- Insertion Sort: 24 shifts/swaps
- Bubble Sort: 27 swaps
- Insertion Sort performs slightly better on this dataset

(f) If dataset were almost sorted:
Insertion Sort would be preferred because it performs very few shifts when elements are already nearly in place. Bubble Sort would still perform comparisons across all passes.

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

PUBLIC LIBRARY

Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 3 — Programming Fundamentals

CHAPTER TEST — 1

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. A set of well-defined instructions which a computer can execute to solve a problem is called a:

A. Algorithm
B. Flowchart
C. Computer program
D. Pseudocode

2. Which type of program accepts input from a user and continues interaction?

A. Batch program
B. Interactive program
C. Compiled program
D. Machine program

3. Python was first introduced in:

A. 1990
B. 1992
C. 1995
D. 2000

4. Which of the following is an online Python IDE?

A. IDLE
B. Replit
C. PyCharm
D. Thonny

5. REPL stands for:

A. Read-Enter-Print-Loop
B. Read-Eval-Print-Loop
C. Run-Eval-Print-Loop
D. Read-Eval-Process-Loop

6. In Turtle Graphics, which function is used to lift the pen so it does not draw while moving?

A. pendown()
B. penup()
C. penlift()
D. penstop()

7. Which of the following is a built-in Python library?

A. numpy
B. pandas
C. turtle
D. matplotlib

8. Which of the following is a valid variable name in Python?

A. 1student
B. student_name
C. student name
D. student-name

9. Which function is used to take input from the user in Python?

A. print()

B. input()
C. eval()
D. get()

10. What is the output of the following code?

```python
print("10" + "20")
```

A. 30
B. 1020
C. "1020"
D. Error

11. What does the `range(5)` function generate?

A. 1, 2, 3, 4, 5
B. 0, 1, 2, 3, 4
C. 0, 1, 2, 3, 4, 5
D. 1, 2, 3, 4

12. Which of the following is NOT a valid Python data type?

A. int
B. float
C. char
D. bool

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Differentiate between a compiler and an interpreter. Give one example of a language that uses each.

Q14. What is an IDE? Name any TWO Python IDEs and state one advantage of each.

Q15. Explain the difference between the `input()` function and the `eval(input())` function with a suitable example.

Q16. Write a short note on Python variables. State any FOUR rules for naming variables.

Q17. Explain the difference between a `list` and a `tuple` in Python.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the different types of operators in Python:
(a) Arithmetic Operators
(b) Comparison Operators
(c) Logical Operators
(d) Membership Operators

Give one example of each type.

Q19. Explain the `for` loop in Python in detail. Describe:
(a) The syntax of the `for` loop
(b) The `range()` function with different forms
(c) The importance of indentation
(d) The `break` and `continue` statements with examples

SECTION D — PROGRAMMING / OUTPUT QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Write Python programs for the following:

(a) Take two numbers as input from the user and print their sum, difference, product, and quotient.

(b) Print the multiplication table of a number entered by the user from 1 to 10 using a `for` loop.

(c) Write a program that takes a number as input and checks whether it is positive, negative, or zero using `if-elif-else`.

(d) Create a list of 5 numbers and print the sum, minimum, and maximum values.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	C	Computer program
2	B	Interactive program
3	B	1992
4	B	Replit
5	B	Read-Eval-Print-Loop
6	B	penup()
7	C	turtle
8	B	student_name
9	B	input()
10	B	1020

11	B	0, 1, 2, 3, 4
12	C	char

SECTION B — SHORT ANSWER KEY

Q13. Compiler vs Interpreter

Compiler	**Interpreter**
Translates entire program at once	Translates line-by-line as it executes
Errors reported together	Errors reported one at a time
Faster execution after compilation	Slower execution
Example: C++, Java	Example: Python, JavaScript

Q14. IDE

Definition: An IDE (Integrated Development Environment) is a software application that provides a complete environment for writing, testing, and running code.

Two IDEs:

1. IDLE: Python's official IDE. Advantage: Works offline, comes with Python.
2. Replit: Online IDE. Advantage: No installation needed, accessible from anywhere.

Q15. input() vs eval(input())

input()	**eval(input())**
Returns input as a string	Converts input to a number
`num = input("Enter: ")` → "123" (string)	`num = eval(input("Enter: "))` → 123 (int)
"123" + "123" = "123123"	123 + 123 = 246

Q16. Python Variables

Definition: A variable stores information that can be used later in the program.

Rules:

1. Can be alphanumeric but cannot start with a number
2. Are case-sensitive (Num and num are different)
3. Cannot contain spaces (use underscore)
4. Should be meaningful

Q17. List vs Tuple

List	Tuple
Mutable (can change)	Immutable (cannot change)
Uses square brackets [ ]	Uses parentheses ( )
Slower	Faster
Example: [1, 2, 3]	Example: (1, 2, 3)

SECTION C — LONG ANSWER KEY

Q18. Types of Operators in Python

(a) Arithmetic Operators: Perform mathematical calculations.

- `+` (addition), `-` (subtraction), `*` (multiplication), `/` (division), `%` (modulus), `//` (floor division), `**` (exponentiation)
- Example: `5 + 3 = 8`

(b) Comparison Operators: Compare two values and return True or False.

- `==`, `!=`, `>`, `<`, `>=`, `<=`
- Example: `5 > 3` returns True

(c) Logical Operators: Combine multiple conditions.

- `and`, `or`, `not`

- Example: `(x > 1) and (x < 10)`

(d) Membership Operators: Check if a value exists in a sequence.

- `in` `not in`
- Example: `5 in [1, 3, 5, 7]` returns True

Q19. for Loop in Python

(a) Syntax:

python

```
for variable in range(...):
    # code to execute
```

(b) range() function:

- range(5) → 0, 1, 2, 3, 4
- range(1, 5) → 1, 2, 3, 4
- range(10, 20, 2) → 10, 12, 14, 16, 18
- range(5, 0, -1) → 5, 4, 3, 2, 1

(c) Indentation: Critical in Python. Code inside the loop must be indented. The `:` after the `for` statement indicates the start of the loop block.

(d) break and continue:

- break: Exits the loop immediately
- continue: Skips the rest of the current iteration and moves to the next

Example:

```python
for i in range(5):
    if i == 2:
        continue
    print(i)  # Output: 0, 1, 3, 4
```

SECTION D — PROGRAMMING / OUTPUT ANSWER

Q20. Python Programs

(a) Sum, Difference, Product, Quotient:

```python
a = eval(input("Enter first number: "))
b = eval(input("Enter second number: "))
print("Sum:", a + b)
print("Difference:", a - b)
print("Product:", a * b)
print("Quotient:", a / b)
```

(b) Multiplication Table:

```python
num = eval(input("Enter a number: "))
for i in range(1, 11):
    print(num, 'x', i, '=', num * i)
```

(c) Positive, Negative, or Zero:

python

```
num = eval(input("Enter a number: "))
if num > 0:
    print("The number is positive.")
elif num < 0:
    print("The number is negative.")
else:
    print("The number is zero.")
```

(d) List — Sum, Min, Max:

python

```
nums = [10, 20, 30, 40, 50]
print("Sum:", sum(nums))
print("Minimum:", min(nums))
print("Maximum:", max(nums))
```

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 3 — Programming Fundamentals

CHAPTER TEST — 2

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. In Python, which mode allows you to write multiple lines of code in a file and run the entire program at once?

A. Interactive console
B. Script mode
C. Command line
D. Debug mode

2. Which of the following is the correct file extension for a Python program?

A. .java
B. .py
C. .cpp
D. .txt

3. In Turtle Graphics, which function is used to change the pen color?

A. turtle.color()
B. turtle.pen()
C. turtle.pencolor()
D. turtle.setcolor()

4. Which of the following libraries needs to be installed using pip?

A. turtle
B. datetime
C. math
D. numpy

5. What is the output of the following code?

python

```
x = 5
y = x
x = 10
print(y)
```

A. 5
B. 10
C. 15
D. Error

6. Which of the following is NOT a valid way to assign a value to multiple variables in Python?

A. `x, y, z = 1, 2, 3`
B. `a = b = c = 100`
C. `x = 1; y = 2; z = 3`
D. `x = y = z = 1, 2, 3`

7. Which operator is used for exponentiation in Python?

A. ^
B. **
C. //
D. %

8. What is the output of the following code?

python

```
print(2 + 3 * 4)
```

A. 20
B. 24
C. 14
D. 9

9. Which of the following logical operators requires ALL conditions to be true?

A. or
B. not
C. and
D. in

10. In a `while` loop, what happens if the condition never becomes false?

A. The loop stops automatically
B. The program crashes
C. An infinite loop occurs
D. Python fixes it automatically

11. Which of the following is the correct way to add an element to the end of a list?

A. `list.insert(element)`
B. `list.append(element)`
C. `list.add(element)`
D. `list.push(element)`

12. What does the `len()` function return when applied to a list?

A. The largest element

B. The smallest element
C. The number of elements
D. The sum of elements

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the difference between an interactive program and a batch program. Give one example of each.

Q14. Explain the `strftime()` function of the `datetime` library. Write any FOUR common formatting arguments.

Q15. Explain the concept of dynamic typing in Python with a suitable example.

Q16. Differentiate between `append()` and `insert()` methods of a list with examples.

Q17. What is a function? How is it defined in Python? Give one example.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the following control structures in Python:
(a) `if-else` statement
(b) `if-elif-else` statement

(c) `while` loop
(d) `for` loop

Provide one example of each.

Q19. Explain the concept of Lists in Python in detail. Include:
(a) Definition and creation
(b) Accessing elements by index
(c) Built-in functions: `len()`, `sum()`, `min()`, `max()`
(d) Methods: `append()`, `insert()`, `remove()`, `index()`
(e) Membership operators `in` and `not in`

SECTION D — PROGRAMMING / OUTPUT QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Write Python programs for the following:

(a) Calculate the area and perimeter of a rectangle. Take length and width as input from the user.

(b) Check whether a given year is a leap year using `if-elif-else`.

(c) Print all even numbers from 1 to 20 using a `for` loop.

(d) Create a list of 10 random numbers between 1 and 100 using the `random` module. Print the list, then print its sorted version, minimum, maximum, and average.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Script mode
2	B	.py
3	C	turtle.pencolor()
4	D	numpy
5	A	5
6	D	x = y = z = 1, 2, 3
7	B	**

8	C	14
9	C	and
10	C	An infinite loop occurs
11	B	list.append(element)
12	C	The number of elements

SECTION B — SHORT ANSWER KEY

Q13. Interactive vs Batch Programs

Interactive Program	**Batch Program**
Accepts input from user or another program	Multiple commands bunched together
Continuous interaction	Processed sequentially, then halts
Example: Web browser	Example: Print jobs on a printer

Q14. strftime() Function

Definition: The `strftime()` function formats dates and times according to the argument provided. It takes a datetime object and returns a formatted string.

Four common arguments:

- `%A` — Weekday, full version (e.g., Friday)
- `%B` — Month name, full version (e.g., August)
- `%d` — Day of month (01-31)
- `%Y` — Year, full version (e.g., 2023)

Q15. Dynamic Typing in Python

Definition: Python is a dynamically typed language — you do not need to declare the data type of a variable. The data type is determined automatically based on the value assigned.

Example:

python

```
x = 5      # x is int
x = "Hello" # x is now str
x = 3.14    # x is now float
```

Q16. append() vs insert()

append()	**insert()**

Adds an element at the end of the list	Adds an element at a specified position
`nums.append(4)` → [1, 2, 3, 4]	`nums.insert(1, 4)` → [1, 4, 2, 3]
Takes one argument (the element)	Takes two arguments (index, element)

Q17. Function in Python

Definition: A function is a named block of code that performs a specific task.

How to define:

python

```
def function_name():
    # code to execute
```

Example:

python

```
def greet():
    print("Hello, welcome!")
greet()
```

Output: Hello, welcome!

SECTION C — LONG ANSWER KEY

Q18. Control Structures in Python

(a) if-else:

python

```
num = eval(input("Enter a number: "))
if num % 2 == 0:
    print("Even")
else:
    print("Odd")
```

(b) if-elif-else:

python

```
num = eval(input("Enter a number: "))
if num > 0:
    print("Positive")
elif num < 0:
    print("Negative")
else:
    print("Zero")
```

(c) while loop:

python

```
i = 1
total = 0
while i <= 10:
```

```
    total = total + i
    i = i + 1
print("Sum:", total)  # Output: 55
```

(d) for loop:

```
python
```

```
for i in range(1, 6):
    print(i)
# Output: 1, 2, 3, 4, 5
```

Q19. Lists in Python

(a) Definition: A list is a collection of items stored in a single variable. Created using square brackets [ ].

```
python
```

```
nums = [1, 3, 5, 7, 9]
```

(b) Accessing elements:

```
python
```

```
print(nums[0])  # 1
print(nums[2])  # 5
```

(c) Built-in functions:

- len(nums) → 5
- sum(nums) → 25

- min(nums) → 1
- max(nums) → 9

(d) Methods:

- nums.append(11) → adds 11 to end
- nums.insert(2, 4) → inserts 4 at index 2
- nums.remove(5) → removes first occurrence of 5
- nums.index(7) → returns index of 7

(e) Membership operators:

```python
print(5 in nums)     # True
print(100 not in nums) # True
```

SECTION D — PROGRAMMING / OUTPUT ANSWER

Q20. Python Programs

(a) Area and Perimeter of Rectangle:

```python
length = eval(input("Enter length: "))
width = eval(input("Enter width: "))
area = length * width
perimeter = 2 * (length + width)
print("Area:", area)
print("Perimeter:", perimeter)
```

(b) Leap Year Check:

python

```
year = eval(input("Enter year: "))
if (year % 4 == 0 and year % 100 != 0) or (year % 400 == 0):
    print(year, "is a leap year")
else:
    print(year, "is not a leap year")
```

(c) Even Numbers from 1 to 20:

python

```
for i in range(1, 21):
    if i % 2 == 0:
        print(i)
```

(d) List of 10 Random Numbers:

python

```
from random import randint
nums = []
for i in range(10):
    nums.append(randint(1, 100))
print("Original:", nums)
nums.sort()
print("Sorted:", nums)
print("Min:", min(nums))
print("Max:", max(nums))
print("Average:", sum(nums) / len(nums))
```

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 3 — Programming Fundamentals

CHAPTER TEST — 3 (Comprehensive & High-Difficulty)

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. What will be the output of the following code?

```python
x = 5
y = 3
temp = 0
temp = x
y = temp
x = y
print(x, y, temp)
```

A. 3 5 5
B. 5 5 5
C. 5 3 5
D. 5 5 3

2. What will be the output of the following code?

```python
for i in range(5, 0, -1):
    print(i)
```

A. 1 2 3 4 5
B. 5 4 3 2 1
C. 0 1 2 3 4
D. 5 4 3 2 1 0

3. What will be the output of the following code?

python

```
L = [1, 3, 5, 7, 9]
L.insert(2, 5)
print(L.index(5))
```

A. 1
B. 2
C. 3
D. 5

4. What will be the output of the following code?

python

```
nums = [1, 2, 3, 4, 5]
nums.pop()
nums.pop(0)
print(nums)
```

A. [2, 3, 4]
B. [1, 2, 3]
C. [2, 3, 4, 5]
D. [1, 2, 3, 4]

5. What will be the output of the following code?

python

```
print(10 // 3, 10 % 3)
```

A. 3.33 1
B. 3 1
C. 3 0
D. 3.33 0

6. Which of the following statements about local variables is TRUE?

A. Local variables can be accessed anywhere in the program
B. Local variables are defined outside all functions
C. Local variables are accessible only within the function where they are defined
D. Local variables are always global

7. What will be the output of the following code?

python

```
def my_func():
    x = 10
    print(x)
my_func()
print(x)
```

A. 10 10
B. 10 (error on second print)
C. Error on first print
D. Nothing

8. Which of the following is the correct way to create a function that returns a value?

A. `def add(a, b): print(a + b)`
B. `def add(a, b): return a + b`

C. `def add(a, b): a + b`
D. `def add(a, b): echo a + b`

9. In Turtle Graphics, what is the exterior angle for a regular hexagon?

A. 45°
B. 60°
C. 72°
D. 90°

10. What will be the output of the following code?

```python
import datetime
x = datetime.datetime(2023, 9, 13)
print(x.strftime("%B"))
```

A. 2023
B. 13
C. September
D. Wednesday

11. Which of the following is NOT a valid Python debugging technique?

A. Using IDLE Debugger
B. Using pdb
C. Using print statements
D. Using a spreadsheet

12. What will be the output of the following code?

```python
x = 5
assert x > 10, "x is too small"
print(x)
```

A. 5
B. 10
C. AssertionError with message "x is too small"
D. Nothing

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. What is the difference between a syntax error, a runtime error, and a logical error? Give one example of each.

Q14. Explain the concept of a package manager. How does `pip` work in Python? What are dependencies?

Q15. Write a short program that takes three numbers as input and determines the largest one. Show the complete code and explain briefly.

Q16. Explain the concept of an "argument" in a function. What is the difference between positional arguments and keyword arguments?

Q17. What is the purpose of breakpoints in debugging? How do you set a breakpoint in IDLE's debugger?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the following in detail:
(a) The difference between a `for` loop and a `while` loop
(b) When to use each type of loop
(c) The `range()` function with all three forms (start, stop, step) with examples
(d) The concepts of `break` and `continue` with examples

Q19. Explain the process of Debugging in Python in detail. Cover:
(a) What is a bug?
(b) The IDLE Debugger and its buttons (Step, Go, Over, Out)
(c) The Command-Line Debugger (pdb) with common commands
(d) Debugging with print statements
(e) The `assert` keyword with an example

SECTION D — COMPREHENSIVE PROGRAMMING / OUTPUT QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Trace the following Python code and determine the output. Show a complete trace table.

```python
x = 5
```

```
y = 3
temp = 0
print("Initial:", x, y)
temp = x
x = y
y = temp
print("After Swap:", x, y)

numbers = [12, 31, 25, 8, 32, 17]
total = 0
for i in range(len(numbers)):
    if numbers[i] % 2 == 0:
        total = total + numbers[i]
print("Sum of even numbers:", total)

def calculate_average(nums):
    if len(nums) == 0:
        return 0
    return sum(nums) / len(nums)

print("Average:", calculate_average(numbers))

count = 0
for i in range(10):
    if i == 5:
        break
    count = count + 1
print("Count:", count)

squares = [x ** 2 for x in range(1, 6)]
print("Squares:", squares)
```

(a) Construct a complete trace table for the variable changes.
(b) State the final output.

(c) Identify the number of iterations of each loop.
(d) Which values are even numbers in the list?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	5 5 5
2	B	5 4 3 2 1
3	B	2
4	A	[2, 3, 4]
5	B	3 1

6	C	Local variables are accessible only within the function where they are defined
7	B	10 (error on second print)
8	B	def add(a, b): return a + b
9	B	60°
10	C	September
11	D	Using a spreadsheet
12	C	AssertionError with message "x is too small"

SECTION B — SHORT ANSWER KEY

Q13. Types of Errors

Error Type	Description	Example
Syntax Error	Violates the rules of the language	`print("Hello"` (missing parenthesis)
Runtime Error	Occurs while the program is running	`10 / 0` (division by zero)

Logical Error	Program runs but gives wrong output	Using `-` instead of `+`

Q14. Package Manager and pip

Definition: A package manager is a tool that installs, updates, and removes software packages and their dependencies automatically.

How pip works:

1. You type `pip install package_name`
2. pip connects to the Python Package Index (PyPI)
3. It downloads the package and all its dependencies
4. It installs everything in the correct location
5. The package is now available for import

Dependencies: Other packages a library needs in order to work. pip installs them automatically.

Q15. Largest of Three Numbers

```python
a = eval(input("Enter first number: "))
b = eval(input("Enter second number: "))
c = eval(input("Enter third number: "))
if a >= b and a >= c:
    print("Largest:", a)
elif b >= a and b >= c:
    print("Largest:", b)
else:
    print("Largest:", c)
```

Q16. Arguments in Functions

Definition: An argument is a value passed to a function when it is called. The function uses this value inside its body.

Positional Arguments: Passed in the order they are defined.

python

```
def greet(first, last):
    print("Hello,", first, last)
greet("Ali", "Khan")  # Hello, Ali Khan
```

Keyword Arguments: Passed with the parameter name.

python

```
greet(last="Khan", first="Ali")  # Hello, Ali Khan
```

Q17. Breakpoints in Debugging

Purpose: A breakpoint is a line in the code where the debugger pauses execution, allowing you to examine variables and step through code line by line.

Setting in IDLE:

1. Activate the debugger (Debug Debugger)
2. Right-click on the line of code you want to set as a breakpoint
3. Select "Set Breakpoint"
4. The line will be highlighted yellow

SECTION C — LONG ANSWER KEY

Q18. for Loop vs while Loop

(a) Differences:

for Loop	while Loop
Number of iterations is known	Number of iterations is not known
Uses range()	Uses a condition
Initialization and increment automatic	Manual initialization and increment
Lower risk of infinite loop	Higher risk of infinite loop

(b) When to use each:

- for: Iterating over a sequence, known number of iterations, processing items in a list
- while: Unknown number of iterations, loop until a condition changes, reading input until valid

(c) range() function forms:

- range(stop) → 0 to stop-1. Example: range(5) → 0, 1, 2, 3, 4
- range(start, stop) → start to stop-1. Example: range(2, 6) → 2, 3, 4, 5
- range(start, stop, step) → start to stop-1 with step. Example: range(1, 10, 2) → 1, 3, 5, 7, 9

(d) break and continue:

- break: Exits the loop immediately
- continue: Skips the rest of the current iteration and moves to the next

Example:

python

```
for i in range(5):
    if i == 2:
        continue
    if i == 4:
        break
    print(i)  # Output: 0, 1, 3
```

Q19. Debugging in Python

(a) Bug: An unanticipated error in a program, generally logical in nature.

(b) IDLE Debugger buttons:

- Step: Execute code line-by-line
- Go: Jump to the breakpoint directly
- Over: Execute a function call completely without stepping into it
- Out: Skip the remaining portion of a function and come out of it

(c) pdb common commands:

- step: Execute current line, step into functions
- next: Execute current line, do not step into functions
- continue: Continue execution until next breakpoint
- list: Show the code around the current line

- break line_number: Set a breakpoint
- print variable: Show value of a variable
- quit: Exit the debugger

(d) Debugging with print statements: Add `print()` at key points to see variable values and trace the flow.

(e) assert keyword:

```python
x = 5
assert x > 0, "x must be positive"
print(x)  # 5
```

If the condition is false, an AssertionError is raised.

SECTION D — COMPREHENSIVE PROGRAMMING / OUTPUT ANSWER

Q20. Trace and Output

(a) Trace Table (Partial — Key Variables):

Step	x	y	temp	numbers	total	i	count	squares
1	5	3	0	-	-	-	-	-
2	5	3	0	-	-	-	-	-

3	5	3	5	-	-	-	-	-
4	3	3	5	-	-	-	-	-
5	3	5	5	-	-	-	-	-
6	3	5	5	[12,31,25,8,32,17]	0	-	-	-
7	3	5	5	-	0	0	-	-
8	3	5	5	-	12	0	-	-
9	3	5	5	-	12	1	-	-
10	3	5	5	-	12	2	-	-
11	3	5	5	-	20	3	-	-
12	3	5	5	-	52	4	-	-
13	3	5	5	-	52	5	-	-
14	3	5	5	-	52	-	0	-
15	3	5	5	-	52	0	1	-

...	...	...	...	...	...	...	...	...
16	3	5	5	-	52	4	5	-
17	3	5	5	-	52	5	5	-
18	3	5	5	-	52	-	5	[1,4,9,16,25]

(b) Final Output:

text

```
Initial: 5 3
After Swap: 3 5
Sum of even numbers: 52
Average: 20.833333333333332
Count: 5
Squares: [1, 4, 9, 16, 25]
```

Calculations:

- Sum of even numbers: 12 + 8 + 32 = 52
- Average: (12+31+25+8+32+17) / 6 = 125/6 ≈ 20.83
- Count: Loop runs from i=0 to i=4, breaks at i=5, so count = 5
- Squares: [1, 4, 9, 16, 25]

(c) Iterations:

- For loop over numbers: 6 iterations

- For loop over range(10): 5 iterations (breaks at i=5)
- List comprehension: 5 iterations

(d) Even numbers in the list: 12, 8, 32

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 4 — Data and Analysis

CHAPTER TEST — 1

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.

- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Statistical modeling is the use of mathematical models and statistical assumptions to:

A. Replace data
B. Generate sample data and make predictions about the real world
C. Delete data
D. Slow down analysis

2. In supervised learning, the algorithm uses:

A. Unlabeled data
B. Labeled data
C. Random data
D. Encrypted data

3. If the result or outcome of a model is a continuous value, it is called:

A. Classification
B. Regression
C. Clustering

D. Association

4. Which of the following is an example of unsupervised learning?

A. Predicting house prices
B. Classifying emails as spam or not spam
C. K-means clustering
D. Predicting whether an employee will get a raise

5. The purpose of experimental design is to:

A. Increase errors
B. Ensure precise planning and prevent erroneous conclusions
C. Skip data collection
D. Avoid analysis

6. In the experimental design flow, which step comes immediately after "Find the variables"?

A. Data Analysis
B. Determine the Experimental Design
C. Carry out the experiment
D. Discuss and Report

7. Which principle of experimental design involves grouping participants according to a trait that could affect results?

A. Randomization
B. Local Control
C. Blocking
D. Replication

8. Which of the following best describes a random sample?

A. Every member of the population has an equal chance of being selected
B. Only friends are selected
C. Only the first 10 people are selected
D. Only people from one city are selected

9. A parameter is a number that describes:

A. A sample
B. The entire population
C. Only the mean
D. Only the median

10. Which of the following is a primary data collection method?

A. Internet
B. Government archives
C. Interviews
D. Libraries

11. Which Python library is used for data visualization?

A. NumPy
B. Matplotlib
C. Pandas
D. Scikit-learn

12. Which type of chart is best for showing proportions?

A. Line chart
B. Histogram
C. Pie chart
D. Scatter plot

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Define statistical modeling. Give one real-world example of a data science use case.

Q14. Differentiate between supervised learning and unsupervised learning.

Q15. Explain the concept of correlation and causation. Why does correlation not imply causation?

Q16. What is a random sample? Why is random sampling important in research?

Q17. Explain the difference between primary and secondary data collection methods. Give one example of each.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the five-step roadmap to solve a data science case study. Describe each step in detail with an example.

Q19. Explain the principles of experimental design:
(a) Principle of Randomization
(b) Principle of Local Control
(c) Principle of Blocking
(d) Principle of Replication

Provide an example for each principle.

SECTION D — PYTHON / DATA ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Consider the following Python code using the Tips dataset:

python

```
import pandas as pd
import matplotlib.pyplot as plt

data = pd.read_csv("tips.csv")

# Visualization 1
plt.scatter(data['total_bill'], data['tip'])
plt.title("Scatter Plot")
plt.xlabel("Total Bill")
plt.ylabel("Tip")
plt.show()

# Visualization 2
```

```
plt.hist(data['total_bill'])
plt.title("Histogram")
plt.show()

# Visualization 3
plt.bar(data['day'], data['tip'])
plt.title("Bar Chart")
plt.show()
```

(a) Name the library used for data analysis and the library used for visualization.
(b) What does `data.head(10)` do?
(c) Which visualization shows the relationship between total bill and tip?
(d) Which visualization shows the distribution of total bills?
(e) What is the purpose of `plt.show()`?
(f) Explain what the bar chart shows.
(g) Write one line of code to display the first 10 rows of the dataset.
(h) Name any TWO other visualizations that can be created with Matplotlib.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Generate sample data and make predictions about the real world
2	B	Labeled data
3	B	Regression
4	C	K-means clustering
5	B	Ensure precise planning and prevent erroneous conclusions
6	B	Determine the Experimental Design
7	C	Blocking
8	A	Every member of the population has an equal chance of being selected
9	B	The entire population
10	C	Interviews
11	B	Matplotlib
12	C	Pie chart

SECTION B — SHORT ANSWER KEY

Q13. Statistical Modeling and Data Science Use Case

Definition: Statistical modeling is the use of mathematical models and statistical assumptions to generate sample data and make predictions about the real world.

Real-world example: Weather forecasting — using historical data (temperature, rainfall, wind speed) to predict future weather conditions.

Q14. Supervised vs Unsupervised Learning

Supervised Learning	Unsupervised Learning
Uses labeled data	Uses unlabeled data
Answer key available for training	No answer key
Examples: Regression, Classification	Examples: Clustering, Association
Predicts known outcomes	Finds hidden patterns

Q15. Correlation and Causation

Correlation: An association between variables — they change together.

Causation: One variable causes changes in another.

Why correlation does not imply causation:

- The relationship may be coincidental
- There may be reverse causation
- A third variable (confounding variable) may cause both changes

Example from textbook: Phone lagging was correlated with sending a text message, but the real cause was lack of RAM.

Q16. Random Sample

Definition: A random sample is a subset of the population where every member has an equal chance of being selected.

Importance:

- Prevents bias
- Ensures the sample represents the population
- Allows valid generalizations
- Increases reliability of results

Q17. Primary vs Secondary Data Collection

Primary Data	**Secondary Data**
Collected firsthand	Already collected by someone else
Original and authentic	Less expensive, easier to collect

Examples: Interviews, surveys, observations	Examples: Internet, government archives, libraries

---

SECTION C — LONG ANSWER KEY

Q18. Five-Step Roadmap to Solve a Data Science Case Study

Step 1: Formulating the Right Question

- Review available literature
- Clearly define what you want to find out
- Set boundaries for research
- Example: "Impact of earthquake in hilly areas of Pakistan"

Step 2: Data Collection

- Conduct data inventory (what data is available/needed)
- Gather data from various sources
- Example: Collect temperature, rainfall, wind speed data

Step 3: Data Wrangling

- Clean, preprocess, transform, manipulate, and map raw data
- Remove duplicates, handle missing values, fix errors
- Example: Remove duplicate weather records, fill missing temperature values

Step 4: Data Analysis and Modeling

- Analyze cleaned data
- Fit into a selected predictive statistical model

- Example: Fit a regression model to predict future weather

Step 5: Result Communication

- Share findings with management, shareholders, involved parties
- Use charts, graphs, reports
- Example: Present weather predictions to stakeholders

Q19. Principles of Experimental Design

(a) Principle of Randomization:

- Divide people into treatment groups randomly
- Ensures no bias or preplanned grouping
- Example: Randomly assign 100 asthma patients into two groups of 50

(b) Principle of Local Control:

- Use a control group that has not received treatment
- Compare treatment group's findings with control group
- Example: One group receives new medicine; control group receives regular medication

(c) Principle of Blocking:

- Group participants by a trait that could affect results
- Ensures results aren't affected by group differences
- Example: Block by gender — 56 women and 44 men divided into two balanced groups

(d) Principle of Replication:

- Repeat the experiment again and again

- Ensures results are reliable
- Example: Different data scientists repeat the asthma medicine test

---

SECTION D — PYTHON / DATA ANALYSIS ANSWER

Q20. Python Code Analysis

(a) Libraries used:

- Data analysis: Pandas
- Visualization: Matplotlib

(b) `data.head(10)`: Displays the first 10 rows of the dataset.

(c) Relationship between total bill and tip: Scatter Plot (`plt.scatter(data['total_bill'], data['tip'])`)

(d) Distribution of total bills: Histogram (`plt.hist(data['total_bill'])`)

(e) Purpose of `plt.show()`: Displays the plot on the screen.

(f) Bar Chart shows: The average tip for each day (Sun, Sat, Thur, Fri).

(g) Code to display first 10 rows:

```python
display(data.head(10))
```

or

```
python

print(data.head(10))
```

(h) Two other visualizations:

1. Line Chart
2. Boxplot
3. Pie Chart

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 4 — Data and Analysis

CHAPTER TEST — 2

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. A concrete real-world task to be solved using available data is called a:

A. Data science use case
B. Data type
C. Data structure
D. Data source

2. In linear regression, the variable used for prediction is called the:

A. Dependent variable
B. Independent variable
C. Random variable
D. Constant variable

3. Which of the following is a classification problem?

A. Predicting house price

B. Predicting temperature
C. Predicting whether an employee will get a raise
D. Predicting salary amount

4. The K-means algorithm is used for:

A. Regression
B. Classification
C. Clustering
D. Sorting

5. Which of the following is a secondary data collection method?

A. Interviews
B. Surveys
C. Government archives
D. Focus groups

6. In the experimental design flow, "Interpretation and Drawing Conclusions" comes immediately after:

A. Random Assignment
B. Data Analysis
C. Carry out the Experiment
D. Develop Hypotheses

7. Which principle of experimental design ensures that results are not coincidental?

A. Randomization
B. Local Control

C. Blocking
D. Replication

8. A statistic is a number that describes:

A. The entire population
B. A sample
C. Only the mean
D. Only the mode

9. Which Python library is used for reading and manipulating data?

A. Matplotlib
B. Pandas
C. NumPy
D. Scikit-learn

10. In the Tips dataset, which column represents the total bill amount?

A. tip
B. sex
C. total_bill
D. day

11. Which visualization is best for showing the relationship between two numerical variables?

A. Pie chart
B. Histogram
C. Scatter plot

D. Bar chart

12. Which of the following is NOT a supervised learning technique?

A. Regression
B. Classification
C. K-means clustering
D. Decision trees

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. What is a data science use case? Name any FOUR common approaches used to solve data science use cases.

Q14. Differentiate between a parameter and a statistic. Give one example of each.

Q15. Explain the difference between classification and regression models in statistical modeling.

Q16. What is the difference between a population and a random sample? Why is random sampling used?

Q17. Explain how the Internet of Things (IoT) and Big Data Analytics are related in the context of data science.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8

Attempt any ONE question.

Q18. Explain the experimental design flow in detail. Describe each step:
(a) Develop Hypotheses
(b) Find the Variables
(c) Determine the Experimental Design
(d) Calculating the Needed Sample Size
(e) Random Assignment and Selection
(f) Carry out the Experiment
(g) Data Analysis
(h) Interpreting and Drawing Conclusions
(i) Discuss and Report

Q19. Explain the various data collection methods in detail:
(a) Primary Data Collection Methods
(b) Secondary Data Collection Methods

Provide at least two techniques under each category with examples.

SECTION D — PYTHON / DATA ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Consider the following Python code using the Tips dataset:

python

```
import pandas as pd
import matplotlib.pyplot as plt

data = pd.read_csv("tips.csv")

# Visualization A
plt.plot(data['tip'])
plt.plot(data['size'])
plt.title("Line Chart")
plt.xlabel("Index")
plt.ylabel("Value")
plt.show()

# Visualization B
plt.boxplot(data['total_bill'])
plt.title("Boxplot")
plt.show()

# Visualization C
plt.pie(data['day'].value_counts(),
        autopct="%.1f%%",
        labels=['Sat', 'Sun', 'Thur', 'Fri'])
plt.title("Pie Chart")
plt.show()
```

(a) What does `pd.read_csv("tips.csv")` do?
(b) Which visualization shows the trend of tip and size across all transactions?
(c) What does a boxplot show?
(d) What does the pie chart show in this example?
(e) What is the purpose of `autopct="%.1f%%"` in the pie chart?
(f) Name any TWO libraries used in the above code.
(g) Write a code snippet to display the shape (rows and columns) of the dataset.
(h) Explain what the boxplot indicates about the distribution of total bills.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	A	Data science use case
2	B	Independent variable
3	C	Predicting whether an employee will get a raise
4	C	Clustering
5	C	Government archives
6	B	Data Analysis
7	D	Replication

8	B	A sample
9	B	Pandas
10	C	total_bill
11	C	Scatter plot
12	C	K-means clustering

SECTION B — SHORT ANSWER KEY

Q13. Data Science Use Case and Approaches

Definition: A data science use case is a concrete real-world task to be solved using available data. It can be a problem to be resolved, a hypothesis to be checked, or a question to be answered.

Four common approaches:

1. Forecasting
2. Classification
3. Pattern and anomaly detection
4. Recommendations
5. Image recognition

Q14. Parameter vs Statistic

Parameter	Statistic
Describes entire population	Describes a sample
Usually unknown	Known, calculated from data
Example: Average income of all citizens of Pakistan	Example: Average income of 500 randomly selected government employees

Q15. Classification vs Regression Models

Classification	Regression
Outcome is a discrete value	Outcome is a continuous value
Example: Predicting whether an employee will get a raise (Yes/No)	Example: Predicting how much salary raise an employee will get
Uses decision trees, Naive Bayes, etc.	Uses linear regression, etc.

Q16. Population vs Random Sample

Population	Random Sample

Complete set of all items	Subset of population
Usually large	Smaller than population
Studying entire population is called census	Studying sample is called sampling

Why random sampling: It prevents bias, ensures representation, and allows valid generalizations about the population.

Q17. IoT and Big Data Analytics

Relationship:

- IoT devices collect vast amounts of data through sensors
- This data is sent to the cloud
- Big Data Analytics processes and analyzes this data
- Insights are extracted to improve decision-making
- Example: Smart factory sensors collect temperature, vibration data Big Data Analytics predicts machine failures

---

SECTION C — LONG ANSWER KEY

Q18. Experimental Design Flow

(a) Develop Hypotheses: Clarify differences and correlations between variables.

(b) Find the Variables: Decide which variables are fixed (independent) and which will change (dependent). Consider confounding factors.

(c) Determine the Experimental Design: Choose appropriate design (factorial, randomized block, etc.) based on research nature and resources.

(d) Calculating the Needed Sample Size: Calculate necessary sample size for valid statistical results.

(e) Random Assignment and Selection: Choose random samples to ensure groups are identical and no bias.

(f) Carry out the Experiment: Follow instructions and gather data strictly according to defined procedure.

(g) Data Analysis: Use appropriate statistical analysis (hypothesis testing, regression, ANOVA).

(h) Interpreting and Drawing Conclusions: Observe results carefully, consider practical factors.

(i) Discuss and Report: Present design, methodology, findings, and conclusions clearly. Document thoroughly for reproducibility.

Q19. Data Collection Methods

(a) Primary Data Collection Methods:

1. Interviews: Direct conversations with stakeholders
    - Example: Interviewing parents about children's digital game usage
2. Surveys and Questionnaires: Distributed to large groups
    - Example: Survey to collect customer satisfaction feedback
3. Observation: Observing users in natural environment
    - Example: Observing students during examinations

4. Focus Groups: Group discussion with common interest

- Example: Focus group of teachers discussing online teaching

(b) Secondary Data Collection Methods:

1. Internet: Large pool of free and paid resources

- Example: Research articles from authentic websites

2. Government Archives: Authentic and verifiable data

- Example: Population records from government databases

3. Libraries: Academic research, business directories

- Example: Annual reports and research papers

SECTION D — PYTHON / DATA ANALYSIS ANSWER

Q20. Python Code Analysis

(a) `pd.read_csv("tips.csv")`: Reads the CSV file "tips.csv" into a Pandas DataFrame called `data`.

(b) Trend of tip and size: Line Chart (`plt.plot(data['tip'])` and `plt.plot(data['size'])`)

(c) Boxplot shows: Distribution of a dataset — central tendency, spread, and potential outliers.

(d) Pie chart shows: Proportion of tips on various days (Sat, Sun, Thur, Fri).

(e) `autopct="%.1f%%"`: Displays percentages with one decimal place on each pie slice.

(f) Two libraries used: Pandas and Matplotlib.

(g) Code to display shape:

python

```
print(data.shape)
```

(h) Boxplot interpretation: Shows the median, interquartile range, and outliers of total bills. The box represents the middle 50% of data; whiskers show the range; dots outside whiskers are outliers.

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 4 — Data and Analysis

CHAPTER TEST — 3 (Comprehensive & High-Difficulty)

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. A financial institution uses cloud-based storage for customer data. The cloud provider stores data in multiple data centers. If one data center fails, data is still accessible from other locations. This is an example of:

A. Scalability
B. Reliability
C. Latency
D. Bandwidth

2. In a linear regression equation y=mx+by=mx+b, the value mm represents:

A. Y-intercept
B. Slope
C. Dependent variable
D. Independent variable

3. A telecom company observes customer usage and divides them into three clusters: long call duration, heavy internet usage, and

short calls with average internet. This is an example of:

A. Regression
B. Classification
C. Clustering
D. Association

4. In a supermarket, if a customer buys bread, there is a high chance they will also buy milk. This is an example of:

A. Classification
B. Regression
C. Association
D. Clustering

5. If a researcher already believes a new medicine will be very effective, they might unintentionally analyze results to align with this belief. This is an example of:

A. Sampling Bias
B. Selection Bias
C. Observer Bias
D. Data Interpretation Bias

6. A survey is conducted only in urban areas, missing rural perspectives. This is an example of:

A. Sampling Bias
B. Selection Bias
C. Observer Bias
D. Data Interpretation Bias

7. Which of the following is NOT a source of reliable information?

A. Government websites (.gov)
B. Educational institutions (.edu)
C. Peer-reviewed journals
D. Anonymous social media posts

8. In the context of data presentation, which tool is a combination of text, images, and design elements?

A. Report
B. Presentation
C. Infographic
D. Table

9. Which of the following best describes the relationship between correlation and causation?

A. Correlation always implies causation
B. Causation always implies correlation
C. They are the same thing
D. They are unrelated

10. A researcher wants to study the average income of all software engineers in Pakistan. Which of the following represents the population?

A. 1000 randomly selected software engineers
B. All software engineers in Pakistan
C. Only software engineers in Lahore
D. Only senior software engineers

11. Which of the following is a characteristic of a good presentation?

A. Cluttered with too many details
B. Audience-centered and visually appealing
C. Using only text, no visuals
D. Ignoring the audience's needs

12. In the context of statistical modeling, which type of learning uses unlabeled data?

A. Supervised learning
B. Unsupervised learning
C. Reinforcement learning
D. Guided learning

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the difference between a method and a strategy in the context of data collection. Give one example of a data collection strategy.

Q14. What is a prototype in the context of data collection? Name any TWO types of prototypes and explain their purpose.

Q15. Explain the concept of data bias. Describe any TWO types of human bias in data collection with examples.

Q16. Differentiate between discrete and continuous values in statistical modeling. Give one example of each type of model.

Q17. Explain the role of data visualization in decision-making. Name any FOUR types of visualizations and state what each is best used for.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the process of building a statistical model using Python. Include:
(a) The libraries used
(b) Steps involved in creating and fitting a model
(c) Making predictions
(d) Visualizing the results

Provide a sample code snippet to illustrate your explanation.

Q19. Explain the real-world experimentation examples discussed in the textbook:
(a) Facebook A/B Testing
(b) Airbnb's use of data science
(c) YouTube's statistical experimentation

For each, describe what is tested and how data-driven decisions are made.

SECTION D — COMPREHENSIVE DATA ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. Consider the following Python code and dataset analysis:

python

```
import pandas as pd
import matplotlib.pyplot as plt

data = pd.read_csv("tips.csv")

# Create visualizations
plt.figure(figsize=(10, 6))

plt.subplot(2, 2, 1)
plt.scatter(data['total_bill'], data['tip'])
plt.title("Scatter: Bill vs Tip")

plt.subplot(2, 2, 2)
plt.hist(data['total_bill'])
plt.title("Histogram: Total Bill")

plt.subplot(2, 2, 3)
plt.bar(data['day'], data['tip'])
plt.title("Bar: Tips by Day")

plt.subplot(2, 2, 4)
plt.pie(data['day'].value_counts(), autopct="%.1f%%",
        labels=['Sat', 'Sun', 'Thur', 'Fri'])
plt.title("Pie: Day Distribution")

plt.tight_layout()
plt.show()
```

(a) What is the purpose of `pd.read_csv("tips.csv")`?
(b) Which visualization shows the relationship between total bill and tip?

(c) Which visualization shows the frequency distribution of total bills?
(d) Which visualization shows the average tip for each day?
(e) What does the pie chart show?
(f) What is the purpose of `plt.tight_layout()`?
(g) Describe the trend you would expect to see in the scatter plot for tips vs total bill.
(h) If the histogram of total bills is right-skewed, what does this indicate about the data?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Reliability
2	B	Slope
3	C	Clustering

4	C	Association
5	C	Observer Bias
6	A	Sampling Bias
7	D	Anonymous social media posts
8	C	Infographic
9	B	Causation always implies correlation
10	B	All software engineers in Pakistan
11	B	Audience-centered and visually appealing
12	B	Unsupervised learning

SECTION B — SHORT ANSWER KEY

Q13. Method vs Strategy

Method	**Strategy**

Process, steps, or procedure to perform a task	Goal, objective, or set of actions to achieve some aim
How to achieve a goal	How to select a goal
Example: Conducting an interview	Example: Using interviews for research

Data collection strategy example: A company uses a "high-end" strategy to market expensive products and uses various methods to reach potential customers.

Q14. Prototype in Data Collection

Definition: A prototype is a preliminary version of data collection tools or methods.

Two types:

1. Survey Prototypes: Small-scale version of a survey before general distribution. Purpose: Identify ambiguities and clarify questions.
2. Questionnaire Prototypes: Draft version of a questionnaire. Purpose: Identify and correct problems before final use.

Q15. Data Bias and Human Bias

Data Bias: Mistakes or problems in information that can make conclusions not quite right. Occurs when data is not fair or accurate.

Two types of human bias:

1. Sampling Bias: Sample does not accurately represent the population. Example: Survey only in urban areas, missing rural perspectives.
2. Observer Bias: Researcher's expectations influence results. Example: Scientist believing a medicine is effective analyzes

results to align with this belief.

Q16. Discrete vs Continuous Values

Discrete Values	Continuous Values
Limited set of categories	Any value within a range
Example: Yes/No, Pass/Fail	Example: Height, Salary
Classification model	Regression model

Q17. Data Visualization and Decision-Making

Role: Makes complex data easier to understand, helps identify patterns and trends, supports data-driven decision-making.

Four visualizations:

1. Bar Chart: Comparing categories
2. Pie Chart: Showing proportions
3. Line Chart: Showing trends over time
4. Scatter Plot: Showing relationships between variables
5. Histogram: Showing distribution
6. Boxplot: Showing distribution and outliers

SECTION C — LONG ANSWER KEY

Q18. Building a Statistical Model Using Python

(a) Libraries used:

- NumPy — numerical operations
- Pandas — data manipulation
- Scikit-learn — machine learning models
- Matplotlib — visualization

(b) Steps:

1. Import libraries
2. Generate or load dataset
3. Create model object
4. Fit model on data
5. Make predictions

(c) Making predictions:

python

```
X_new = np.array([[0], [2]])
y_pred = model.predict(X_new)
```

(d) Visualizing results:

python

```
plt.scatter(X, y, label='Original data')
plt.plot(X_new, y_pred, 'r-', label='Linear regression line')
plt.xlabel('X')
```

```
plt.ylabel('y')
plt.legend()
plt.show()
```

Sample code:

python

```
import numpy as np
from sklearn.linear_model import LinearRegression
import matplotlib.pyplot as plt

np.random.seed(42)
X = 2 * np.random.rand(100, 1)
y = 4 + 3 * X + np.random.randn(100, 1)

model = LinearRegression()
model.fit(X, y)

X_new = np.array([[0], [2]])
y_pred = model.predict(X_new)

plt.scatter(X, y, label='Original data')
plt.plot(X_new, y_pred, 'r-', label='Linear regression line')
plt.xlabel('X')
plt.ylabel('y')
plt.legend()
plt.show()
```

Q19. Real-World Experimentation Examples

(a) Facebook A/B Testing:

- Creates two versions (A and B) of a webpage, app feature, or advertisement
- Randomly assigns users to each group
- Collects data on user interactions, conversion rates
- Determines which version performs better
- Uses data-driven approach for informed decisions

(b) Airbnb's Use of Data Science:

- Uses A/B testing for new features like redesigned booking flow or search algorithm
- Creates two versions, randomly assigns users
- Collects data on user interactions, conversion rates
- Makes informed decisions about implementing changes
- Continuously refines platform based on empirical evidence

(c) YouTube's Statistical Experimentation:

- Uses A/B testing to improve user engagement and content discovery
- Tests new recommendation algorithms or layout changes
- Randomly assigns users to control and experimental groups
- Collects data on click-through rates, watch time, user feedback
- Fine-tunes algorithms and optimizes features

SECTION D — COMPREHENSIVE DATA ANALYSIS ANSWER

Q20. Python Code Analysis

(a) `pd.read_csv("tips.csv")`: Reads the CSV file "tips.csv" into a Pandas DataFrame.

(b) Relationship between total bill and tip: Scatter Plot (`plt.scatter(data['total_bill'], data['tip'])`)

(c) Frequency distribution of total bills: Histogram (`plt.hist(data['total_bill'])`)

(d) Average tip for each day: Bar Chart (`plt.bar(data['day'], data['tip'])`)

(e) Pie chart shows: Proportion of tips on various days (Sat, Sun, Thur, Fri).

(f) `plt.tight_layout()`: Automatically adjusts subplot parameters to give specified padding and prevent overlapping.

(g) Scatter plot trend: Positive correlation — as total bill increases, tip generally increases.

(h) Right-skewed histogram: Most total bills are on the lower end, with fewer high bills. The tail extends to the right.

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 5 — Internet of Things and Blockchain

CHAPTER TEST — 1

Time Allowed: 1 Hour 30 Minutes

Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. IoT is made up of two words: Internet and:

A. Technology
B. Things
C. Network
D. Devices

2. Which of the following is a wireless technology used for creating IoT networks?

A. Wi-Fi
B. Bluetooth
C. Zigbee
D. All of the above

3. Which type of sensor is used to measure environmental conditions?

A. Motion detection sensor
B. Industrial sensor
C. Environmental sensor
D. Proximity sensor

4. Which of the following is NOT a type of cloud computing deployment model?

A. Public Cloud
B. Private Cloud
C. Hybrid Cloud
D. Sequential Cloud

5. A Blockchain is a:

A. Centralized database
B. Digital ledger of transactions
C. Type of computer
D. Network protocol

6. Cryptography in Blockchain ensures that transaction data is:

A. Easily editable
B. Secure and immutable
C. Publicly available
D. Centralized

7. Which type of Blockchain network is open to anyone?

A. Private Blockchain Network
B. Permissioned Blockchain Network
C. Public Blockchain Network
D. Consortium Blockchain Network

8. Which of the following is a benefit of integrating Blockchain with IoT?

A. Increased vulnerability
B. Enhanced security and reliability
C. Slower communication
D. Centralized control

9. Which of the following is a stakeholder in AI systems?

A. End users
B. Developers
C. Regulators
D. All of the above

10. Which of the following is a positive impact of AI systems?

A. Lack of employment
B. High cost
C. Reduction in human error
D. Ethical concerns

11. Which of the following is a negative impact of AI systems?

A. Unbiased decisions

B. Around the clock availability
C. Less creativity and emotions
D. Zero risk

12. What is the purpose of cloud computing in IoT?

A. To slow down data processing
B. To provide data storage and computing services over the Internet
C. To replace sensors
D. To increase physical hardware

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Define Internet of Things (IoT). Name any FOUR examples of "things" in IoT.

Q14. Explain the role of Wireless Sensor Networks (WSNs) in IoT. Name the three types of sensors used.

Q15. Define Blockchain. Why is data stored in a Blockchain secure?

Q16. Differentiate between public and private Blockchain networks.

Q17. Explain any TWO positive impacts of AI systems.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the technologies that enabled Internet of Things (IoT). Describe:
(a) Wireless Sensor Networks (WSNs)
(b) Cloud Computing
(c) Big Data Analytics
(d) Communication Protocols
(e) Embedded Systems

Q19. Explain the integration of Blockchain and IoT. Discuss:
(a) Why integration is needed
(b) Benefits of integration
(c) Applications of integration in supply chain, healthcare, and agriculture

---

SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) Explain the four types of Blockchain networks: Public, Private, Permissioned, and Consortium.
(b) For each type, give ONE suitable application.
(c) Explain the transaction process on a Blockchain network, including:

- Direct deals without intermediaries
- Peer-to-peer verification
- Permanence and irreversibility
- Decentralization of data

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Things
2	D	All of the above
3	C	Environmental sensor
4	D	Sequential Cloud
5	B	Digital ledger of transactions
6	B	Secure and immutable
7	C	Public Blockchain Network

8	B	Enhanced security and reliability
9	D	All of the above
10	C	Reduction in human error
11	C	Less creativity and emotions
12	B	To provide data storage and computing services over the Internet

---

SECTION B — SHORT ANSWER KEY

Q13. IoT Definition and "Things"

Definition: Internet of Things (IoT) is a network of physical devices, appliances, machines, and other objects that are embedded with sensors, software, and network connectivity, allowing them to collect and exchange data over the internet.

Four examples of "things":

1. Smart mobiles
2. Smart watches
3. Smart security systems
4. Medical sensors
5. Home appliances
6. Smart light bulbs

7. Smart door locks
8. Smart TVs

Q14. Wireless Sensor Networks (WSNs) in IoT

Role: WSNs are networks of physical devices that communicate through wireless channels. They collect data from the physical world and send it for processing.

Three types of sensors:

1. Environmental sensors (temperature, humidity, air quality, pressure, wind, light)
2. Industrial sensors (heat, pressure, gas, vibration, viscosity, fluid flow, magnetic field)
3. Motion detection sensors (ultrasonic, proximity, vibration, PIR)

Q15. Blockchain Definition and Security

Definition: A Blockchain is a digital ledger of transactions that is shared and maintained by network users. The ledger is a list of continuously growing records, known as blocks.

Why data is secure:

- Cryptography ensures transaction data is secure and immutable
- It cannot be hacked or altered
- Each block contains a hash of the previous block
- Changing any block would change its hash and break the chain

Q16. Public vs Private Blockchain Networks

Public Blockchain	**Private Blockchain**

Anyone can join	Managed by a single organization
Open platform	Public access restricted
Weak security	More secure
Used for cryptocurrency (Bitcoin)	Used for business record-keeping

Q17. Positive Impacts of AI Systems

1. Unbiased Decisions: Decisions based on reason and logic rather than emotions. Example: AI recruitment hires based on skills, not ethnicity.
2. Around the Clock Availability: AI systems work 24x7 without breaks. Example: Online customer support Chatbot available anytime.
3. Zero Risk: AI robots perform tasks in hazardous environments. Example: Defusing a bomb.
4. Reduction in Human Error: AI provides high accuracy. Example: Robotic surgery systems.

SECTION C — LONG ANSWER KEY

Q18. Technologies that Enabled IoT

(a) Wireless Sensor Networks (WSNs):

- Network of physical devices communicating through wireless channels
- Devices embedded with sensors and software
- Three types: environmental, industrial, motion detection sensors

(b) Cloud Computing:

- IT infrastructure providing data storage, databases, servers, networking, and application software over the Internet
- Four deployment models: Public, Private, Community, Hybrid
- Examples: AWS, Microsoft Azure, Google Cloud

(c) Big Data Analytics:

- Collecting extremely big data from various resources
- Using analytics software to find market trends, patterns, and insights
- Used in healthcare, transport, banking, weather, insurance, marketing, etc.

(d) Communication Protocols:

- Set of rules governing how data is transferred and understood
- Provides exchange of information and methods of connection
- Needed for proper functioning of IoT devices

(e) Embedded Systems:

- Small electronic devices that are combination of hardware and firmware
- Have microcontroller or microprocessor
- Designed to perform a specific task
- Applications: medical equipment, home appliances, automotive devices, industrial equipment

---

Q19. Integration of Blockchain and IoT

(a) Why integration is needed:

- IoT devices collect and exchange vast amounts of data
- This data is vulnerable to cyber-attacks

- Security measures are needed against hacking and breaches
- Blockchain provides decentralized, secure, and transparent recording

(b) Benefits:

- Enhanced security (cryptography protects data)
- Improved performance (faster communication without intermediaries)
- Increased reliability (decentralized, no single point of failure)
- Transparency (all transactions visible)
- Immutable recording (data cannot be altered)

(c) Applications:

- Supply Chain: Track products from manufacturer to customer, verify authenticity, reduce fraud
- Healthcare: Secure medical records, track medical devices, ensure data privacy
- Agriculture: Track food from farm to table, monitor crop conditions, ensure food safety

---

SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. Blockchain Networks and Transaction Process

(a) Four types of Blockchain networks:

1. Public Blockchain: Anyone can join, open platform, weak security
2. Private Blockchain: Managed by single organization, restricted access, more secure
3. Permissioned Blockchain: Only authorized individuals, safe and secure, better transparency
4. Consortium Blockchain: Multiple organizations manage together, complex, safe and secure

(b) Applications:

1. Public: Cryptocurrency (Bitcoin)

2. Private: Business record-keeping
3. Permissioned: Supply chain management
4. Consortium: Banking and finance

(c) Transaction process:

- Direct deals: Individuals make deals without intermediaries (bank or government)
- Peer-to-peer verification: Each transaction is verified by participants
- Permanence: Transaction is permanent once recorded
- Irreversibility: Added to ledger and cannot be changed
- Decentralization: Data stored in millions of computers worldwide
- Faster: No intermediaries means faster transactions

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

(Not an official FBISE scheme)

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 5 — Internet of Things and Blockchain

CHAPTER TEST — 2

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Which of the following is NOT an example of an IoT device?

A. Smart watch
B. Smart door lock
C. Traditional desktop calculator
D. Smart TV

2. Which wireless technology is used for very short-range communication, such as payments?

A. Wi-Fi
B. Bluetooth
C. Zigbee
D. NFC

3. A barometer is used to measure:

A. Temperature
B. Humidity
C. Atmospheric air pressure
D. Wind speed

4. Which cloud computing model provides access and services to multiple organizations with common interests?

A. Public Cloud
B. Private Cloud
C. Community Cloud
D. Hybrid Cloud

5. Which type of Blockchain network is managed by a single organization?

A. Public Blockchain Network
B. Private Blockchain Network
C. Consortium Blockchain Network
D. Permissioned Blockchain Network

6. Which technology does Blockchain use to ensure transaction data is secure?

A. Encryption only
B. Cryptography
C. Firewalls
D. Antivirus software

7. In Blockchain, what is a "block"?

A. A type of virus
B. A record of transactions
C. A network device
D. A cloud server

8. Which of the following is a type of environmental sensor?

A. Water flow sensor
B. Magnetic field sensor
C. Air quality sensor
D. Vibration sensor

9. What is the primary purpose of AI systems in decision-making?

A. To replace all human decisions

B. To make intelligent decisions to solve complex problems
C. To slow down processes
D. To increase human error

10. Which of the following is a conflicting requirement among stakeholders in AI systems?

A. Everyone wants the same thing
B. Different stakeholders have different expectations
C. All stakeholders agree on everything
D. There are no conflicts

11. Which of the following is NOT a positive impact of AI systems?

A. Unbiased decisions
B. Around the clock availability
C. High cost
D. Zero risk

12. Which of the following is a goal of integrating IoT and Blockchain?

A. Increasing vulnerability
B. Reducing connectivity
C. Enhancing security and reliability
D. Slowing down communication

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12

Attempt any THREE questions.

Q13. Explain the role of Big Data Analytics in IoT. How does it help in decision-making?

Q14. Differentiate between environmental sensors and industrial sensors. Give two examples of each.

Q15. Explain the concept of a digital ledger in Blockchain. Why is it considered immutable?

Q16. What are the four types of Blockchain networks? Briefly describe each.

Q17. Explain any TWO conflicting requirements of stakeholders in AI systems with examples.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the components of an IoT system in detail:
(a) Wireless Sensor Networks
(b) Cloud Computing
(c) Big Data Analytics
(d) Communication Protocols
(e) Embedded Systems

Explain how these components work together in a smart home.

Q19. Explain the positive and negative impacts of AI systems in detail. Provide at least FOUR positive and FOUR negative impacts with examples.

SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) Explain the different types of Blockchain networks with examples.
(b) Discuss the process of a Blockchain transaction. Include:

- How a transaction is initiated
- How it is verified
- How it is added to the ledger
- Why it is irreversible
  (c) How does the integration of Blockchain and IoT improve supply chain management?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer

1	C	Traditional desktop calculator
2	D	NFC
3	C	Atmospheric air pressure
4	C	Community Cloud
5	B	Private Blockchain Network
6	B	Cryptography
7	B	A record of transactions
8	C	Air quality sensor
9	B	To make intelligent decisions to solve complex problems
10	B	Different stakeholders have different expectations
11	C	High cost
12	C	Enhancing security and reliability

SECTION B — SHORT ANSWER KEY

Q13. Big Data Analytics in IoT

Role: Big Data Analytics collects extremely big data from various resources and uses analytics software to find market trends, patterns, and insights.

How it helps:

- Transforms IoT data into actionable information
- Improves decision-making
- Enables predictive maintenance
- Enhances customer service
- Increases revenue

Q14. Environmental vs Industrial Sensors

Environmental Sensors	Industrial Sensors
Measure environmental conditions	Measure physical quantities in manufacturing
Temperature, humidity, air quality	Heat, pressure, gas, vibration
Examples: Temperature sensor, humidity sensor	Examples: Water flow sensor, magnetic field sensor

Q15. Digital Ledger in Blockchain

Definition: A digital ledger is a list of continuously growing records (blocks) shared and maintained by network users.

Why immutable:

- Cryptography ensures transaction data is secure
- Each block contains a hash of the previous block
- Changing any block would change its hash
- The network would reject the altered chain

Q16. Four Types of Blockchain Networks

1. Public Blockchain: Anyone can join, open platform, weak security
2. Private Blockchain: Managed by single organization, restricted access, more secure
3. Permissioned Blockchain: Only authorized individuals, safe and secure, better transparency
4. Consortium Blockchain: Multiple organizations manage together, complex, safe and secure

Q17. Conflicting Requirements of Stakeholders

1. Privacy vs Data Access:

    - End users want privacy
    - Developers want data for training
    - Example: Patients want privacy; developers need data for AI in healthcare

2. Efficiency vs Safety:

    - Business owners want cost reduction
    - Regulators want safety
    - Example: Factory owners want automation; regulators want worker safety

---

SECTION C — LONG ANSWER KEY

Q18. Components of IoT System

(a) Wireless Sensor Networks (WSNs):

- Collect data from physical world
- Three types: environmental, industrial, motion detection
- Example: Temperature sensor in smart home

(b) Cloud Computing:

- Stores and processes data
- Provides services over the Internet
- Example: Cloud stores temperature data from smart home

(c) Big Data Analytics:

- Analyzes large amounts of data
- Finds patterns and insights
- Example: Learns when to adjust thermostat

(d) Communication Protocols:

- Enable devices to communicate
- Set rules for data transfer
- Example: Wi-Fi connects smart devices to cloud

(e) Embedded Systems:

- Control device operations
- Contain microcontroller and firmware
- Example: Thermostat's embedded system controls temperature

How they work together in a smart home:

1. Sensors collect temperature data
2. Communication protocols send data to cloud
3. Cloud stores and processes data
4. Big Data Analytics learns preferences
5. Embedded systems adjust thermostat automatically

Q19. Positive and Negative Impacts of AI Systems

Positive Impacts:

1. Unbiased Decisions: Based on reason and logic, not emotions.
    - Example: AI recruitment hires based on skills, not ethnicity
2. Around the Clock Availability: Works 24x7 without breaks.
    - Example: Chatbot provides customer support anytime
3. Zero Risk: Robots perform hazardous tasks.
    - Example: Defusing a bomb
4. Reduction in Human Error: High accuracy.
    - Example: Robotic surgery systems

Negative Impacts:

1. Less Creativity and Emotions: AI cannot be creative or experience emotions.
    - Example: AI cannot write emotional poetry

2. Lack of Employment: Robots replace humans.

- Example: Robots in manufacturing and hotels

3. Ethical and Moral Concerns: Difficult to incorporate ethics.

- Example: Concern that AI may grow uncontrollably

4. High Cost: Very costly to develop.

- Example: Requires time, resources, latest hardware and software

---

SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. Blockchain Networks and Transactions

(a) Types of Blockchain Networks:

1. Public Blockchain: Anyone can join. Example: Bitcoin
2. Private Blockchain: Single organization. Example: Business record-keeping
3. Permissioned Blockchain: Authorized individuals only. Example: Supply chain
4. Consortium Blockchain: Multiple organizations. Example: Banking group

(b) Blockchain Transaction Process:

1. Initiation: User initiates a transaction
2. Broadcast: Transaction broadcast to peer-to-peer network
3. Verification: Network participants verify transaction
4. Block Creation: Verified transactions grouped into block
5. Addition: Block added to existing chain
6. Completion: Transaction permanent and irreversible

Why irreversible:

- Each block contains hash of previous block
- Changing any block changes its hash
- Network rejects altered chain

(c) Blockchain and IoT in Supply Chain:

1. IoT sensors track product location and condition
2. Data is recorded on Blockchain
3. All parties can verify product authenticity
4. Reduces fraud and counterfeiting
5. Improves transparency and trust
6. Enables faster, more reliable transactions

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 5 — Internet of Things and Blockchain

CHAPTER TEST — 3 (Comprehensive & High-Difficulty)

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. In a smart factory, sensors on machines collect temperature and vibration data. This data is analyzed to predict machine failures before they occur. This is an example of:

A. Cloud computing only
B. Big Data Analytics in IoT
C. Blockchain only
D. Embedded systems only

2. A smart thermostat automatically adjusts room temperature based on learned preferences. Which technology controls this operation?

A. Cloud Computing
B. Big Data Analytics

C. Embedded System
D. Communication Protocol

3. Which of the following correctly describes "Resource Pooling" in cloud computing?

A. Resources are dedicated to one user
B. Resources are shared and pooled to serve multiple customers
C. Resources are stored offline
D. Resources are not scalable

4. A financial institution stores customer data in multiple data centers across different geographical regions. If one data center fails, data is still accessible from other locations. This demonstrates:

A. Scalability
B. Reliability
C. Latency
D. Bandwidth

5. Horizontal scalability in cloud computing means:

A. Adding more resources to a single server
B. Increasing the number of servers to distribute workload
C. Reducing the number of servers
D. Storing data offline

6. In Blockchain, why is transaction data considered immutable?

A. It is stored on paper
B. Cryptography creates hashes that change if data is altered

C. It is managed by a single authority
D. It uses AC voltage

7. A group of banks collectively manages a Blockchain network for recording debtors' information. This is an example of:

A. Public Blockchain
B. Private Blockchain
C. Permissioned Blockchain
D. Consortium Blockchain

8. Which of the following is a key challenge in integrating IoT with Blockchain?

A. Too much security
B. Scalability and data storage
C. Lack of sensors
D. No network connectivity

9. An AI-based recruitment system hires candidates based on skills and qualifications, not ethnicity. This is an example of:

A. Negative impact of AI
B. Positive impact of AI (Unbiased Decisions)
C. Ethical concern
D. Lack of employment

10. Which of the following is an ethical concern related to AI systems?

A. AI works 24x7
B. AI may grow uncontrollably and destroy humanity
C. AI reduces human error

D. AI performs dangerous tasks

11. In the context of AI stakeholders, which group is primarily interested in job security and training?

A. End users
B. Developers
C. Employees
D. Regulators

12. Which of the following best describes the relationship between IoT and Blockchain?

A. They are the same technology
B. IoT collects data; Blockchain secures it
C. Blockchain collects data; IoT secures it
D. They cannot be integrated

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the role of communication protocols in IoT. Why are they needed for proper functioning of IoT devices?

Q14. Differentiate between vertical and horizontal scalability in cloud computing.

Q15. Explain the concept of "permissioned Blockchain network." How does it differ from a private Blockchain network?

Q16. Describe any FOUR applications of the integration of Blockchain and IoT.

Q17. Explain why conflicts among stakeholders in AI system development should be resolved, not suppressed.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the technologies that enabled Blockchain in detail:
(a) Cryptography
(b) Blockchain Networks (Public, Private, Permissioned, Consortium)
(c) Transaction Process on the Network

Q19. Explain the positive and negative impacts of AI systems on society. Provide at least FOUR positive and FOUR negative impacts with detailed examples. Also discuss how conflicting requirements of stakeholders can be managed.

SECTION D — COMPREHENSIVE ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) Explain the complete architecture of an IoT system, including all five enabling technologies.
(b) Describe how these technologies work together in a real-world application (e.g., smart agriculture or smart healthcare).
(c) Explain how Blockchain can be integrated with this IoT system to enhance security and reliability.
(d) Discuss any TWO challenges in this integration and suggest possible solutions.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Big Data Analytics in IoT
2	C	Embedded System
3	B	Resources are shared and pooled to serve multiple customers
4	B	Reliability
5	B	Increasing the number of servers to distribute workload
6	B	Cryptography creates hashes that change if data is altered
7	D	Consortium Blockchain
8	B	Scalability and data storage

9	B	Positive impact of AI (Unbiased Decisions)
10	B	AI may grow uncontrollably and destroy humanity
11	C	Employees
12	B	IoT collects data; Blockchain secures it

SECTION B — SHORT ANSWER KEY

Q13. Communication Protocols in IoT

Role: IoT communication protocols are sets of rules that govern how data is transferred and understood between physical devices, sensors, and end users.

Why needed:

- Provide exchange of information between devices
- Define methods of connection
- Enable proper functioning of IoT devices
- Ensure devices from different manufacturers can communicate
- Provide security and reliability

Q14. Vertical vs Horizontal Scalability

Vertical Scalability	Horizontal Scalability
Increasing capacity of a single server	Increasing number of servers
Adding CPU, RAM, disk space	Distributing workload among servers
Physical limit to upgrade	Quicker and easier to accomplish
Costly and time-consuming	Better for high availability
Potential downtime	Near-zero downtime

Q15. Permissioned vs Private Blockchain

Permissioned Blockchain	Private Blockchain
Only authorized individuals can access	Managed by single organization
Anyone who wants to join needs permission	Public access restricted
Safe and secure with better transparency	More secure than public
Used for supply chain, trade finance	Used for business record-keeping

Q16. Applications of Blockchain and IoT Integration

1. Supply Chain: Track products from manufacturer to customer, verify authenticity
2. Healthcare: Secure medical records, track medical devices
3. Energy Grid: Manage energy distribution, peer-to-peer energy trading
4. Agriculture: Track food from farm to table, monitor crop conditions
5. Automotive: Secure vehicle-to-vehicle communication
6. Water Management: Monitor water quality and usage

Q17. Resolving Stakeholder Conflicts

Why conflicts should be resolved, not suppressed:

- Conflicts are unavoidable when different stakeholders have different expectations
- Suppressing conflicts leads to failure of AI systems
- Developers must satisfy all stakeholders
- Open communication builds trust
- Ethical frameworks guide decisions
- Balanced solutions benefit all parties
- Example: In healthcare AI, patients want privacy; developers need data. Resolution: Use anonymized data and transparent policies.

SECTION C — LONG ANSWER KEY

Q18. Technologies that Enabled Blockchain

(a) Cryptography:

- Protects information and communications by coding it
- Provides confidentiality, integrity, and authentication

- Ensures transaction data is secure and immutable
- Used to create hashes and digital signatures
- Example: Each block has a unique hash; changing data changes the hash

(b) Blockchain Networks:

1. Public Blockchain: Anyone can join, open platform, weak security. Example: Bitcoin
2. Private Blockchain: Managed by single organization, restricted access, more secure. Example: Business records
3. Permissioned Blockchain: Only authorized individuals, safe and secure, better transparency. Example: Supply chain
4. Consortium Blockchain: Multiple organizations manage together, complex. Example: Banking group

(c) Transaction Process:

- Direct deals without intermediaries (bank or government)
- Each transaction verified by participants in peer-to-peer network
- Transactions are permanent and irreversible
- Faster than traditional databases
- Decentralized: data stored in millions of computers worldwide

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Q19. Positive and Negative Impacts of AI Systems

Positive Impacts:

1. Unbiased Decisions: Based on reason and logic. Example: AI recruitment based on skills
2. Around the Clock Availability: Works 24x7. Example: Chatbot support
3. Zero Risk: Robots perform hazardous tasks. Example: Defusing bombs
4. Reduction in Human Error: High accuracy. Example: Robotic surgery

Negative Impacts:

1. Less Creativity and Emotions: AI cannot be creative. Example: Cannot write emotional poetry

2. Lack of Employment: Robots replace humans. Example: Manufacturing and hotels
3. Ethical and Moral Concerns: Difficult to incorporate ethics. Example: AI may grow uncontrollably
4. High Cost: Very costly to develop. Example: Requires latest hardware and software

Managing Conflicting Requirements:

- Open communication with all stakeholders
- Stakeholder engagement in design
- Negotiation and compromise
- Ethical frameworks
- Transparent decision-making
- Iterative development with feedback

SECTION D — COMPREHENSIVE ANALYSIS ANSWER

Q20. IoT Architecture and Blockchain Integration

(a) IoT Architecture with Five Enabling Technologies:

1. Wireless Sensor Networks (WSNs): Collect data from physical world
2. Cloud Computing: Store and process data
3. Big Data Analytics: Analyze data for insights
4. Communication Protocols: Enable device communication
5. Embedded Systems: Control device operations

(b) Real-World Application — Smart Agriculture:

1. Soil moisture sensors collect data
2. Communication protocols send data to cloud
3. Cloud stores and processes data
4. Big Data Analytics analyzes crop conditions

5. Embedded systems control irrigation automatically
6. Farmers receive insights on mobile apps

(c) Blockchain Integration:

- IoT sensor data recorded on Blockchain
- Cryptography ensures data cannot be altered
- All parties (farmers, distributors, retailers) can verify
- Transparency in food supply chain
- Reduced fraud and improved trust

(d) Challenges and Solutions:

Challenge	**Solution**
Scalability (IoT generates massive data)	Use permissioned Blockchain; edge computing
Privacy (IoT data may be sensitive)	Use private/permissioned Blockchain; encryption
Energy consumption	Use energy-efficient consensus mechanisms
Storage limitations	Use off-chain storage with on-chain verification

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END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 6 — Impacts of Computing

CHAPTER TEST — 1

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. In the context of computers, "information" refers to:

A. Raw facts and figures
B. Data that has been meaningfully organized, processed, or formatted
C. Only numbers
D. Only text

2. Which of the following is a primary source of information?

A. Encyclopedia
B. Diary
C. Textbook
D. News report

3. Which of the following is an example of a tertiary source?

A. Letters
B. Research article
C. Encyclopedia
D. Diary

4. Which of the following is a source of reliable information?

A. Anonymous social media posts
B. Government websites (.gov)
C. Unverified blogs
D. Personal anecdotes

5. What is sampling bias?

A. When the researcher's expectations influence results
B. When the sample does not accurately represent the population
C. When certain groups are systematically excluded
D. When data is interpreted to fit pre-existing beliefs

6. Which of the following is NOT a characteristic of reliable information?

A. Accuracy
B. Credibility
C. Bias
D. Verifiability

7. What is data search?

A. The process of deleting data
B. The process of looking for specific information in a large amount of data
C. The process of storing data
D. The process of encrypting data

8. Which task is best suited for humans rather than computers?

A. Processing large amounts of data
B. Statistical analysis
C. Subjective judgments
D. Automated verification

9. Which of the following is a positive environmental impact of increased connectivity?

A. E-waste

B. Energy consumption
C. Reduced travel
D. Resource extraction

10. What is the digital divide?

A. The gap between those who have access to digital technologies and those who do not
B. The division of a network
C. The difference between hardware and software
D. The gap between data and information

11. Which assistive technology is used by people with visual impairments?

A. Wheelchair
B. Screen reader
C. Voice recognition software
D. Joystick controller

12. Which technological innovation enables wireless data exchange over short distances?

A. Wi-Fi
B. Bluetooth
C. 5G
D. Smartphones

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12

Attempt any THREE questions.

Q13. Differentiate between data and information with one example of each.

Q14. What are the five key guidelines for safe use of information sources? List any FOUR.

Q15. Explain the concept of bias in data. Describe sampling bias with an example.

Q16. What is the digital divide? Describe any TWO factors that contribute to the digital divide.

Q17. Explain any TWO positive and TWO negative effects of increased connectivity on people.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the different sources of information in detail:
(a) Primary Sources
(b) Secondary Sources
(c) Tertiary Sources
(d) Digital Sources
(e) Print Sources
(f) Human Sources
(g) Electronic Sources

Q19. Explain the impact of increased connectivity on the environment. Discuss:
(a) Positive environmental impacts

(b) Negative environmental impacts
(c) Solutions to address the negative impacts

SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) Explain the four types of human bias in data collection:

- Sampling Bias
- Selection Bias
- Observer Bias
- Data Interpretation Bias

(b) For each type, provide a real-world example.

(c) How can these biases be reduced or eliminated in research?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Data that has been meaningfully organized, processed, or formatted
2	B	Diary
3	C	Encyclopedia
4	B	Government websites (.gov)
5	B	When the sample does not accurately represent the population
6	C	Bias
7	B	The process of looking for specific information in a large amount of data
8	C	Subjective judgments
9	C	Reduced travel
10	A	The gap between those who have access to digital technologies and those who do not
11	B	Screen reader

12	B	Bluetooth

SECTION B — SHORT ANSWER KEY

Q13. Data vs Information

Data	**Information**
Raw facts and figures	Processed data with meaning
No context	Has context
Example: 85, 90, 78, 92, 88	Example: Average score is 86.6

Q14. Safe Use of Information Sources — Five Guidelines

1. Evaluate the source's credibility
2. Beware of bias and misinformation
3. Respect copyright and intellectual property
4. Avoid plagiarism
5. Report false information

Q15. Bias in Data and Sampling Bias

Bias in Data: Mistakes or problems in information that can make conclusions not quite right. Occurs when data is not fair or accurate.

Sampling Bias: Occurs when the sample used for data collection does not accurately represent the entire population.

Example: A survey conducted only in urban areas may not capture the perspectives of rural populations.

Q16. Digital Divide

Definition: The gap between those who have access to digital technologies and the internet and those who do not.

Two factors:

1. Income: Wealthier people can afford technology; poor people cannot.
2. Location: Urban areas have better infrastructure; rural areas may have limited or no internet access.

Q17. Effects of Increased Connectivity on People

Positive Effects:

1. Easier communication with family and friends
2. Fast information access

Negative Effects:

1. Screen and social media addiction
2. Privacy issues

SECTION C — LONG ANSWER KEY

Q18. Sources of Information

(a) Primary Sources:

- Authentic, undisturbed documents offering first-hand knowledge
- Examples: Letters, diaries, photographs, surveys, raw data

(b) Secondary Sources:

- Created by analyzing, interpreting, or summarizing primary sources
- Examples: Books, academic articles, documentaries, news reports

(c) Tertiary Sources:

- Compilation of primary and secondary sources
- Examples: Encyclopedias, dictionaries, handbooks, textbooks

(d) Digital Sources:

- Information in digital format accessible through the internet
- Examples: Websites, online databases, social media, blogs

(e) Print Sources:

- In-depth analysis, historical context, tangible medium
- Examples: Books, newspapers, magazines, journals

(f) Human Sources:

- Information sourced directly from people
- Examples: Experts, mentors, colleagues, community members

(g) Electronic Sources:

- Information stored and accessed in digital form
- Examples: Online databases, websites, e-books, digital journals

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Q19. Impact of Increased Connectivity on the Environment

(a) Positive Environmental Impacts:

1. Reduced Travel: Remote work and online meetings reduce carbon emissions
2. Resource and Efficiency Improvement: IoT enables more effective use of water, electricity
3. Monitoring the Environment: Real-time environmental monitoring detects pollution, deforestation
4. Economic Opportunities for Green Technologies: Smart grids and renewable energy

(b) Negative Environmental Impacts:

1. E-waste: Discarded electronic devices contain toxic materials
2. Energy Consumption: Data centers consume significant amounts of energy
3. Resource Extraction: Mining for rare earth metals causes habitat destruction
4. Digital Divide: Uneven resource distribution and environmental impacts

(c) Solutions:

- Use renewable energy in data centers
- Improve energy efficiency
- Recycle e-waste properly
- Extend device lifespans
- Promote digital inclusion

SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. Human Bias in Data Collection

(a) Four types of human bias:

1. Sampling Bias: Sample does not accurately represent the population.

    - Real-world example: Survey conducted only in urban areas, missing rural perspectives.

2. Selection Bias: Certain individuals or groups are systematically excluded.

    - Real-world example: Interviewers only select candidates from a specific university.

3. Observer Bias: Researcher's expectations influence results.

    - Real-world example: Scientist believing a medicine is effective analyzes results to align with this belief.

4. Data Interpretation Bias: Interpreting data to fit pre-existing beliefs.

    - Real-world example: Analyst interpreting results to support their preferred model.

(c) How to reduce biases:

- Use random sampling
- Be aware of unconscious bias
- Use blind or double-blind studies
- Have multiple observers/analysts
- Use standardized procedures
- Cross-check findings from multiple sources

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 6 — Impacts of Computing

CHAPTER TEST — 2

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Which of the following is a human source of information?

A. Website
B. Expert
C. E-book
D. Encyclopedia

2. Which of the following is NOT a part of safe and responsible use of information sources?

A. Identifying reliable sources
B. Sharing information without verification
C. Applying critical thinking skills
D. Understanding sources of information

3. Which type of bias occurs when the researcher's expectations influence how they interpret or record information?

A. Sampling Bias
B. Selection Bias
C. Observer Bias
D. Data Interpretation Bias

4. Which of the following is a source of reliable information?

A. Anonymous blog
B. Social media post
C. Peer-reviewed journal
D. Personal anecdote

5. What is the primary purpose of data searches?

A. To delete information

B. To find specific information in a large amount of data
C. To encrypt data
D. To store data

6. Which task is ideally completed by computing devices rather than humans?

A. Subjective judgments
B. Complex decision-making
C. Processing large amounts of data
D. Handling ambiguity

7. Which of the following is a negative environmental impact of increased connectivity?

A. Reduced travel
B. E-waste
C. Resource efficiency
D. Environmental monitoring

8. What is a global village?

A. A village with internet
B. The world as a single community interconnected by technology
C. A small network
D. A type of cloud computing

9. Which of the following is a positive effect of increased connectivity on people?

A. Screen addiction
B. Privacy issues

C. Online education and work opportunities
D. Spread of false information

10. Which assistive technology is used to help people with mobility issues?

A. Screen reader
B. Wheelchair
C. Voice recognition software
D. Braille display

11. What is the digital divide?

A. The gap between data and information
B. The gap between those who have access to digital technologies and those who do not
C. The division of a network into subnets
D. The difference between hardware and software

12. Which technological innovation enables high-speed mobile internet?

A. Bluetooth
B. NFC
C. 5G
D. Wi-Fi

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the difference between primary and secondary sources of information. Give one example of each.

Q14. What is plagiarism? How can it be avoided?

Q15. Explain the concept of data interpretation bias with an example.

Q16. Describe any TWO tasks suitable for humans and TWO tasks suitable for computers in data source verification.

Q17. Explain any TWO effects of increased connectivity on culture.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the concept of reliable information in detail:
(a) What makes information reliable?
(b) Sources of reliable information
(c) How to identify reliable sources
(d) The importance of cross-checking information

Q19. Explain the effects of increased connectivity on people. Discuss:
(a) Positive effects
(b) Negative effects
(c) How to maintain a balance and use technology with awareness

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SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) Explain the different types of assistive technologies discussed in the textbook:

- Voice Recognition Software
- Screen Readers
- Mobility Devices
- Adaptable Software and Hardware

(b) For each type, state who it helps and how it helps.

(c) Why are assistive technologies important for people with disabilities?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Expert

2	B	Sharing information without verification
3	C	Observer Bias
4	C	Peer-reviewed journal
5	B	To find specific information in a large amount of data
6	C	Processing large amounts of data
7	B	E-waste
8	B	The world as a single community interconnected by technology
9	C	Online education and work opportunities
10	B	Wheelchair
11	B	The gap between those who have access to digital technologies and those who do not
12	C	5G

SECTION B — SHORT ANSWER KEY

Q13. Primary vs Secondary Sources

Primary Sources	Secondary Sources
Authentic, undisturbed documents	Analyze, interpret, or summarize primary sources
First-hand knowledge	One step removed from the event
Example: Diary, letter, photograph	Example: Book, academic article, documentary

Q14. Plagiarism

Definition: Presenting someone else's work or ideas as your own, with or without their consent.

How to avoid:

- Always cite sources
- Use quotation marks for direct quotes
- Paraphrase properly
- Keep track of sources
- Learn proper citation style (e.g., APA)

Q15. Data Interpretation Bias

Definition: The tendency to interpret information in a way that aligns with pre-existing beliefs, expectations, or preferences, rather than objectively analyzing the data.

Example: An analyst who prefers a particular model interprets results to support that model, ignoring contradictory evidence.

Q16. Tasks Suitable for Humans vs Computers

Tasks for Humans	Tasks for Computers
Subjective judgments	Processing large amounts of data
Complex decision-making	Statistical analysis
Handling ambiguity	Pattern recognition
Personal judgments	Automated verification

Q17. Effects of Connectivity on Culture

1. Rich Exchange of Cultural Practices: People from different cultures can easily connect, share ideas, and learn from each other.
2. Concern About Cultural Homogenization: Global trends and influences spread quickly, potentially making all cultures the same.

SECTION C — LONG ANSWER KEY

Q18. Reliable Information

(a) What makes information reliable:

- Accuracy
- Credibility
- Verifiability
- Objectivity
- Currency
- Completeness
- Authority
- Evidence-based

(b) Sources of reliable information:

- Academic institutions and peer-reviewed publications
- Government websites (.gov)
- Educational institutions (.edu)
- Databases at the library (JSTOR, PubMed, Google Scholar)
- Cross-checking from multiple sources

(c) How to identify reliable sources:

- Check the source's reputation and authority
- Consider the author's qualifications
- Look for peer review
- Check the domain (.gov, .edu)
- Cross-check information

(d) Importance of cross-checking:

- Verifies accuracy
- Confirms information from multiple sources

- Reduces risk of misinformation
- Increases confidence in findings

Q19. Effects of Increased Connectivity on People

(a) Positive effects:

1. Easier communication with family and friends
2. Fast information access
3. Interaction with people around the world
4. Online education and work opportunities

(b) Negative effects:

1. Screen and social media addiction
2. Privacy issues
3. Spread of false information

(c) Maintaining balance:

- Set limits on screen time
- Be aware of technology's effects
- Verify information before sharing
- Protect privacy
- Focus on real-life activities
- Use technology purposefully

SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. Assistive Technologies

(a) Types of assistive technologies:

1. Voice Recognition Software:

    - Recognizes speech commands and enables voice control
    - Who it helps: People with physical disabilities
    - How it helps: Enables hands-free computer use, dictation of documents

2. Screen Readers:

    - Software that reads text out loud
    - Who it helps: People who are blind or visually impaired
    - How it helps: Enables computer use, internet browsing, access to information

3. Mobility Devices:

    - Wheelchairs, walkers, canes
    - Who it helps: People with mobility impairments
    - How it helps: Enables independent movement, increases mobility

4. Adaptable Software and Hardware:

    - Modified keyboards, switches, joystick controllers
    - Who it helps: People with physical limitations
    - How it helps: Enables computer use, provides independence

(c) Importance:

- Enhances independence
- Improves functionality

- Enhances quality of life
- Addresses barriers in daily activities
- Promotes inclusion

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 6 — Impacts of Computing

CHAPTER TEST — 3 (Comprehensive & High-Difficulty)

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.

- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. A company collects customer feedback only from people who volunteer to respond. This is an example of:

A. Sampling Bias
B. Voluntary Response Bias
C. Observer Bias
D. Data Interpretation Bias

2. A researcher analyzes data in a way that supports their pre-existing beliefs, ignoring contradictory evidence. This is an example of:

A. Sampling Bias
B. Selection Bias
C. Observer Bias
D. Data Interpretation Bias

3. Which of the following is the correct order of the data-information-knowledge-wisdom hierarchy?

A. Information □ Data □ Knowledge □ Wisdom
B. Data □ Information □ Knowledge □ Wisdom
C. Wisdom □ Knowledge □ Information □ Data
D. Knowledge □ Data □ Information □ Wisdom

4. A student copies a paragraph from a website without citing the source. This is an example of:

A. Copyright
B. Plagiarism
C. Fair use
D. Attribution

5. Which of the following is a key characteristic of a good infographic?

A. Cluttered with unnecessary details
B. Accurate, visually appealing, and easy to understand
C. Using only text, no visuals
D. Ignoring the audience

6. In the context of data source verification, which task is best suited for humans?

A. Processing millions of records
B. Detecting patterns in large data
C. Making ethical judgments about content
D. Performing repetitive calculations

7. A community has no internet access and cannot benefit from remote work opportunities. This is an example of:

A. Digital literacy
B. Digital divide
C. Cloud computing
D. Information overload

8. Which of the following is a positive environmental impact of increased connectivity?

A. Increased e-waste
B. Reduced travel through remote work
C. Higher energy consumption
D. Resource extraction for devices

9. Which of the following correctly describes cultural homogenization?

A. Preservation of unique cultural practices
B. Different cultures becoming more similar to each other
C. Increased cultural diversity
D. Isolation of cultures

10. A visually impaired student uses software that reads text aloud from a computer screen. This is an example of:

A. Mobility device
B. Screen reader
C. Voice recognition
D. Adaptive hardware

11. Which of the following is a negative effect of increased connectivity on people?

A. Easier communication
B. Fast information access
C. Privacy issues
D. Online education

12. Which technological innovation enables wireless data exchange between devices over short distances?

A. Wi-Fi

B. Bluetooth
C. 5G
D. Fiber optic

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the difference between misinformation and disinformation. Give one example of each.

Q14. What is the digital divide? Describe any TWO solutions to bridge the digital divide.

Q15. Explain how a screen reader works and who it helps. Why is this technology important?

Q16. Differentiate between 4G and 5G networks. State ONE advantage of 5G.

Q17. Explain the concept of "global village" in the context of connectivity. What are its positive and negative effects on culture?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the concept of data bias in detail:
(a) What is data bias?
(b) Four types of human bias in data collection

(c) Real-world examples of each type
(d) How to reduce or eliminate bias in data collection

Q19. Explain the concept of assistive technologies in detail:
(a) What are assistive technologies?
(b) Four types of assistive technologies with examples
(c) How each type helps people with disabilities
(d) Why are assistive technologies important for inclusion?

SECTION D — COMPREHENSIVE ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) Explain the impact of increased connectivity on the environment in detail:

- Positive impacts (at least FOUR)
- Negative impacts (at least FOUR)

(b) Discuss how increased connectivity affects culture:

- Rich exchange of cultural practices
- Concern about cultural homogenization
- Challenge of keeping cultural identities

(c) Suggest any TWO measures to maximize the benefits and minimize the negative impacts of connectivity.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Voluntary Response Bias
2	D	Data Interpretation Bias
3	B	Data Information Knowledge Wisdom
4	B	Plagiarism
5	B	Accurate, visually appealing, and easy to understand
6	C	Making ethical judgments about content
7	B	Digital divide
8	B	Reduced travel through remote work

9	B	Different cultures becoming more similar to each other
10	B	Screen reader
11	C	Privacy issues
12	B	Bluetooth

SECTION B — SHORT ANSWER KEY

Q13. Misinformation vs Disinformation

Misinformation	**Disinformation**
False information shared without harmful intent	False information shared with harmful intent
Example: Sharing a rumor you believed was true	Example: Creating fake news to manipulate people

Q14. Digital Divide and Solutions

Definition: The gap between those who have access to digital technologies and the internet and those who do not.

Two solutions:

1. Affordable Access: Subsidized devices, low-cost internet plans, free public Wi-Fi
2. Infrastructure Development: Expand internet coverage to rural areas, build infrastructure in developing countries

Q15. Screen Readers

How it works: Software reads text on screen aloud. Users navigate using keyboard shortcuts. The software describes images and buttons.

Who it helps: People who are blind or visually impaired.

Importance: Enables computer use for blind people, provides access to information, allows internet browsing, supports education and employment.

Q16. 4G vs 5G Networks

4G	**5G**
Up to 100 Mbps	Up to 10 Gbps
Higher latency	Lower latency
Fewer devices connected	Supports IoT and massive connectivity

One advantage of 5G: Ultra-fast data speeds and low latency enable real-time applications like autonomous vehicles and IoT.

Q17. Global Village

Definition: The world as a single community interconnected by technology.

Positive effects on culture:

- Rich exchange of cultural practices
- Increased awareness and understanding of different cultures

Negative effects on culture:

- Cultural homogenization (cultures becoming more similar)
- Loss of unique traditions and languages

SECTION C — LONG ANSWER KEY

Q18. Data Bias

(a) What is data bias: Mistakes or problems in information that can make conclusions not quite right. Occurs when data is not fair or accurate.

(b) Four types of human bias:

1. Sampling Bias: Sample does not accurately represent the population.
2. Selection Bias: Certain individuals or groups are systematically excluded.
3. Observer Bias: Researcher's expectations influence results.
4. Data Interpretation Bias: Interpreting data to fit pre-existing beliefs.

(c) Real-world examples:

1. Sampling Bias: Survey conducted only in urban areas

2. Selection Bias: Interviewers only select candidates from one university
3. Observer Bias: Scientist believing medicine is effective analyzes results accordingly
4. Data Interpretation Bias: Analyst interprets results to support preferred model

(d) How to reduce bias:

- Use random sampling
- Be aware of unconscious bias
- Use blind or double-blind studies
- Have multiple observers/analysts
- Use standardized procedures
- Cross-check findings

Q19. Assistive Technologies

(a) Definition: Tools, devices, software, or equipment designed to help individuals with disabilities or functional limitations perform tasks they might otherwise have difficulty with.

(b) Four types:

1. Voice Recognition Software: Recognizes speech commands. Example: Dragon NaturallySpeaking
2. Screen Readers: Reads text aloud. Example: JAWS, NVDA
3. Mobility Devices: Wheelchairs, walkers, canes
4. Adaptable Software and Hardware: Modified keyboards, switches, joysticks

(c) How each helps:

1. Voice Recognition: Enables hands-free computer use
2. Screen Readers: Enables access to information for blind people
3. Mobility Devices: Enables independent movement

4. Adaptable Hardware: Enables computer use for people with physical limitations

(d) Importance: Enhances independence, improves functionality, enhances quality of life, addresses barriers, promotes inclusion.

SECTION D — COMPREHENSIVE ANALYSIS ANSWER

Q20. Impact of Connectivity

(a) Environmental impacts:

Positive:

1. Reduced travel (remote work, online meetings)
2. Resource and efficiency improvement (IoT, smart grids)
3. Monitoring the environment (sensors, early warning)
4. Economic opportunities for green technologies (smart grids, renewable energy)

Negative:

1. E-waste (discarded devices contain toxic materials)
2. Energy consumption (data centers use significant energy)
3. Resource extraction (mining for rare earth metals)
4. Digital divide (uneven access to technology)

(b) Effects on culture:

- Rich exchange: People share customs, traditions, and ideas across cultures
- Cultural homogenization: Global trends spread quickly, making cultures similar
- Cultural identity challenge: People must balance exploring other cultures with preserving their own

(c) Measures to maximize benefits and minimize negative impacts:

1. Promote digital inclusion: Bridge the digital divide through affordable access and infrastructure development
2. Encourage sustainable computing: Use renewable energy in data centers, recycle e-waste properly, extend device lifespans

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END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 7 — Digital Literacy

CHAPTER TEST — 1

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Digital literacy is the ability to:

A. Only use a computer
B. Find, create, evaluate, communicate, and share digital content
C. Only browse the internet
D. Only send emails

2. A research question is:

A. A question that has no answer
B. The goal or objective to achieve after collecting and evaluating data
C. A type of survey
D. A data collection tool

3. Which of the following is an example of a qualitative interview question?

A. Do you like chocolate? (Yes/No)
B. How do you feel about online learning?
C. What is 2 + 2?
D. Is the sky blue?

4. Which method of data collection generates data rather than collecting it directly?

A. Survey
B. Interview
C. Simulation
D. Questionnaire

5. In the context of data collection, a prototype is:

A. The final product
B. A preliminary version of data collection tools or methods
C. A type of survey
D. A research question

6. Which of the following is a step to create a Google Form?

A. Type "docs.google.com/forms" in web browser
B. Click on Blank form
C. Click on "Untitled form" and type the name
D. All of the above

7. In a survey, the "Strongly Agreed, Agreed, Not Agreed, Neutral" format is an example of:

A. Open-ended question
B. Likert scale
C. True/False question
D. Fill-in-the-blank question

8. Which of the following is NOT a method of conducting surveys?

A. Printed questionnaires
B. Online Google Forms
C. Telephonic surveys
D. Machine language surveys

9. Data presentation is the process of:

A. Deleting data

B. Showing the relationship between datasets with visual tools
C. Encrypting data
D. Storing data

10. Infographics are a combination of:

A. Only text
B. Text, images, and design elements
C. Only numbers
D. Only graphs

11. Which of the following is an enhanced data representation tool?

A. Infographics
B. Presentations
C. Reports
D. All of the above

12. A good presentation should be:

A. Cluttered with too many details
B. Accurate, clear, visually appealing, and audience-centered
C. Only text
D. Ignoring the audience

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12

Attempt any THREE questions.

Q13. Define digital literacy. Why is it important in today's world?

Q14. Differentiate between a method and a strategy in the context of data collection. Give one example of each.

Q15. What is a qualitative interview? Describe any FOUR steps to conduct a qualitative interview.

Q16. What is a simulation in data collection? When is it used?

Q17. Explain the purpose of data presentation. Name any THREE enhanced data representation tools.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the following data collection strategies in detail:
(a) Qualitative Interviews
(b) Simulations
(c) Prototypes
(d) Surveys

Provide one example of each.

Q19. Explain the concept of prototypes in data collection. Describe any FIVE types of prototypes and their purposes.

SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) Design a survey questionnaire to collect data on the "impact of digital games on children aged 4-5 years." Include at least SIX questions using appropriate formats.

(b) Explain how you would use a Google Form to create this survey.

(c) Describe any TWO challenges you might face in collecting data through this survey and suggest solutions.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Find, create, evaluate, communicate, and share digital content

2	B	The goal or objective to achieve after collecting and evaluating data
3	B	How do you feel about online learning?
4	C	Simulation
5	B	A preliminary version of data collection tools or methods
6	D	All of the above
7	B	Likert scale
8	D	Machine language surveys
9	B	Showing the relationship between datasets with visual tools
10	B	Text, images, and design elements
11	D	All of the above
12	B	Accurate, clear, visually appealing, and audience-centered

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SECTION B — SHORT ANSWER KEY

Q13. Digital Literacy

Definition: Digital literacy is the ability to find, create, evaluate, communicate, and share digital content. It involves interaction with digital technologies like cell phones, social media platforms, smart devices, and the Internet.

Importance:

- Enables informed research
- Helps evaluate reliable sources
- Facilitates effective communication
- Supports informed decision-making
- Essential for academic and professional success

Q14. Method vs Strategy

Method	**Strategy**
Process, steps, or procedure to perform a task	Goal, objective, or set of actions to achieve some aim
How to achieve a goal	How to select a goal
Example: Conducting an interview	Example: Using interviews for research

Q15. Qualitative Interviews

Definition: Qualitative interviews are usually an informal research method in which open-ended questions are asked from participants

to gain in-depth insight about the research question.

Four steps to conduct:

1. Define your research question or objective
2. Participants Selection
3. Obtain informed consent
4. Develop an interview guideline
5. Interviewer Training
6. Recording equipment
7. Comfortable environment
8. Conduct the interview
9. Respect participants' perspectives
10. Transcribe and analyze the data

Q16. Simulation in Data Collection

Definition: Simulation is an indirect method of data collection in which data is generated or created rather than collected directly.

When used:

- When direct data collection is difficult or unreliable
- When real-world experiments are dangerous
- When data is needed in huge amounts
- When studying complex systems
- Example: Pilot learning to fly in an aircraft simulator

Q17. Data Presentation and Tools

Purpose: Data presentation shows the relationship between datasets with visual tools. It makes complex data easier to understand and supports informed decisions.

Three enhanced tools:

1. Infographics
2. Presentations
3. Reports

SECTION C — LONG ANSWER KEY

Q18. Data Collection Strategies

(a) Qualitative Interviews:

- Informal research method with open-ended questions
- Aims to understand participants' viewpoint
- Example: Interviewing parents about children's digital game usage

(b) Simulations:

- Indirect method where data is generated
- Synthetic data imitates real-world data
- Example: Flight simulator for pilot training

(c) Prototypes:

- Preliminary version of data collection tools
- Used to identify design flaws before full implementation
- Example: Small-scale version of a survey before general distribution

(d) Surveys:

- Systematic or structured tool for data collection

- Conducted through printed questionnaires, online forms, interviews
- Example: Customer satisfaction survey using Google Forms

Q19. Prototypes in Data Collection

Definition: A prototype is a preliminary version of data collection tools or methods. It serves as a sample for the final data before full-scale implementation.

Five types of prototypes:

1. Survey Prototypes: Small-scale version of a survey before general distribution
2. Questionnaire Prototypes: Draft version of a questionnaire
3. Data Collection Tool Prototypes: Prototype of data collection tool to evaluate working
4. Interview Prototypes: Mock interviews to check performance
5. Data Visualization Prototypes: Early versions of data visualizations

Purpose of each:

- Identify and address design flaws
- Assess user experience
- Ensure final product aligns with objectives
- Minimize risks
- Improve efficiency

SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. Survey Questionnaire Design

(a) Sample Survey Questions:

Title: Impact of Digital Games on Children Aged 4-5 Years

1. Does your child play digital games?
    - Yes / No
2. Which digital game does your child prefer?
    - Action / Puzzle / Educational / Other
3. For how long does your child use a smartphone/tablet daily?
    - Less than 1 hour / 1-2 hours / 2-3 hours / More than 3 hours
4. Do you think the use of digital gadgets is necessary for your child?
    - Strongly Agree / Agree / Disagree / Strongly Disagree
5. Does the use of digital gadgets affect the social development of your child?
    - Positively / Negatively / No effect
6. What is the behavior of your child if you don't give them a digital gadget?
    - Calm / Angry / Crying / Other

(b) Using Google Form:

1. Type "docs.google.com/forms" in browser
2. Click on Blank form
3. Click on "Untitled form" and type the name
4. Add questions and options
5. Click on three dots and share the link

(c) Challenges and Solutions:

Challenge	Solution
Low response rate	Send reminders; offer incentives
Incomplete responses	Make questions clear; mark required fields
Bias in responses	Assure anonymity; use neutral wording

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 7 — Digital Literacy

CHAPTER TEST — 2

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Which of the following best describes a research question?

A. A question that has no answer
B. The goal or objective to achieve after collecting and evaluating data
C. A type of survey
D. A data collection tool

2. Which of the following is NOT a data collection method?

A. Qualitative interviews
B. Simulations
C. Prototypes
D. Compilers

3. In a qualitative interview, the interviewer uses probing techniques to:

A. End the interview quickly
B. Delve deeper into participants' responses
C. Avoid eye contact
D. Skip questions

4. Which of the following is a type of prototype in data collection?

A. Survey Prototype
B. Questionnaire Prototype
C. Interview Prototype
D. All of the above

5. What is the purpose of a survey?

A. To delete data
B. To collect feedback, reviews, and opinions from targeted participants
C. To encrypt data
D. To store data

6. Which step is NOT part of creating a Google Form?

A. Type "docs.google.com/forms" in browser
B. Click on Blank form
C. Write code in Python
D. Share the link

7. Which type of data presentation is a combination of text, images, and design elements?

A. Report
B. Presentation
C. Infographic
D. Table

8. A good infographic should be:

A. Cluttered with too many details
B. Accurate, understandable, visually appealing, and free from unnecessary details
C. Only text
D. Ignoring the audience

9. Which of the following is a characteristic of a good presentation?

A. Using only text
B. Accurate, clear, visually appealing, and audience-centered
C. Ignoring the audience
D. Cluttered with unnecessary details

10. What is the purpose of a report?

A. To present data in a summarized form
B. To delete data
C. To encrypt data
D. To store data

11. In a survey, "What is your favorite color?" is an example of:

A. Open-ended question

B. Closed-ended question
C. Likert scale
D. True/False question

12. Which of the following is a benefit of using online surveys?

A. No internet needed
B. Can reach respondents from anywhere in the world
C. No data analysis needed
D. No questions needed

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the difference between a research question and a survey question. Give one example of each.

Q14. What is the purpose of obtaining informed consent in qualitative interviews? Why is it important?

Q15. Describe the steps to create a Google Form for a survey.

Q16. Explain the difference between an infographic and a presentation. State one advantage of each.

Q17. What is the role of data presentation in research? How does it help in decision-making?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the process of conducting a qualitative interview in detail. Describe all TEN steps with examples.

Q19. Explain the concept of surveys in detail:
(a) Definition and purpose
(b) Methods of conducting surveys
(c) Steps to create a Google Form
(d) Advantages and disadvantages of surveys

SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) You are conducting research on the "impact of social media on teenagers." Design a qualitative interview guide with at least SIX open-ended questions.

(b) Explain how you would select participants for this research.

(c) Describe any TWO ethical considerations you must follow during the interview process.

(d) How would you transcribe and analyze the collected data?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	The goal or objective to achieve after collecting and evaluating data
2	D	Compilers
3	B	Delve deeper into participants' responses
4	D	All of the above
5	B	To collect feedback, reviews, and opinions from targeted participants
6	C	Write code in Python
7	C	Infographic
8	B	Accurate, understandable, visually appealing, and free from unnecessary details

9	B	Accurate, clear, visually appealing, and audience-centered
10	A	To present data in a summarized form
11	A	Open-ended question
12	B	Can reach respondents from anywhere in the world

SECTION B — SHORT ANSWER KEY

Q13. Research Question vs Survey Question

Research Question	**Survey Question**
The overall goal or objective of the research	A specific question asked to participants
Broad and guides the entire study	Narrow and collects specific data
Example: "How does social media affect teenagers?"	Example: "How many hours do you spend on social media daily?"

Q14. Informed Consent

Purpose: Before commencing interviews, researchers must obtain informed consent from participants. This involves clearly explaining the purpose of research, procedures, and potential risks and benefits.

Importance:

- Ensures ethical conduct
- Respects participants' autonomy
- Participants understand involvement is voluntary
- Participants have the right to withdraw at any time
- Builds trust between researcher and participant

Q15. Steps to Create a Google Form

1. Type "docs.google.com/forms" in your web browser
2. Click on Blank form option to create a new form
3. Click on "Untitled form" and type the name of the form
4. In the text box, click on "Untitled Question" and type your question
5. In the options section, give your options one by one
6. After adding all questions, click on three dots in the top right corner and share the link
7. (Note: Google Form is saved automatically)

Q16. Infographic vs Presentation

Infographic	**Presentation**
Combination of text, images, and design elements	Collection of multimedia elements (text, images, audio, video)
Advantage: Simplifies complex data into visually appealing formats	Advantage: Can include interactive elements to keep audience engaged

Q17. Role of Data Presentation

Role: Data presentation shows the relationship between datasets with visual tools. It makes complex data easier to understand.

How it helps in decision-making:

- Provides clear insights
- Highlights trends and patterns
- Enables informed decisions
- Communicates findings effectively
- Supports data-driven decisions

SECTION C — LONG ANSWER KEY

Q18. Conducting a Qualitative Interview

Ten steps:

1. Define your research question or objective: Clearly define the research question. Start broad and narrow down.
    - Example: "Impact of earthquake in hilly areas of Pakistan"
2. Participants Selection: Choose the right participants. Establish inclusion criteria. Use purposeful sampling.
    - Example: Parents with children aged 4-5 years who use digital gadgets.
3. Obtain informed consent: Explain purpose, procedures, risks, and benefits. Ensure voluntary participation.
    - Example: Only select participants who are willing to share information without hesitation.
4. Develop an interview guideline: Set of open-ended questions. Flexible enough for spontaneous exploration.

    - Example: "Does your child play any digital games?"
5. Interviewer Training: Equip interviewers with necessary skills. Active listening, probing techniques.
    - Example: Train on how to interact with parents.
6. Recording equipment: Use audio or video recorders. More effective than writing.
    - Example: Digital audio and video recording.
7. Comfortable environment: Select a suitable place. Ensure privacy. Free from distractions.
    - Example: A quiet room where both feel comfortable.
8. Conduct the interview: Introduce yourself. Be flexible and responsive. Use probing techniques.
    - Example: Ask questions and record responses.
9. Respect participants' perspectives: Show respect for responses. No judgments.
    - Example: Record true and genuine responses.
10. Transcribe and analyze the data: Accurate transcription. Analyze qualitative data.
    - Example: Transcribe and analyze to get clear results.

Q19. Surveys

(a) Definition and purpose:

- A survey is a systematic or structured tool designed for data collection from a group of individuals.

- Purpose: To collect feedback, reviews, and opinions from targeted participants.

(b) Methods of conducting surveys:

- Printed questionnaires
- Online Google Forms
- Telephonic surveys
- Face-to-face surveys

(c) Steps to create a Google Form:

1. Type "docs.google.com/forms" in browser
2. Click on Blank form
3. Click on "Untitled form" and type the name
4. Add questions and options
5. Click on three dots and share the link

(d) Advantages and disadvantages:

Advantages	**Disadvantages**
Can reach large numbers of people	Low response rate possible
Cost-effective	Respondents may not understand questions
Standardized questions ensure consistency	Cannot probe for deeper answers
Easy to analyze (closed-ended questions)	Self-reporting bias possible

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SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. Research on Impact of Social Media on Teenagers

(a) Qualitative Interview Guide:

1. How much time do you spend on social media daily?
2. Which social media platforms do you use most frequently?
3. How has social media affected your relationships with friends and family?
4. Do you feel pressured to present a certain image on social media?
5. How does social media affect your mood or self-esteem?
6. Have you ever experienced cyberbullying or negative interactions on social media?

(b) Participants Selection:

- Teenagers aged 13-19 years
- Both male and female
- Regular users of social media
- Willing to share experiences
- Use purposeful sampling

(c) Ethical Considerations:

1. Informed Consent: Obtain permission from parents/guardians and teenagers
2. Privacy and Confidentiality: Keep responses anonymous; do not share personal information
3. Right to Withdraw: Participants can stop at any time
4. No Harm: Avoid sensitive topics that may cause distress

(d) Transcribe and Analyze:

- Record interviews with consent

- Transcribe recordings accurately
- Identify common themes and patterns
- Use thematic analysis
- Draw conclusions based on findings
- Maintain privacy and ethics throughout

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 7 — Digital Literacy

CHAPTER TEST — 3 (Comprehensive & High-Difficulty)

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. A researcher wants to study the impact of online classes on students' learning. Which of the following represents the research question?

A. "Do you like online classes?"
B. "How do online classes affect students' learning outcomes?"
C. "How many students attended online classes?"
D. "What is your favorite subject?"

2. In a qualitative interview, when the interviewer repeats the participant's last words to encourage more detail, this is called:

A. Silent Probe
B. Echo Probe
C. Clarification Probe
D. Elaboration Probe

3. A prototype that is a small-scale version of a survey before its general distribution is called:

A. Questionnaire Prototype
B. Survey Prototype
C. Interview Prototype
D. Data Visualization Prototype

4. Which of the following is NOT a method of conducting a survey?

A. Printed questionnaire
B. Online Google Form
C. Telephonic survey
D. Machine learning

5. In the context of data presentation, a report is:

A. A visual representation of data
B. A summarized form of data
C. An interactive dashboard
D. A type of survey

6. Which of the following is an advantage of infographics?

A. They simplify complex data
B. They are difficult to understand
C. They require no data
D. They cannot be shared online

7. A presentation should be designed to be:

A. Only for the presenter's understanding
B. Effective, understandable, and actionable for the audience
C. Cluttered with all available data
D. Ignoring the audience's needs

8. In a survey questionnaire, which type of question allows respondents to answer in their own words?

A. Closed-ended question
B. Open-ended question
C. Multiple choice question
D. Rating scale question

9. Which of the following best describes a simulation in data collection?

A. Data collected directly from real-world sources
B. Synthetic data generated to imitate real-world data
C. A type of survey
D. A qualitative interview

10. What is the primary purpose of a Google Form?

A. To delete data
B. To collect data systematically
C. To encrypt data
D. To store data

11. Which of the following is a characteristic of a well-designed survey?

A. Questions are ambiguous
B. Questions are clear, relevant, and unbiased
C. Questions are leading
D. Questions are too personal

12. A student copies information from a website without citing the source. This is an example of:

A. Fair use
B. Plagiarism
C. Copyright
D. Attribution

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the difference between a method and a strategy in data collection. Give one example of each.

Q14. Describe any FOUR steps involved in conducting a qualitative interview.

Q15. What is the purpose of a prototype in data collection? Describe any TWO types of prototypes.

Q16. Explain the difference between an infographic and a report. State one advantage of each.

Q17. What is the role of data presentation in research? How does it help in decision-making?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the complete process of conducting a qualitative interview. Include:
(a) Research question definition
(b) Participant selection
(c) Informed consent
(d) Interview guideline
(e) Recording equipment
(f) Comfortable environment
(g) Conducting the interview
(h) Transcribing and analyzing data

Q19. Explain the different data collection strategies in detail:
(a) Qualitative Interviews
(b) Simulations
(c) Prototypes
(d) Surveys

For each, provide a definition, purpose, and one example.

SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) You are conducting research on the "impact of digital games on children aged 4-5 years." Design a survey questionnaire with at least SIX questions.

(b) Explain how you would use a Google Form to create and distribute this survey.

(c) Describe any TWO ethical considerations you must follow when collecting data from parents.

(d) Explain how you would present the collected data using infographics and reports.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	"How do online classes affect students' learning outcomes?"
2	B	Echo Probe
3	B	Survey Prototype
4	D	Machine learning
5	B	A summarized form of data
6	A	They simplify complex data
7	B	Effective, understandable, and actionable for the audience
8	B	Open-ended question
9	B	Synthetic data generated to imitate real-world data

10	B	To collect data systematically
11	B	Questions are clear, relevant, and unbiased
12	B	Plagiarism

SECTION B — SHORT ANSWER KEY

Q13. Method vs Strategy

Method	**Strategy**
Process, steps, or procedure to perform a task	Goal, objective, or set of actions to achieve some aim
How to achieve a goal	How to select a goal
Example: Conducting an interview	Example: Using interviews for research

Q14. Steps in Qualitative Interview

Any FOUR of the following:

1. Define research question
2. Participants selection
3. Obtain informed consent
4. Develop interview guideline
5. Interviewer training
6. Recording equipment
7. Comfortable environment
8. Conduct interview
9. Respect participants' perspectives
10. Transcribe and analyze data

Q15. Prototypes in Data Collection

Purpose: A prototype is a preliminary version of data collection tools. It helps identify design flaws, assess user experience, and ensure the final product aligns with objectives.

Two types:

1. Survey Prototypes: Small-scale version of a survey before general distribution
2. Questionnaire Prototypes: Draft version of a questionnaire

Q16. Infographic vs Report

Infographic	**Report**
Combination of text, images, and design elements	Summarized form of data
Advantage: Simplifies complex data visually	Advantage: Communicates complex information clearly

Q17. Role of Data Presentation

Role: Data presentation shows the relationship between datasets with visual tools. It makes complex data easier to understand.

How it helps:

- Provides clear insights
- Highlights trends and patterns
- Enables informed decisions
- Communicates findings effectively

SECTION C — LONG ANSWER KEY

Q18. Complete Process of Qualitative Interview

(a) Research question definition: Clearly define the objective. Start broad and narrow down.

- Example: "Impact of earthquake in hilly areas of Pakistan"

(b) Participant selection: Choose the right participants. Establish inclusion criteria. Use purposeful sampling.

(c) Informed consent: Explain purpose, procedures, risks, and benefits. Ensure voluntary participation.

(d) Interview guideline: Set of open-ended questions. Flexible enough for spontaneous exploration.

(e) Recording equipment: Use audio or video recorders. More effective than writing.

(f) Comfortable environment: Select a suitable place. Ensure privacy. Free from distractions.

(g) Conducting the interview: Introduce yourself. Be flexible and responsive. Use probing techniques.

(h) Transcribing and analyzing data: Accurate transcription. Analyze qualitative data. Maintain privacy and ethics.

Q19. Data Collection Strategies

(a) Qualitative Interviews:

- Definition: Informal research method with open-ended questions
- Purpose: Gain in-depth insight about research question
- Example: Interviewing parents about children's digital game usage

(b) Simulations:

- Definition: Indirect method where data is generated
- Purpose: Study complex systems when direct collection is difficult
- Example: Flight simulator for pilot training

(c) Prototypes:

- Definition: Preliminary version of data collection tools
- Purpose: Identify design flaws before full implementation
- Example: Small-scale version of a survey

(d) Surveys:

- Definition: Systematic or structured tool for data collection
- Purpose: Collect feedback, reviews, opinions from targeted participants
- Example: Customer satisfaction survey using Google Forms

SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. Research on Impact of Digital Games

(a) Survey Questionnaire:

Title: Impact of Digital Games on Children Aged 4-5 Years

1. Does your child play digital games?
    - Yes / No
2. Which digital game does your child prefer?
    - Action / Puzzle / Educational / Other
3. For how long does your child use a smartphone/tablet daily?
    - Less than 1 hour / 1-2 hours / 2-3 hours / More than 3 hours
4. Do you think the use of digital gadgets is necessary for your child?
    - Strongly Agree / Agree / Disagree / Strongly Disagree
5. Does the use of digital gadgets affect the social development of your child?
    - Positively / Negatively / No effect
6. What is the behavior of your child if you don't give them a digital gadget?
    - Calm / Angry / Crying / Other

(b) Using Google Form:

1. Type "docs.google.com/forms" in browser

2. Click on Blank form
3. Name the form
4. Add questions and options
5. Click on three dots and share the link

(c) Ethical Considerations:

1. Informed Consent: Obtain permission from parents
2. Privacy: Keep responses anonymous
3. Right to Withdraw: Participants can stop at any time
4. No Harm: Avoid sensitive topics

(d) Data Presentation:

- Infographics: Visual summary of key findings
- Reports: Detailed written document with charts and recommendations

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END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science

Chapter: Unit 8 — Entrepreneurship in Digital Age

CHAPTER TEST — 1

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. Product development is the process of:

A. Only selling products
B. Creating a new product or improving an existing one
C. Only advertising products
D. Only packaging products

2. Which of the following is NOT a stage of product development?

A. Idea Generation
B. Prototyping
C. Testing
D. Deleting

3. A prototype is:

A. The final product
B. A preliminary version or working model of a product
C. A type of advertisement
D. A sales report

4. Low-fidelity prototypes are:

A. Detailed and realistic
B. Simple, rough, and quick to create
C. Expensive to make
D. Interactive

5. High-fidelity prototypes are:

A. Simple sketches
B. Detailed, realistic, and close to the final product
C. Cheap to make
D. Only used for physical products

6. The primary purpose of creating a prototype is to:

A. Impress investors

B. Test ideas, gather feedback, and identify problems
C. Finalize the product
D. Sell the product

7. Which of the following is a best practice when creating a prototype?

A. Start with high-fidelity
B. Start simple with low-fidelity
C. Avoid user feedback
D. Spend maximum time on design

8. Testing prototypes with real users helps to:

A. Delay the project
B. Find problems early and improve the product
C. Increase costs
D. Avoid feedback

9. Which method involves users speaking their thoughts while using a prototype?

A. A/B Testing
B. Think-Aloud Protocol
C. Heuristic Evaluation
D. Cognitive Walkthrough

10. MVP stands for:

A. Most Valuable Product
B. Minimum Viable Product

C. Maximum Value Product
D. Minimum Value Prototype

11. The main purpose of an MVP is to:

A. Build the final product immediately
B. Learn from real users and validate ideas with minimum effort
C. Avoid user feedback
D. Increase development time

12. Which of the following is a real-world example of an MVP?

A. Facebook started for Harvard students only
B. A fully featured product launched immediately
C. A product with all possible features
D. A product that is never tested

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Define product development. List any FOUR stages of product development.

Q14. What is a prototype? Why are prototypes important in product development?

Q15. Differentiate between low-fidelity and high-fidelity prototypes. Give one example of each.

Q16. Explain the purpose of testing prototypes. Why is it important to test with real users?

Q17. Define Minimum Viable Product (MVP). What should be included in an MVP?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the process of creating a prototype in detail. Include:
(a) Steps to create a prototype
(b) Tools for creating prototypes
(c) Best practices for creating effective prototypes

Q19. Explain the process of testing prototypes in detail. Include:
(a) Steps in testing prototypes
(b) Methods of testing prototypes
(c) What to look for during testing
(d) Best practices for testing

SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) Explain the concept of MVP (Minimum Viable Product) in detail. Include:

- Definition and purpose
- Steps in building an MVP
- What to include and what to leave out
- Benefits of launching an MVP early

(b) Describe any TWO real-world examples of successful MVPs (e.g., Airbnb, Uber, Facebook, Dropbox) and explain what made them successful.

(c) Why is an MVP considered a learning tool rather than the final product?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Creating a new product or improving an existing one
2	D	Deleting

3	B	A preliminary version or working model of a product
4	B	Simple, rough, and quick to create
5	B	Detailed, realistic, and close to the final product
6	B	Test ideas, gather feedback, and identify problems
7	B	Start simple with low-fidelity
8	B	Find problems early and improve the product
9	B	Think-Aloud Protocol
10	B	Minimum Viable Product
11	B	Learn from real users and validate ideas with minimum effort
12	A	Facebook started for Harvard students only

SECTION B — SHORT ANSWER KEY

Q13. Product Development

Definition: Product development is the process of creating a new product or service, or improving an existing one, to meet the needs of customers.

Four stages:

1. Idea Generation
2. Research
3. Design
4. Prototyping
5. Testing
6. Refinement
7. Launch
8. Maintenance

Q14. Prototype and Importance

Definition: A prototype is a preliminary version or working model of a product.

Importance:

- Test ideas before full development
- Gather feedback early
- Identify problems before costly development
- Save time and money
- Reduce risk

Q15. Low-Fidelity vs High-Fidelity Prototypes

Low-Fidelity	**High-Fidelity**

Simple, rough, quick to create	Detailed, realistic, interactive
Cheap materials (paper, cardboard)	Design software, 3D printing
Example: Paper sketch of an app	Example: Clickable app prototype in Figma

Q16. Testing Prototypes

Purpose: Evaluate a prototype with real users to identify problems, gather feedback, and determine whether the product meets user needs.

Importance of testing with real users:

- Reveals real problems
- Provides honest feedback
- Identifies usability issues
- Validates assumptions
- Ensures user satisfaction

Q17. Minimum Viable Product (MVP)

Definition: MVP is the smallest version of a product that delivers core value to users and allows the team to learn from real customer feedback with minimum effort.

What to include:

- Core value proposition
- Essential features

- Basic usability

SECTION C — LONG ANSWER KEY

Q18. Creating a Prototype

(a) Steps:

1. Define the purpose
2. Choose the type (low-fidelity or high-fidelity)
3. Select tools and materials
4. Build the prototype
5. Test the prototype
6. Refine and iterate
7. Move to next stage

(b) Tools:

- Paper and pencil (sketching)
- Figma, Adobe XD (design software)
- InVision, Marvel (prototyping tools)
- 3D printers, Arduino (physical tools)

(c) Best practices:

1. Start with low-fidelity
2. Focus on the user
3. Iterate quickly
4. Keep it simple
5. Document everything

6. Be willing to throw it away

Q19. Testing Prototypes

(a) Steps:

1. Prepare for testing
2. Recruit participants
3. Conduct the testing
4. Collect data
5. Analyze results
6. Refine the prototype

(b) Methods:

1. Usability Testing
2. A/B Testing
3. Think-Aloud Protocol
4. Heuristic Evaluation
5. Cognitive Walkthrough

(c) What to look for:

- Usability issues
- Design issues
- Functional issues
- User experience issues

(d) Best practices:

1. Test early

2. Test often
3. Test with real users
4. Test in real context
5. Record everything
6. Focus on behavior
7. Prioritize problems
8. Iterate

SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. MVP (Minimum Viable Product)

(a) MVP Concept:

- Definition: The smallest version of a product that delivers core value to users and allows the team to learn from real feedback.
- Purpose: Learn from real users, validate ideas, launch faster
- Steps: Identify core problem Define core features Build Test Launch Learn Iterate
- What to include: Core value, essential features, basic usability
- What to leave out: Non-essential features, complexity, perfection
- Benefits: Validate ideas, save resources, launch faster, generate revenue, reduce risk

(b) Two real-world MVPs:

1. Airbnb:

    - Started with air mattresses in founders' apartment
    - Simple website, few listings
    - Learned: People want to stay in homes, not hotels

    - Success: Validated demand, iterated based on feedback

2. Uber:

    - Started with black cars in San Francisco
    - Simple app, few drivers
    - Learned: People want convenient rides
    - Success: Validated demand, expanded to new cities

3. Facebook:

    - Started for Harvard students only
    - Basic profiles, friend requests
    - Learned: People want to connect online
    - Success: Expanded to other universities, then globally

4. Dropbox:

    - Started with a simple video demo
    - Basic file sync
    - Learned: People want easy file sharing
    - Success: Validated demand, built full product

(c) MVP as a learning tool:

- MVP is not the final product
- Its purpose is to learn, not to be perfect
- Provides real feedback from actual users
- Helps identify what works and what doesn't
- Guides future development
- Reduces risk of building unwanted features

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 8 — Entrepreneurship in Digital Age

CHAPTER TEST — 2

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. The primary goal of product development is to:

A. Waste resources
B. Meet customer needs and achieve business growth
C. Ignore customer feedback
D. Reduce product quality

2. Which of the following is a step in product development?

A. Idea Generation
B. Prototyping
C. Testing
D. All of the above

3. Low-fidelity prototypes are typically created using:

A. 3D printers
B. Paper, cardboard, or simple sketches
C. Advanced software
D. Real materials

4. High-fidelity prototypes:

A. Are quick to create
B. Look and feel like the final product
C. Are cheap to make
D. Have no interactivity

5. Which of the following is a benefit of using prototypes?

A. Increased cost
B. Reduced risk of failure
C. Longer development time
D. Ignoring user feedback

6. The first step in creating a prototype is to:

A. Build the prototype
B. Define the purpose
C. Test with users
D. Refine the design

7. Which of the following is a prototype testing method?

A. Usability Testing
B. A/B Testing
C. Think-Aloud Protocol
D. All of the above

8. In A/B testing, users are:

A. All shown the same version
B. Randomly assigned to two different versions
C. Not involved in testing
D. Asked to design the product

9. The main goal of testing prototypes is to:

A. Delay the project

B. Identify problems and improve the product
C. Increase development costs
D. Avoid user feedback

10. An MVP is:

A. The final product
B. The smallest version of a product that delivers core value
C. A type of prototype
D. A testing method

11. The primary purpose of an MVP is to:

A. Build all features at once
B. Learn from real users and validate ideas
C. Avoid user feedback
D. Increase development time

12. Which of the following is NOT included in an MVP?

A. Core value proposition
B. Essential features
C. Non-essential features
D. Basic usability

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12

Attempt any THREE questions.

Q13. Differentiate between a prototype and an MVP.

Q14. Explain the concept of "Minimum Viable Product" (MVP). Why is it important to launch an MVP early?

Q15. Describe any FOUR methods used to test prototypes.

Q16. Explain the importance of user feedback in product development. How does it help improve the product?

Q17. Describe any FOUR best practices for creating effective prototypes.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the complete process of building and launching an MVP. Include:
(a) Steps to build an MVP
(b) What to include and what to leave out
(c) Launching strategies
(d) Learning and iterating after launch

Q19. Explain the difference between low-fidelity and high-fidelity prototypes in detail. Describe:
(a) When to use each type
(b) Advantages and disadvantages of each
(c) Examples of each type

SECTION D — APPLICATION / ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) You are developing a mobile app for students to share notes. Design a plan for building an MVP for this app. Include:

- Core problem
- Core features
- What to leave out
- Target users

(b) Explain how you would test the MVP with real users.

(c) Describe the metrics you would track to measure the success of the MVP.

(d) What would you do if the MVP does not get positive feedback?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Meet customer needs and achieve business growth
2	D	All of the above
3	B	Paper, cardboard, or simple sketches
4	B	Look and feel like the final product
5	B	Reduced risk of failure
6	B	Define the purpose
7	D	All of the above
8	B	Randomly assigned to two different versions
9	B	Identify problems and improve the product
10	B	The smallest version of a product that delivers core value
11	B	Learn from real users and validate ideas
12	C	Non-essential features

SECTION B — SHORT ANSWER KEY

Q13. Prototype vs MVP

Prototype	MVP
Preliminary version for testing	Smallest functional version for real users
Used internally or with test participants	Released to real customers
Focus on concept validation	Focus on market validation
May be rough or detailed	Must be functional and usable

Q14. MVP

Definition: MVP is the smallest version of a product that delivers core value to users and allows the team to learn from real customer feedback with minimum effort.

Why launch early:

- Validate ideas with real users
- Learn what users actually want
- Avoid wasting time on features nobody needs
- Start generating revenue sooner

- Iterate and improve based on real feedback

Q15. Methods to Test Prototypes

Any FOUR of the following:

1. Usability Testing
2. A/B Testing
3. Think-Aloud Protocol
4. Heuristic Evaluation
5. Cognitive Walkthrough

Q16. Importance of User Feedback

- Reveals real problems
- Provides honest opinions
- Identifies usability issues
- Validates assumptions
- Guides improvements
- Ensures product meets user needs
- Increases chances of success

Q17. Best Practices for Creating Prototypes

Any FOUR of the following:

1. Start with low-fidelity
2. Focus on the user
3. Iterate quickly
4. Keep it simple
5. Document everything

6. Be willing to throw it away

SECTION C — LONG ANSWER KEY

Q18. Building and Launching an MVP

(a) Steps to build an MVP:

1. Identify the core problem
2. Define core features
3. Build the MVP
4. Test the MVP
5. Launch the MVP
6. Learn and iterate

(b) What to include:

- Core value proposition
- Essential features
- Basic usability

What to leave out:

- Non-essential features
- Complex functionality
- Perfect design

(c) Launching strategies:

- Prepare marketing materials
- Choose launch channel (website, app store, social media)

- Release to target users
- Monitor performance

(d) Learning and iterating:

- Analyze feedback
- Identify improvements
- Add features
- Fix problems
- Launch new version

Q19. Low-Fidelity vs High-Fidelity Prototypes

(a) When to use each:

Low-Fidelity	**High-Fidelity**
Early in design process	Later in design process
When exploring multiple ideas	When testing specific features
When quick feedback is needed	When presenting to stakeholders

(b) Advantages and disadvantages:

Low-Fidelity	High-Fidelity
Advantages: Fast, cheap, encourage feedback	Advantages: Realistic user testing, accurate feedback
Disadvantages: May not represent final look	Disadvantages: Time-consuming, expensive, harder to change

(c) Examples:

Low-Fidelity	High-Fidelity
Paper sketches	Clickable app prototype (Figma)
Cardboard models	3D-printed working model

SECTION D — APPLICATION / ANALYSIS ANSWER

Q20. MVP Plan for Student Notes App

(a) MVP Plan:

Core Problem: Students need an easy way to share and access class notes.

Core Features:

- Upload notes (PDF, images)
- Browse notes by subject
- Download notes

What to leave out:

- Ratings and reviews
- User profiles
- Advanced search filters
- Multiple payment options
- Loyalty programs

Target Users: High school and college students

(b) Testing the MVP:

1. Recruit 10-20 students
2. Give them tasks: upload notes, browse, download
3. Observe their behavior
4. Collect feedback
5. Identify problems
6. Fix issues

(c) Metrics to track:

- Activation Rate: % of users who upload/download notes
- Retention Rate: % of users who return
- Engagement: How often users use the app
- Conversion Rate: % of users who pay (if applicable)
- Net Promoter Score: Would recommend?

(d) If MVP does not get positive feedback:

- Analyze feedback to understand why
- Identify specific problems
- Pivot: change direction if needed
- Persevere: improve and retest
- Consider if the problem is real
- Learn from failure and iterate

END OF ANSWER KEY

FBISE-STYLE CHAPTER TEST — PRACTICE PAPER

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Class 11 — Federal Board (FBISE)
Subject: Computer Science
Chapter: Unit 8 — Entrepreneurship in Digital Age

CHAPTER TEST — 3 (Comprehensive & High-Difficulty)

Time Allowed: 1 Hour 30 Minutes
Total Marks: 40

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any THREE questions from Section B.
- Attempt any ONE question from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 12 × 1 = 12
Attempt all questions. Choose the best option.

1. A startup creates a simple website with basic features to test if users are interested in their product idea. This is an example of:

A. Final product launch
B. MVP
C. Full-scale production
D. Marketing campaign

2. Which of the following best describes a low-fidelity prototype?

A. Detailed, realistic, and interactive
B. Simple, rough, and quick to create
C. Used only for final testing
D. Requires advanced software

3. When testing a prototype, "Think-Aloud Protocol" involves:

A. Users speaking their thoughts while using the prototype
B. Developers thinking about the design
C. Users writing their feedback after testing
D. Testing without any users

4. In the context of MVP, "validated learning" means:

A. Learning from books
B. Learning from real user feedback and data
C. Learning from competitors
D. Learning from theoretical models

5. Which of the following is NOT a characteristic of a good MVP?

A. Delivers core value
B. Has all possible features
C. Allows learning from real users
D. Is the smallest version that works

6. A/B testing is used to:

A. Test two versions and determine which performs better
B. Test the alphabet
C. Avoid user feedback
D. Increase development time

7. The primary goal of prototyping is to:

A. Finalize the product

B. Learn, test ideas, and gather feedback
C. Sell the product
D. Increase costs

8. Which of the following is a key benefit of using high-fidelity prototypes?

A. They are quick to create
B. They provide realistic user testing and accurate feedback
C. They are cheap to make
D. They require no user involvement

9. In MVP development, "scope creep" refers to:

A. Reducing features
B. Adding more features than necessary
C. Testing the product
D. Launching the product

10. Which of the following is a risk of NOT testing prototypes?

A. Finding problems early
B. Costly mistakes later in development
C. Improved user satisfaction
D. Faster development

11. The "Build-Measure-Learn" loop is associated with:

A. Waterfall Model
B. Lean Startup methodology

C. Agile Model only
D. Traditional product development

12. Which of the following best describes the relationship between prototypes and MVPs?

A. They are the same thing
B. Prototypes are for learning; MVPs are for real users
C. MVPs are for learning; prototypes are for real users
D. Neither is used in product development

SECTION B — SHORT ANSWER QUESTIONS

Marks: 3 × 4 = 12
Attempt any THREE questions.

Q13. Explain the difference between a prototype and an MVP. Why is each important in product development?

Q14. Describe the "Build-Measure-Learn" loop. How does it help in MVP development?

Q15. Explain any TWO methods of testing prototypes in detail. How does each method help identify problems?

Q16. What is the role of user feedback in product development? Describe how feedback from testing prototypes differs from feedback after launching an MVP.

Q17. Explain the concept of "pivoting" in the context of MVP. When should a startup consider pivoting?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 1 × 8 = 8
Attempt any ONE question.

Q18. Explain the complete process of product development from idea to MVP launch. Include:
(a) Idea Generation
(b) Prototyping (Low and High Fidelity)
(c) Testing Prototypes
(d) Building the MVP
(e) Launching the MVP
(f) Learning and Iterating

Q19. Explain the following in detail:
(a) The difference between low-fidelity and high-fidelity prototypes
(b) When to use each type
(c) Best practices for creating and testing prototypes
(d) Common mistakes to avoid in prototyping

SECTION D — COMPREHENSIVE ANALYSIS QUESTION

Marks: 1 × 8 = 8
Attempt the following question.

Q20. (a) You are developing a food delivery app for your city. Design a complete MVP plan including:

- Core problem
- Core features (at least FOUR)
- What to leave out
- Target users

- Launch strategy

(b) Explain how you would test this MVP with real users.

(c) Describe the metrics you would track to measure success.

(d) After launching, you find that users like the app but complain about delivery time. What would you do?

(e) If the MVP shows low engagement, how would you decide whether to pivot or persevere?

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	MVP
2	B	Simple, rough, and quick to create

3	A	Users speaking their thoughts while using the prototype
4	B	Learning from real user feedback and data
5	B	Has all possible features
6	A	Test two versions and determine which performs better
7	B	Learn, test ideas, and gather feedback
8	B	They provide realistic user testing and accurate feedback
9	B	Adding more features than necessary
10	B	Costly mistakes later in development
11	B	Lean Startup methodology
12	B	Prototypes are for learning; MVPs are for real users

SECTION B — SHORT ANSWER KEY

Q13. Prototype vs MVP

Prototype	MVP
Preliminary version for testing	Smallest functional version for real users
Used internally or with test participants	Released to real customers
Focus on concept validation	Focus on market validation
May be rough or detailed	Must be functional and usable

Importance:

- Prototypes help identify problems early and refine design
- MVPs help validate market demand and gather real feedback

Q14. Build-Measure-Learn Loop

Description: The Build-Measure-Learn loop is a core concept of Lean Startup methodology:

1. Build: Create the MVP
2. Measure: Track how users interact with it
3. Learn: Analyze data and feedback

How it helps:

- Validates assumptions
- Guides iterations
- Reduces risk

- Ensures product meets user needs
- Enables data-driven decisions

Q15. Methods of Testing Prototypes

1. Usability Testing:

- Users try to complete tasks
- Observers watch and take notes
- Problems are identified
- How it helps: Reveals real user difficulties

2. Think-Aloud Protocol:

- Users speak their thoughts while using
- Reveals what they are thinking
- Identifies confusion and frustration
- How it helps: Provides deep insights into user experience

Q16. User Feedback in Product Development

Role: User feedback is essential for identifying problems, validating assumptions, and improving the product.

Difference between prototype testing and MVP feedback:

Prototype Testing	**MVP Feedback**
Controlled environment	Real-world usage

Few participants	Many users
Concept-level feedback	Market-level feedback
Focus on usability	Focus on value and demand

Q17. Pivoting in MVP

Definition: Pivoting means changing direction based on feedback and learning from the MVP.

When to consider pivoting:

- Low user engagement
- Users don't see value
- Market demand is not as expected
- Better opportunity identified
- Core assumptions proven wrong

SECTION C — LONG ANSWER KEY

Q18. Product Development from Idea to MVP Launch

(a) Idea Generation: Come up with new product ideas based on market needs.

(b) Prototyping:

- Low-Fidelity: Simple sketches, cardboard models

- High-Fidelity: Clickable prototypes, 3D-printed models
- Purpose: Test ideas, gather feedback

(c) Testing Prototypes:

- Usability Testing
- A/B Testing
- Think-Aloud Protocol
- Purpose: Identify problems, refine design

(d) Building the MVP:

- Identify core problem
- Define core features
- Build the smallest version that works
- Focus on value, not features

(e) Launching the MVP:

- Release to market
- Target early adopters
- Monitor performance

(f) Learning and Iterating:

- Analyze feedback
- Identify improvements
- Add features
- Fix problems
- Launch new version

Q19. Prototyping in Detail

(a) Low-Fidelity vs High-Fidelity:

Low-Fidelity	High-Fidelity
Simple, rough	Detailed, realistic
Quick and cheap	Time-consuming and expensive
Focus on concept	Focus on design

(b) When to use:

- Low-Fidelity: Early in design, exploring ideas, quick feedback
- High-Fidelity: Later in design, testing specific features, stakeholder presentations

(c) Best practices:

1. Start with low-fidelity
2. Focus on the user
3. Iterate quickly
4. Keep it simple
5. Document everything
6. Be willing to throw it away

(d) Common mistakes:

1. Starting with high-fidelity
2. Not testing with users
3. Ignoring feedback
4. Getting attached to prototypes
5. Over-engineering
6. Not documenting

SECTION D — COMPREHENSIVE ANALYSIS ANSWER

Q20. MVP Plan for Food Delivery App

(a) MVP Plan:

Core Problem: People want convenient food delivery from local restaurants.

Core Features:

1. Restaurant listings with menus
2. Order placement
3. Basic payment option (cash on delivery)
4. Order tracking

What to leave out:

- Ratings and reviews
- Multiple payment options
- Loyalty programs
- Advanced search filters
- In-app chat

Target Users: Young professionals and students in the city

Launch Strategy: Launch in one neighborhood, partner with 5-10 local restaurants

(b) Testing the MVP:

1. Recruit 20-30 users
2. Give them tasks: browse, order, track
3. Observe behavior
4. Collect feedback
5. Identify problems
6. Fix issues

(c) Metrics to track:

- Activation Rate: % of users who place an order
- Retention Rate: % of users who order again
- Delivery Time: Average time from order to delivery
- Order Value: Average order amount
- Net Promoter Score: Would recommend?

(d) If users complain about delivery time:

- Analyze delivery process
- Identify bottlenecks
- Optimize routes
- Add more delivery partners
- Communicate realistic delivery times
- Iterate and retest

(e) If engagement is low:

    - Analyze data to understand why
    - Talk to users
    - Identify specific problems
- Consider pivot if:
    - Core problem is not real
    - Users don't see value
    - Better opportunity exists
- Consider persevere if:
    - Problem is real
    - Feedback suggests improvements
    - Adjustments can solve issues

END OF ANSWER KEY

FBISE-STYLE FULL BOOK MODEL PAPER — PRACTICE PAPER

(Not an official FBISE scheme)

PUBLIC LIBRARY

Class 11 — Federal Board (FBISE)
Subject: Computer Science
Book: Full Book (Units 1–8)

FULL BOOK MODEL PAPER — 1

Time Allowed: 3 Hours
Total Marks: 100

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any FIVE questions from Section B.
- Attempt any TWO questions from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 20 × 1 = 20
Attempt all questions. Choose the best option.

1. A single binary digit (0 or 1) is called a:

A. Byte
B. Bit
C. Nibble
D. Word

2. Which logic gate produces a HIGH (1) output only when ALL inputs are HIGH (1)?

A. OR gate
B. AND gate

C. NOT gate
D. NAND gate

3. Which software development model follows a sequential approach where phases do not overlap?

A. Agile Model
B. Waterfall Model
C. Spiral Model
D. Prototype Model

4. In which network topology are all devices connected to a single central cable?

A. Star Topology
B. Ring Topology
C. Bus Topology
D. Mesh Topology

5. Which type of malware encrypts files and demands payment for decryption?

A. Virus
B. Worm
C. Ransomware
D. Spyware

6. Which computational thinking step involves breaking a complex problem into smaller, manageable sub-problems?

A. Abstraction
B. Decomposition
C. Pattern Recognition

D. Algorithmic Design

7. In a flowchart, which symbol is used for a decision?

A. Oval
B. Parallelogram
C. Diamond
D. Rectangle

8. Which algorithm compares adjacent elements and swaps them if they are in the wrong order?

A. Insertion Sort
B. Bubble Sort
C. Binary Search
D. Linear Search

9. Python was first introduced in:

A. 1990
B. 1992
C. 1995
D. 2000

10. Which of the following is an online Python IDE?

A. IDLE
B. Replit
C. PyCharm
D. Thonny

11. What is the output of the following code?

```python
print("10" + "20")
```

A. 30
B. 1020
C. "1020"
D. Error

12. Which of the following is a valid variable name in Python?

A. 1student
B. student_name
C. student name
D. student-name

13. Which of the following is a built-in Python library?

A. numpy
B. pandas
C. turtle
D. matplotlib

14. What is the primary purpose of an MVP (Minimum Viable Product)?

A. Build the final product immediately
B. Learn from real users and validate ideas with minimum effort
C. Avoid user feedback

D. Increase development time

15. Statistical modeling is the use of mathematical models and statistical assumptions to:

A. Replace data
B. Generate sample data and make predictions about the real world
C. Delete data
D. Slow down analysis

16. Which of the following is an example of unsupervised learning?

A. Predicting house prices
B. Classifying emails as spam or not spam
C. K-means clustering
D. Predicting whether an employee will get a raise

17. Which of the following is a wireless technology used for creating IoT networks?

A. Wi-Fi
B. Bluetooth
C. Zigbee
D. All of the above

18. A Blockchain is a:

A. Centralized database
B. Digital ledger of transactions
C. Type of computer
D. Network protocol

19. Which of the following is a source of reliable information?

A. Anonymous social media posts
B. Government websites (.gov)
C. Unverified blogs
D. Personal anecdotes

20. Digital literacy is the ability to:

A. Only use a computer
B. Find, create, evaluate, communicate, and share digital content
C. Only browse the internet
D. Only send emails

SECTION B — SHORT ANSWER QUESTIONS

Marks: 5 × 4 = 20
Attempt any FIVE questions.

Q21. Differentiate between analog and digital signals with two examples of each.

Q22. Draw the truth table for a two-input NAND gate and write its Boolean expression.

Q23. Explain the phases of the Software Development Life Cycle (SDLC). Name any FOUR.

Q24. Compare Bus Topology and Star Topology. Give one advantage and one disadvantage of each.

Q25. Define decomposition and pattern recognition in computational thinking. Give one example of each.

Q26. Explain the difference between the `input()` function and the `eval(input())` function with a suitable example.

Q27. Differentiate between supervised learning and unsupervised learning.

Q28. Define Internet of Things (IoT). Name any FOUR examples of "things" in IoT.

Q29. Explain the different sources of information in brief. Name any FOUR.

Q30. What is a prototype? Why are prototypes important in product development?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 2 × 10 = 20
Attempt any TWO questions.

Q31. Explain the different types of operators in Python:
(a) Arithmetic Operators
(b) Comparison Operators
(c) Logical Operators
(d) Membership Operators

Give one example of each type.

Q32. Explain the technologies that enabled Internet of Things (IoT) in detail:
(a) Wireless Sensor Networks (WSNs)
(b) Cloud Computing
(c) Big Data Analytics
(d) Communication Protocols

(e) Embedded Systems

Q33. Explain the impact of increased connectivity on the environment. Discuss:
(a) Positive environmental impacts
(b) Negative environmental impacts
(c) Solutions to address the negative impacts

Q34. Explain the process of creating and testing prototypes in detail. Include:
(a) Steps to create a prototype
(b) Types of prototypes (Low-Fidelity and High-Fidelity)
(c) Methods of testing prototypes
(d) Best practices for creating effective prototypes

SECTION D — COMPREHENSIVE / APPLICATION QUESTIONS

Marks: 2 × 20 = 40
Attempt any TWO questions.

Q35. (a) Simplify the following Boolean function using a Karnaugh Map (K-Map):

$F = \bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C + ABC$

Show all steps:

- Plot the terms on the K-Map
- Group the cells
- Eliminate the variable that appears in both normal and complemented form
- Write the simplified result

(b) Draw the truth table for the simplified function.

(c) Draw the logic circuit for the simplified function using basic logic gates.

Q36. (a) Explain the five-step roadmap to solve a data science case study:

1. Formulating the Right Question
2. Data Collection
3. Data Wrangling
4. Data Analysis and Modeling
5. Result Communication

(b) Provide a real-world example for each step.

(c) Explain the difference between correlation and causation with an example.

Q37. (a) Explain the different types of Blockchain networks:

- Public Blockchain Network
- Private Blockchain Network
- Permissioned Blockchain Network
- Consortium Blockchain Network

(b) For each type, give ONE suitable application.

(c) Explain the integration of Blockchain and IoT. Discuss:

- Why integration is needed

- Benefits of integration
- Applications in supply chain, healthcare, and agriculture

Q38. (a) Explain the positive and negative impacts of AI systems in detail. Provide at least FOUR positive and FOUR negative impacts with examples.

(b) Explain the conflicting requirements of stakeholders in AI systems. Why should conflicts be resolved, not suppressed?

(c) Explain the digital divide. Describe any TWO factors that contribute to it and TWO solutions.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Bit
2	B	AND gate

3	B	Waterfall Model
4	C	Bus Topology
5	C	Ransomware
6	B	Decomposition
7	C	Diamond
8	B	Bubble Sort
9	B	1992
10	B	Replit
11	B	1020
12	B	student_name
13	C	turtle
14	B	Learn from real users and validate ideas with minimum effort
15	B	Generate sample data and make predictions about the real world

16	C	K-means clustering
17	D	All of the above
18	B	Digital ledger of transactions
19	B	Government websites (.gov)
20	B	Find, create, evaluate, communicate, and share digital content

---

SECTION B — SHORT ANSWER KEY

Q21. Analog vs Digital Signals

Analog Signals	**Digital Signals**
Continuous waveform	Discrete values (0s and 1s)
Can take any value in a range	Limited discrete values
Susceptible to noise	More resistant to noise
Degrades over long distances	Transmits over long distances with less degradation

Examples: Human speech, analog audio cassette tapes	Examples: MP3 files, digital images (JPEG), binary code

Q22. NAND Gate

Boolean expression: $F = \overline{(x \cdot y)}$

Truth Table:

x	y	F
0	0	1
0	1	1
1	0	1
1	1	0

Q23. Four Phases of SDLC

Any FOUR of the following:

1. Defining the Problem Phase
2. Planning Phase

3. Feasibility Study Phase
4. Analysis Phase
5. Requirement Engineering Phase
6. Design Phase
7. Development/Coding Phase
8. Testing/Verification Phase
9. Deployment/Implementation Phase
10. Documentation Phase
11. Maintenance/Support Phase

Q24. Bus vs Star Topology

Bus Topology	**Star Topology**
All devices connected to one cable	All devices connected to central hub/switch
Advantage: Easy to install and maintain	Advantage: If one node fails, rest of network still works
Disadvantage: Single cable failure affects entire network	Disadvantage: If hub/switch fails, entire network is affected

Q25. Decomposition and Pattern Recognition

Decomposition: Breaking down a complex problem into smaller, manageable sub-problems.
Example: Developing a mobile app break into UI design, login feature, navigation, data storage.

Pattern Recognition: Identifying patterns or trends within data, problems, or solutions.

Example: Analyzing user behavior on a website to identify which pages are visited most.

Q26. input() vs eval(input())

input()	**eval(input())**
Returns input as a string	Converts input to a number
`num = input("Enter: ")` → "123" (string)	`num = eval(input("Enter: "))` → 123 (int)
"123" + "123" = "123123"	123 + 123 = 246

Q27. Supervised vs Unsupervised Learning

Supervised Learning	**Unsupervised Learning**
Uses labeled data	Uses unlabeled data
Answer key available for training	No answer key
Examples: Regression, Classification	Examples: Clustering, Association
Predicts known outcomes	Finds hidden patterns

Q28. IoT Definition and "Things"

Definition: Internet of Things (IoT) is a network of physical devices, appliances, machines, and other objects that are embedded with sensors, software, and network connectivity, allowing them to collect and exchange data over the internet.

Four examples of "things":

1. Smart mobiles
2. Smart watches
3. Smart security systems
4. Medical sensors

Q29. Sources of Information

Four sources:

1. Primary Sources: Letters, diaries, raw data
2. Secondary Sources: Books, articles, documentaries
3. Tertiary Sources: Encyclopedias, dictionaries
4. Digital Sources: Websites, social media

Q30. Prototype and Importance

Definition: A prototype is a preliminary version or working model of a product.

Importance:

- Test ideas before full development
- Gather feedback early
- Identify problems before costly development
- Save time and money
- Reduce risk

SECTION C — LONG ANSWER KEY

Q31. Types of Operators in Python

(a) Arithmetic Operators: Perform mathematical calculations.

- + (addition), - (subtraction), * (multiplication), / (division), % (modulus), // (floor division), ** (exponentiation)
- Example: 5 + 3 = 8

(b) Comparison Operators: Compare two values and return True or False.

- ==, !=, >, <, >=, <=
- Example: 5 > 3 returns True

(c) Logical Operators: Combine multiple conditions.

- and, or, not
- Example: (x > 1) and (x < 10)

(d) Membership Operators: Check if a value exists in a sequence.

- in, not in
- Example: 5 in [1, 3, 5, 7] returns True

Q32. Technologies that Enabled IoT

(a) Wireless Sensor Networks (WSNs):

- Network of physical devices communicating through wireless channels
- Devices embedded with sensors and software

- Three types: environmental, industrial, motion detection sensors

(b) Cloud Computing:

- IT infrastructure providing data storage, databases, servers, networking, and application software over the Internet
- Four deployment models: Public, Private, Community, Hybrid
- Examples: AWS, Microsoft Azure, Google Cloud

(c) Big Data Analytics:

- Collecting extremely big data from various resources
- Using analytics software to find market trends, patterns, and insights
- Used in healthcare, transport, banking, weather, insurance, marketing, etc.

(d) Communication Protocols:

- Set of rules governing how data is transferred and understood
- Provides exchange of information and methods of connection
- Needed for proper functioning of IoT devices

(e) Embedded Systems:

- Small electronic devices that are combination of hardware and firmware
- Have microcontroller or microprocessor
- Designed to perform a specific task
- Applications: medical equipment, home appliances, automotive devices, industrial equipment

---

Q33. Impact of Increased Connectivity on the Environment

(a) Positive Environmental Impacts:

1. Reduced Travel: Remote work and online meetings reduce carbon emissions
2. Resource and Efficiency Improvement: IoT enables more effective use of water, electricity
3. Monitoring the Environment: Real-time environmental monitoring detects pollution, deforestation
4. Economic Opportunities for Green Technologies: Smart grids and renewable energy

(b) Negative Environmental Impacts:

1. E-waste: Discarded electronic devices contain toxic materials
2. Energy Consumption: Data centers consume significant amounts of energy
3. Resource Extraction: Mining for rare earth metals causes habitat destruction
4. Digital Divide: Uneven resource distribution and environmental impacts

(c) Solutions:

- Use renewable energy in data centers
- Improve energy efficiency
- Recycle e-waste properly
- Extend device lifespans
- Promote digital inclusion

Q34. Creating and Testing Prototypes

(a) Steps to create a prototype:

1. Define the purpose
2. Choose the type (low-fidelity or high-fidelity)
3. Select tools and materials
4. Build the prototype
5. Test the prototype
6. Refine and iterate

7. Move to next stage

(b) Types of prototypes:

- Low-Fidelity: Simple, rough, quick (paper, cardboard)
- High-Fidelity: Detailed, realistic, interactive (Figma, 3D printing)

(c) Methods of testing:

1. Usability Testing
2. A/B Testing
3. Think-Aloud Protocol
4. Heuristic Evaluation
5. Cognitive Walkthrough

(d) Best practices:

1. Start with low-fidelity
2. Focus on the user
3. Iterate quickly
4. Keep it simple
5. Document everything
6. Be willing to throw it away

SECTION D — COMPREHENSIVE / APPLICATION ANSWER

Q35. K-Map Simplification

Function: F = $\bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C + ABC$

Step 1: Plot on K-Map

Three-variable K-Map:

	$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
$\bar{A}$	0	1	1	0
A	0	1	1	0

Step 2: Group the cells

All four 1s form one group of four (column C = 1)

Step 3: Eliminate variables

In the group of four, both A and B appear in normal and complemented form ($\bar{A}$, A, $\bar{B}$, B) both eliminated. C remains.

Step 4: Simplified result

F = C

Truth Table for F = C:

A	B	C	F = C

0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Logic Circuit for F = C:

- Input C directly connected to output F (no gates needed)

Q36. Data Science Case Study Roadmap

(a) Five steps:

1. Formulating the Right Question: Review available literature, clearly define what you want to find out, set boundaries.

2. Data Collection: Conduct data inventory, gather data from various sources.
3. Data Wrangling: Clean, preprocess, transform, manipulate, and map raw data.
4. Data Analysis and Modeling: Analyze cleaned data, fit into a selected predictive statistical model.
5. Result Communication: Share findings with management, shareholders, involved parties.

(b) Real-world example: Weather Forecasting

1. Question: How can we predict future weather?
2. Collect: Temperature, rainfall, wind speed data
3. Wrangle: Remove duplicates, handle missing values
4. Analyze: Fit statistical model
5. Communicate: Present predictions to stakeholders

(c) Correlation vs Causation:

Correlation: An association between variables — they change together.
Causation: One variable causes changes in another.

Example from textbook: Phone lagging was correlated with sending a text message, but the real cause was lack of RAM.

Q37. Blockchain Networks and IoT Integration

(a) Four types of Blockchain networks:

1. Public Blockchain: Anyone can join, open platform, weak security
2. Private Blockchain: Managed by single organization, restricted access, more secure
3. Permissioned Blockchain: Only authorized individuals, safe and secure, better transparency
4. Consortium Blockchain: Multiple organizations manage together, complex, safe and secure

(b) Applications:

1. Public: Cryptocurrency (Bitcoin)
2. Private: Business record-keeping
3. Permissioned: Supply chain management
4. Consortium: Banking and finance

(c) Integration of Blockchain and IoT:

Why needed:

- IoT devices collect and exchange vast amounts of data
- This data is vulnerable to cyber-attacks
- Security measures are needed against hacking and breaches
- Blockchain provides decentralized, secure, and transparent recording

Benefits:

- Enhanced security (cryptography protects data)
- Improved performance (faster communication without intermediaries)
- Increased reliability (decentralized, no single point of failure)
- Transparency (all transactions visible)
- Immutable recording (data cannot be altered)

Applications:

- Supply Chain: Track products from manufacturer to customer, verify authenticity, reduce fraud
- Healthcare: Secure medical records, track medical devices, ensure data privacy
- Agriculture: Track food from farm to table, monitor crop conditions, ensure food safety

---

Q38. AI Systems and Digital Divide

(a) Positive and Negative Impacts of AI:

Positive Impacts:

1. Unbiased Decisions: Based on reason and logic. Example: AI recruitment based on skills
2. Around the Clock Availability: Works 24x7. Example: Chatbot support
3. Zero Risk: Robots perform hazardous tasks. Example: Defusing bombs
4. Reduction in Human Error: High accuracy. Example: Robotic surgery

Negative Impacts:

1. Less Creativity and Emotions: AI cannot be creative. Example: Cannot write emotional poetry
2. Lack of Employment: Robots replace humans. Example: Manufacturing and hotels
3. Ethical and Moral Concerns: Difficult to incorporate ethics. Example: AI may grow uncontrollably
4. High Cost: Very costly to develop. Example: Requires latest hardware and software

(b) Conflicting Requirements of Stakeholders:

- Different stakeholders have different expectations, desires, and goals
- Conflicts are unavoidable
- Conflicts should be resolved, not suppressed
- Open communication, negotiation, and ethical frameworks help resolve conflicts

(c) Digital Divide:

Definition: The gap between those who have access to digital technologies and the internet and those who do not.

Two factors:

1. Income: Wealthier people can afford technology; poor people cannot.
2. Location: Urban areas have better infrastructure; rural areas may have limited or no internet access.

Two solutions:

1. Affordable Access: Subsidized devices, low-cost internet plans, free public Wi-Fi
2. Infrastructure Development: Expand internet coverage to rural areas, build infrastructure in developing countries

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END OF ANSWER KEY

FBISE-STYLE FULL BOOK MODEL PAPER — PRACTICE PAPER

(Not an official FBISE scheme)

PUBLIC LIBRARY

Class 11 — Federal Board (FBISE)
Subject: Computer Science
Book: Full Book (Units 1–8)

FULL BOOK MODEL PAPER — 2

Time Allowed: 3 Hours
Total Marks: 100

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any FIVE questions from Section B.
- Attempt any TWO questions from Section C.

- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 20 × 1 = 20
Attempt all questions. Choose the best option.

1. In a digital computer, when no current flows through an electronic switch, it represents:

A. Binary 1
B. Binary 0
C. HIGH state
D. Signal present

2. ASCII uses how many bits to represent a character?

A. 4 bits
B. 7 or 8 bits
C. 16 bits
D. 32 bits

3. Which principle states that a dual expression can be obtained by interchanging AND and OR operators while complementing variables?

A. Absorption Law
B. Principle of Duality
C. Identity Law
D. Distributive Law

4. Which phase of SDLC involves assessing whether a system is technically, financially, legally, and operationally feasible?

A. Analysis Phase
B. Design Phase
C. Feasibility Study Phase
D. Testing Phase

5. Which network topology provides the highest level of redundancy?

A. Bus Topology
B. Star Topology
C. Ring Topology
D. Mesh Topology

6. In the Agile Model, what are short development cycles called?

A. Phases
B. Sprints
C. Stages
D. Milestones

7. Which of the following is an example of a digital signal?

A. Human speech
B. Analog audio cassette tape
C. MP3 audio file
D. Analog temperature reading

8. In a Karnaugh Map, groups may be:

A. Diagonal only
B. Horizontal or vertical
C. Circular only
D. Random

9. Which of the following is the correct typical sequence of artifacts?

A. Code → Algorithm → Flowchart → Pseudocode
B. Algorithm → Flowchart → Pseudocode → Code
C. Flowchart → Code → Algorithm → Pseudocode
D. Pseudocode → Algorithm → Code → Flowchart

10. Binary Search can only be applied to:

A. Any list
B. A sorted list
C. A list of strings
D. A list of size less than 10

11. In Turtle Graphics, which function is used to lift the pen so it does not draw while moving?

A. pendown()
B. penup()
C. penlift()
D. penstop()

12. What is the output of the following code?

python

```
x = 5
y = x
x = 10
print(y)
```

A. 5
B. 10
C. 15
D. Error

13. Which operator is used for exponentiation in Python?

A. ^
B. **
C. //
D. %

14. Which of the following is the correct way to add an element to the end of a list?

A. `list.insert(element)`
B. `list.append(element)`
C. `list.add(element)`
D. `list.push(element)`

15. In a linear regression equation y=mx+by=mx+b, the value mm represents:

A. Y-intercept
B. Slope
C. Dependent variable
D. Independent variable

16. In a supermarket, if a customer buys bread, there is a high chance they will also buy milk. This is an example of:

A. Classification
B. Regression
C. Association
D. Clustering

17. Which type of Blockchain network is open to anyone?

A. Private Blockchain Network
B. Permissioned Blockchain Network
C. Public Blockchain Network
D. Consortium Blockchain Network

18. Which of the following is a positive environmental impact of increased connectivity?

A. E-waste
B. Energy consumption
C. Reduced travel
D. Resource extraction

19. Which of the following is a source of reliable information?

A. Anonymous blog
B. Social media post
C. Peer-reviewed journal
D. Personal anecdote

20. What is the primary purpose of an MVP (Minimum Viable Product)?

A. Build the final product immediately
B. Learn from real users and validate ideas with minimum effort
C. Avoid user feedback
D. Increase development time

SECTION B — SHORT ANSWER QUESTIONS

Marks: 5 × 4 = 20
Attempt any FIVE questions.

Q21. Explain why binary digits are used in computers to represent data.

Q22. Write the truth table for a two-input NOR gate and write its Boolean expression.

Q23. Differentiate between Black Box Testing and White Box Testing.

Q24. Define network topology. Name any FOUR common network topologies.

Q25. What is a trace table? Explain how it helps in testing an algorithm.

Q26. Explain the difference between a `list` and a `tuple` in Python.

Q27. Explain the concept of correlation and causation. Why does correlation not imply causation?

Q28. Differentiate between public and private Blockchain networks.

Q29. What are the five key guidelines for safe use of information sources? List any FOUR.

Q30. Differentiate between low-fidelity and high-fidelity prototypes. Give one example of each.

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 2 × 10 = 20
Attempt any TWO questions.

Q31. Explain the Waterfall Model and the Agile Model of software development. Discuss:
(a) Phases of each model
(b) Advantages and disadvantages of each
(c) Which model is more suitable for projects with changing requirements

Q32. Explain the principles of experimental design:
(a) Principle of Randomization
(b) Principle of Local Control
(c) Principle of Blocking
(d) Principle of Replication

Provide an example for each principle.

Q33. Explain the different types of Blockchain networks:
(a) Public Blockchain Network
(b) Private Blockchain Network
(c) Permissioned Blockchain Network
(d) Consortium Blockchain Network

For each type, give ONE suitable application.

Q34. Explain the effects of increased connectivity on people:
(a) Positive effects
(b) Negative effects
(c) How to maintain a balance and use technology with awareness

---

SECTION D — COMPREHENSIVE / APPLICATION QUESTIONS

Marks: 2 × 20 = 40
Attempt any TWO questions.

Q35. (a) Simplify the following Boolean function using a Karnaugh Map (K-Map):

$F = \bar{A}B + A\bar{B} + AB$

Show all steps:

- Plot the terms on the K-Map
- Group the cells
- Eliminate the variable that appears in both normal and complemented form
- Write the simplified result

(b) Draw the truth table for the simplified function.

(c) Draw the logic circuit for the simplified function using basic logic gates.

Q36. (a) Explain the planning and development process of a computational artifact. Describe the five steps:

1. Define the problem

2. List inputs and outputs
3. Plan
4. Development
5. Test the algorithm

(b) Write an algorithm to find the sum of the first 10 positive numbers. Draw its flowchart and trace table.

Q37. (a) Explain the concept of data bias in detail:

- What is data bias?
- Four types of human bias in data collection
- Real-world examples of each type

(b) Explain the digital divide. Describe any TWO factors that contribute to it and TWO solutions.

Q38. (a) Explain the complete process of building and launching an MVP. Include:

- Steps to build an MVP
- What to include and what to leave out
- Launching strategies
- Learning and iterating after launch

(b) Describe any TWO real-world examples of successful MVPs (e.g., Airbnb, Uber) and explain what made them successful.

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	Binary 0
2	B	7 or 8 bits
3	B	Principle of Duality
4	C	Feasibility Study Phase
5	D	Mesh Topology
6	B	Sprints
7	C	MP3 audio file
8	B	Horizontal or vertical
9	B	Algorithm Flowchart Pseudocode Code

10	B	A sorted list
11	B	penup()
12	A	5
13	B	**
14	B	list.append(element)
15	B	Slope
16	C	Association
17	C	Public Blockchain Network
18	C	Reduced travel
19	C	Peer-reviewed journal
20	B	Learn from real users and validate ideas with minimum effort

---

SECTION B — SHORT ANSWER KEY

Q21. Why Binary Digits Are Used in Computers

- A digital computer is made of millions of electronic switches.
- Each switch has only two states: ON (current flows) and OFF (no current).
- Binary digits 0 and 1 correspond directly to these two states.
- 1 represents ON (current flows), 0 represents OFF (no current).
- Since the switch has exactly two states, the binary system is a natural fit.

Q22. NOR Gate

Boolean expression: $F = \overline{(x + y)}$

Truth Table:

x	y	F
0	0	1
0	1	0
1	0	0
1	1	0

Q23. Black Box vs White Box Testing

Black Box Testing	White Box Testing
Internal workings not known to tester	Tester has knowledge of internal code
Focus on outputs based on inputs	Evaluates internal structures and code paths
No access to source code	Access to source code
Tests functionality	Tests internal logic and quality

Q24. Network Topology and Types

Definition: Network topology is the systematic arrangement of computers and other devices in a network.

Four types: Bus, Star, Ring, Mesh (also acceptable: Tree, Hybrid)

Q25. Trace Table

Definition: A trace table shows how variables change at each stage of an algorithm.

Purpose:

- Helps check if the logic is correct
- Finds logical errors
- Generates output for a given set of inputs
- Verifies that the algorithm works as expected

Q26. List vs Tuple

List	Tuple
Mutable (can change)	Immutable (cannot change)
Uses square brackets [ ]	Uses parentheses ( )
Slower	Faster
Example: [1, 2, 3]	Example: (1, 2, 3)

Q27. Correlation and Causation

Correlation: An association between variables — they change together.

Causation: One variable causes changes in another.

Why correlation does not imply causation:

- The relationship may be coincidental
- There may be reverse causation
- A third variable (confounding variable) may cause both changes

Q28. Public vs Private Blockchain Networks

Public Blockchain	Private Blockchain
Anyone can join	Managed by single organization
Open platform	Public access restricted
Weak security	More secure
Used for cryptocurrency (Bitcoin)	Used for business record-keeping

Q29. Safe Use of Information Sources

Five guidelines:

1. Evaluate the source's credibility
2. Beware of bias and misinformation
3. Respect copyright and intellectual property
4. Avoid plagiarism
5. Report false information

Q30. Low-Fidelity vs High-Fidelity Prototypes

Low-Fidelity	High-Fidelity
Simple, rough, quick to create	Detailed, realistic, interactive

Cheap materials (paper, cardboard)	Design software, 3D printing
Example: Paper sketch of an app	Example: Clickable app prototype in Figma

---

SECTION C — LONG ANSWER KEY

Q31. Waterfall Model vs Agile Model

Waterfall Model:

- Sequential/linear development approach
- Phases: Requirements Design Development Testing Deployment Maintenance
- Phases do not overlap
- Used when requirements are well-defined

Advantages:

- Easy to understand
- Clear milestones
- Well-documented

Disadvantages:

- Inflexible to changes
- Long delivery times
- Late defect detection

Agile Model:

- Iterative and incremental approach
- Breaks tasks into sprints
- Emphasizes flexibility, collaboration, customer feedback

Advantages:

- Flexible and adaptable
- Continuous client involvement
- Early and incremental delivery

Disadvantages:

- Dependency on customer availability
- Scope creep possible
- Limited documentation

Suitability: Agile Model is more suitable for projects with changing requirements.

Q32. Principles of Experimental Design

(a) Principle of Randomization: Divide people into treatment groups randomly. Example: Randomly assign 100 asthma patients into two groups of 50.

(b) Principle of Local Control: Use a control group that has not received treatment. Example: One group receives new medicine; control group receives regular medication.

(c) Principle of Blocking: Group participants by a trait that could affect results. Example: Block by gender — 56 women and 44 men divided into balanced groups.

(d) Principle of Replication: Repeat the experiment. Example: Different data scientists repeat the asthma medicine test.

Q33. Types of Blockchain Networks

1. Public Blockchain: Anyone can join. Example: Bitcoin
2. Private Blockchain: Single organization. Example: Business record-keeping
3. Permissioned Blockchain: Authorized individuals only. Example: Supply chain
4. Consortium Blockchain: Multiple organizations. Example: Banking group

---

Q34. Effects of Increased Connectivity on People

(a) Positive effects:

1. Easier communication with family and friends
2. Fast information access
3. Interaction with people around the world
4. Online education and work opportunities

(b) Negative effects:

1. Screen and social media addiction
2. Privacy issues
3. Spread of false information

(c) Maintaining balance:

- Set limits on screen time
- Be aware of technology's effects
- Verify information before sharing

- Protect privacy
- Focus on real-life activities
- Use technology purposefully

SECTION D — COMPREHENSIVE / APPLICATION ANSWER

Q35. K-Map Simplification

Function: F = $\bar{A}B + A\bar{B} + AB$

Step 1: Plot on K-Map

Two-variable K-Map:

	$\bar{B}$	B
$\bar{A}$	0	1
A	1	1

Step 2: Group the cells

- Horizontal group: $A\bar{B} + AB$ (covers B and $\bar{B}$ in row A)
- Vertical group: $\bar{A}B + AB$ (covers A and $\bar{A}$ in column B)

Step 3: Eliminate variables

- Horizontal group: B eliminated A remains
- Vertical group: A eliminated B remains

Step 4: Simplified result

F = A + B

Truth Table for F = A + B:

A	B	F = A + B
0	0	0
0	1	1
1	0	1
1	1	1

Logic Circuit for F = A + B:

- Input A and B connected to OR gate; output is F

Q36. Planning and Developing a Computational Artifact

(a) Five steps:

1. Define the problem: State the problem clearly.
2. List inputs and outputs: Identify what data is needed and what result is expected.
3. Plan: Outline logic, choose data structures, choose control structures.
4. Development: Describe steps to convert inputs to outputs.
5. Test the algorithm: Verify with different inputs.

(b) Algorithm — Sum of First 10 Positive Numbers:

text

```
1. Set sum = 0
2. For i from 1 to 10:
3. sum = sum + i
4. Print sum
```

Flowchart:
Start → sum = 0 → i = 1 → i ≤ 10? → sum = sum + i → i = i + 1 → (back to condition) → Print sum → End

Trace Table:

i	sum
1	1
2	3
3	6

4	10
5	15
6	21
7	28
8	36
9	45
10	55

Output: 55

Q37. Data Bias and Digital Divide

(a) Data Bias:

Definition: Mistakes or problems in information that can make conclusions not quite right.

Four types of human bias:

1. Sampling Bias: Sample does not accurately represent the population. Example: Survey conducted only in urban areas.

2. Selection Bias: Certain individuals or groups are systematically excluded. Example: Interviewers only select candidates from one university.
3. Observer Bias: Researcher's expectations influence results. Example: Scientist believing medicine is effective analyzes results accordingly.
4. Data Interpretation Bias: Interpreting data to fit pre-existing beliefs. Example: Analyst interprets results to support preferred model.

(b) Digital Divide:

Definition: The gap between those who have access to digital technologies and the internet and those who do not.

Two factors:

1. Income: Wealthier people can afford technology; poor people cannot.
2. Location: Urban areas have better infrastructure; rural areas may have limited or no internet access.

Two solutions:

1. Affordable Access: Subsidized devices, low-cost internet plans, free public Wi-Fi.
2. Infrastructure Development: Expand internet coverage to rural areas, build infrastructure in developing countries.

Q38. Building and Launching an MVP

(a) MVP Process:

Steps to build an MVP:

1. Identify the core problem
2. Define core features
3. Build the MVP
4. Test the MVP

5. Launch the MVP
6. Learn and iterate

What to include:

- Core value proposition
- Essential features
- Basic usability

What to leave out:

- Non-essential features
- Complex functionality
- Perfect design

Launching strategies:

- Prepare marketing materials
- Choose launch channel
- Release to target users
- Monitor performance

Learning and iterating:

- Analyze feedback
- Identify improvements
- Add features
- Fix problems
- Launch new version

(b) Real-world MVPs:

1. Airbnb:

- Started with air mattresses in founders' apartment
- Simple website, few listings
- Learned: People want to stay in homes, not hotels

2. Uber:

- Started with black cars in San Francisco
- Simple app, few drivers
- Learned: People want convenient rides

3. Facebook:

- Started for Harvard students only
- Basic profiles, friend requests
- Learned: People want to connect online

4. Dropbox:

- Started with a simple video demo
- Basic file sync
- Learned: People want easy file sharing

END OF ANSWER KEY

FBISE-STYLE FULL BOOK MODEL PAPER — PRACTICE PAPER

(Not an official FBISE scheme)

PUBLIC LIBRARY

Class 11 — Federal Board (FBISE)
Subject: Computer Science
Book: Full Book (Units 1–8)

FULL BOOK MODEL PAPER — 3 (Comprehensive & High-Difficulty)

Time Allowed: 3 Hours
Total Marks: 100

Instructions:

- Attempt all questions.
- Section A is compulsory.
- Attempt any FIVE questions from Section B.
- Attempt any TWO questions from Section C.
- Write answers clearly and to the point.

SECTION A — OBJECTIVE (MCQs)

Marks: 20 × 1 = 20
Attempt all questions. Choose the best option.

1. The circuit of a digital computer works on which type of voltage?

A. AC voltage
B. DC voltage

C. Both AC and DC
D. High-frequency voltage

2. Which of the following is a source of reliable information?

A. Government websites (.gov)
B. Anonymous social media posts
C. Unverified blogs
D. Personal anecdotes

3. In a three-variable K-map, how many cells are there?

A. 4 cells
B. 6 cells
C. 8 cells
D. 16 cells

4. A researcher analyzes data in a way that supports their pre-existing beliefs, ignoring contradictory evidence. This is an example of:

A. Sampling Bias
B. Selection Bias
C. Observer Bias
D. Data Interpretation Bias

5. Which of the following is a negative environmental impact of increased connectivity?

A. Reduced travel
B. E-waste
C. Resource efficiency

D. Environmental monitoring

6. Which logic gate produces a 0 output only when all inputs are 1?

A. AND gate
B. OR gate
C. NAND gate
D. NOR gate

7. Binary Search follows which problem-solving approach?

A. Sequential
B. Divide and Conquer
C. Random
D. Linear

8. Which type of Blockchain network is managed by a single organization?

A. Public Blockchain Network
B. Private Blockchain Network
C. Consortium Blockchain Network
D. Permissioned Blockchain Network

9. Which assistive technology is used by people with visual impairments?

A. Wheelchair
B. Screen reader
C. Voice recognition software
D. Joystick controller

10. What will be the output of the following code?

```python
x = 5
y = 3
temp = 0
temp = x
y = temp
x = y
print(x, y, temp)
```

A. 3 5 5
B. 5 5 5
C. 5 3 5
D. 5 5 3

11. Which of the following is a characteristic of a good infographic?

A. Cluttered with unnecessary details
B. Accurate, visually appealing, and easy to understand
C. Using only text, no visuals
D. Ignoring the audience

12. What is the output of the following code?

```python
for i in range(5, 0, -1):
    print(i)
```

A. 1 2 3 4 5

B. 5 4 3 2 1
C. 0 1 2 3 4
D. 5 4 3 2 1 0

13. Which of the following is a step in product development?

A. Idea Generation
B. Prototyping
C. Testing
D. All of the above

14. A financial institution uses cloud-based storage for customer data. The cloud provider stores data in multiple data centers. If one data center fails, data is still accessible from other locations. This demonstrates:

A. Scalability
B. Reliability
C. Latency
D. Bandwidth

15. Which of the following best describes the relationship between correlation and causation?

A. Correlation always implies causation
B. Causation always implies correlation
C. They are the same thing
D. They are unrelated

16. Which of the following is a valid variable name in Python?

A. 1student

B. student_name
C. student name
D. student-name

17. In the context of MVP, "validated learning" means:

A. Learning from books
B. Learning from real user feedback and data
C. Learning from competitors
D. Learning from theoretical models

18. What is the purpose of the `plt.show()` function in Matplotlib?

A. To delete the plot
B. To display the plot on the screen
C. To encrypt the plot
D. To save the plot

19. Which of the following is a positive impact of AI systems?

A. Lack of employment
B. High cost
C. Reduction in human error
D. Ethical concerns

20. In a smart factory, sensors on machines collect temperature and vibration data. This data is analyzed to predict machine failures before they occur. This is an example of:

A. Cloud computing only

B. Big Data Analytics in IoT
C. Blockchain only
D. Embedded systems only

SECTION B — SHORT ANSWER QUESTIONS

Marks: 5 × 4 = 20
Attempt any FIVE questions.

Q21. Explain the difference between a closed switch and an open switch in terms of binary representation.

Q22. Write the truth table for a two-input XOR gate and write its Boolean expression.

Q23. Explain the difference between an interactive program and a batch program. Give one example of each.

Q24. Describe the working of Bubble Sort with a simple example.

Q25. Explain the `strftime()` function of the `datetime` library. Write any FOUR common formatting arguments.

Q26. Explain the concept of dynamic typing in Python with a suitable example.

Q27. Explain the concept of "permissioned Blockchain network." How does it differ from a private Blockchain network?

Q28. Describe any FOUR applications of the integration of Blockchain and IoT.

Q29. Explain any TWO tasks suitable for humans and TWO tasks suitable for computers in data source verification.

Q30. What is the role of user feedback in product development? How does it help improve the product?

SECTION C — LONG / EXTENDED RESPONSE QUESTIONS

Marks: 2 × 10 = 20
Attempt any TWO questions.

Q31. Explain the following control structures in Python:
(a) `if-else` statement
(b) `if-elif-else` statement
(c) `while` loop
(d) `for` loop

Provide one example of each.

Q32. Explain the experimental design flow in detail:
(a) Develop Hypotheses
(b) Find the Variables
(c) Determine the Experimental Design
(d) Calculating the Needed Sample Size
(e) Random Assignment and Selection
(f) Carry out the Experiment
(g) Data Analysis
(h) Interpreting and Drawing Conclusions
(i) Discuss and Report

Q33. Explain the technologies that enabled Blockchain in detail:
(a) Cryptography
(b) Blockchain Networks
(c) Transaction Process on the Network

Q34. Explain the impact of increased connectivity on the environment in detail:
(a) Positive environmental impacts (at least FOUR)
(b) Negative environmental impacts (at least FOUR)
(c) Solutions to address the negative impacts

SECTION D — COMPREHENSIVE / APPLICATION QUESTIONS

Marks: 2 × 20 = 40
Attempt any TWO questions.

Q35. (a) Simplify the following Boolean function using a Karnaugh Map (K-Map):

$F = \bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C + ABC$

Show all steps:

- Plot the terms on the K-Map
- Group the cells
- Eliminate the variable that appears in both normal and complemented form
- Write the simplified result

(b) Draw the truth table for the simplified function.

(c) Draw the logic circuit for the simplified function using basic logic gates.

Q36. (a) Trace the following Python code and determine the output. Show a complete trace table.

python

```
x = 5
y = 3
temp = 0
print("Initial:", x, y)
temp = x
x = y
y = temp
print("After Swap:", x, y)

numbers = [12, 31, 25, 8, 32, 17]
total = 0
for i in range(len(numbers)):
    if numbers[i] % 2 == 0:
        total = total + numbers[i]
print("Sum of even numbers:", total)

def calculate_average(nums):
    if len(nums) == 0:
        return 0
    return sum(nums) / len(nums)

print("Average:", calculate_average(numbers))

squares = [x ** 2 for x in range(1, 6)]
print("Squares:", squares)
```

(b) State the final output.
(c) Identify the number of iterations of each loop.
(d) Which values are even numbers in the list?

Q37. (a) Explain the concept of data bias in detail:

- What is data bias?
- Four types of human bias in data collection
- Real-world examples of each type
- How to reduce or eliminate bias in data collection

(b) Explain the digital divide. Describe any TWO factors that contribute to it and TWO solutions.

Q38. (a) Explain the complete process of building and launching an MVP. Include:

- Steps to build an MVP
- What to include and what to leave out
- Launching strategies
- Learning and iterating after launch

(b) Describe any TWO real-world examples of successful MVPs (e.g., Airbnb, Uber) and explain what made them successful.

(c) You are developing a food delivery app for your city. Design a complete MVP plan including:

- Core problem
- Core features (at least FOUR)
- What to leave out
- Target users
- Launch strategy

END OF TEST PAPER

ANSWER KEY / TEACHER KEY

SECTION A — MCQ ANSWERS

Q#	Correct Option	Answer
1	B	DC voltage
2	A	Government websites (.gov)
3	C	8 cells
4	D	Data Interpretation Bias
5	B	E-waste
6	C	NAND gate
7	B	Divide and Conquer
8	B	Private Blockchain Network
9	B	Screen reader

10	B	5 5 5
11	B	Accurate, visually appealing, and easy to understand
12	B	5 4 3 2 1
13	D	All of the above
14	B	Reliability
15	B	Causation always implies correlation
16	B	student_name
17	B	Learning from real user feedback and data
18	B	To display the plot on the screen
19	C	Reduction in human error
20	B	Big Data Analytics in IoT

SECTION B — SHORT ANSWER KEY

Q21. Closed Switch vs Open Switch

Closed Switch	Open Switch
Current flows	No current flows
Represents binary 1	Represents binary 0
Also called ON state	Also called OFF state

Q22. XOR Gate

Boolean expression: F = x □ y (or F = $\bar{x}$y + x$\bar{y}$)

Truth Table:

x	y	F
0	0	0
0	1	1
1	0	1

1	1	0

Q23. Interactive vs Batch Programs

Interactive Program	**Batch Program**
Accepts input from user or another program	Multiple commands bunched together
Continuous interaction	Processed sequentially, then halts
Example: Web browser	Example: Print jobs on a printer

Q24. Bubble Sort Working

Definition: Bubble Sort repeatedly compares and swaps adjacent elements if they are not in correct order.

Example: [13, 32, 26, 35, 10]

Iteration 1:

- 13 and 32: no swap
- 32 and 26: swap [13, 26, 32, 35, 10]
- 32 and 35: no swap
- 35 and 10: swap [13, 26, 32, 10, 35]

Iteration 2: ... (continues until sorted)

Final sorted array: [10, 13, 26, 32, 35]

Q25. strftime() Function

Definition: The `strftime()` function formats dates and times according to the argument provided.

Four common arguments:

- `%A` — Weekday, full version (e.g., Friday)
- `%B` — Month name, full version (e.g., August)
- `%d` — Day of month (01-31)
- `%Y` — Year, full version (e.g., 2023)

Q26. Dynamic Typing in Python

Definition: Python is a dynamically typed language — you do not need to declare the data type of a variable. The data type is determined automatically based on the value assigned.

Example:

python

```
x = 5       # x is int
x = "Hello" # x is now str
x = 3.14    # x is now float
```

Q27. Permissioned vs Private Blockchain

Permissioned Blockchain	Private Blockchain
Only authorized individuals can access	Managed by single organization
Anyone who wants to join needs permission	Public access restricted
Safe and secure with better transparency	More secure than public
Used for supply chain, trade finance	Used for business record-keeping

Q28. Applications of Blockchain and IoT Integration

1. Supply Chain: Track products from manufacturer to customer, verify authenticity
2. Healthcare: Secure medical records, track medical devices
3. Energy Grid: Manage energy distribution, peer-to-peer energy trading
4. Agriculture: Track food from farm to table, monitor crop conditions
5. Automotive: Secure vehicle-to-vehicle communication
6. Water Management: Monitor water quality and usage

Q29. Tasks for Humans vs Computers

Tasks for Humans	Tasks for Computers
Subjective judgments	Processing large amounts of data

Complex decision-making	Statistical analysis
Handling ambiguity	Pattern recognition
Personal judgments	Automated verification

Q30. Importance of User Feedback

- Reveals real problems
- Provides honest opinions
- Identifies usability issues
- Validates assumptions
- Guides improvements
- Ensures product meets user needs
- Increases chances of success

SECTION C — LONG ANSWER KEY

Q31. Control Structures in Python

(a) if-else:

python

```
num = eval(input("Enter a number: "))
if num % 2 == 0:
    print("Even")
```

```
else:
    print("Odd")
```

(b) if-elif-else:

```
python
```

```
num = eval(input("Enter a number: "))
if num > 0:
    print("Positive")
elif num < 0:
    print("Negative")
else:
    print("Zero")
```

(c) while loop:

```
python
```

```
i = 1
total = 0
while i <= 10:
    total = total + i
    i = i + 1
print("Sum:", total)  # Output: 55
```

(d) for loop:

```
python
```

```
for i in range(1, 6):
    print(i)
# Output: 1, 2, 3, 4, 5
```

Q32. Experimental Design Flow

(a) Develop Hypotheses: Clarify differences and correlations between variables.

(b) Find the Variables: Decide which variables are fixed (independent) and which will change (dependent). Consider confounding factors.

(c) Determine the Experimental Design: Choose appropriate design (factorial, randomized block, etc.) based on research nature and resources.

(d) Calculating the Needed Sample Size: Calculate necessary sample size for valid statistical results.

(e) Random Assignment and Selection: Choose random samples to ensure groups are identical and no bias.

(f) Carry out the Experiment: Follow instructions and gather data strictly according to defined procedure.

(g) Data Analysis: Use appropriate statistical analysis (hypothesis testing, regression, ANOVA).

(h) Interpreting and Drawing Conclusions: Observe results carefully, consider practical factors.

(i) Discuss and Report: Present design, methodology, findings, and conclusions clearly. Document thoroughly for reproducibility.

Q33. Technologies that Enabled Blockchain

(a) Cryptography:

- Protects information and communications by coding it
- Provides confidentiality, integrity, and authentication

- Ensures transaction data is secure and immutable
- Used to create hashes and digital signatures

(b) Blockchain Networks:

1. Public Blockchain: Anyone can join, open platform, weak security. Example: Bitcoin
2. Private Blockchain: Managed by single organization, restricted access, more secure. Example: Business records
3. Permissioned Blockchain: Only authorized individuals, safe and secure, better transparency. Example: Supply chain
4. Consortium Blockchain: Multiple organizations manage together, complex. Example: Banking group

(c) Transaction Process:

- Direct deals without intermediaries (bank or government)
- Each transaction verified by participants in peer-to-peer network
- Transactions are permanent and irreversible
- Faster than traditional databases
- Decentralized: data stored in millions of computers worldwide

---

Q34. Impact of Increased Connectivity on the Environment

(a) Positive Environmental Impacts:

1. Reduced Travel: Remote work and online meetings reduce carbon emissions
2. Resource and Efficiency Improvement: IoT enables more effective use of water, electricity
3. Monitoring the Environment: Real-time environmental monitoring detects pollution, deforestation
4. Economic Opportunities for Green Technologies: Smart grids and renewable energy

(b) Negative Environmental Impacts:

1. E-waste: Discarded electronic devices contain toxic materials
2. Energy Consumption: Data centers consume significant amounts of energy

3. Resource Extraction: Mining for rare earth metals causes habitat destruction
4. Digital Divide: Uneven resource distribution and environmental impacts

(c) Solutions:

- Use renewable energy in data centers
- Improve energy efficiency
- Recycle e-waste properly
- Extend device lifespans
- Promote digital inclusion

SECTION D — COMPREHENSIVE / APPLICATION ANSWER

Q35. K-Map Simplification

Function: F = $\bar{A}\bar{B}C + \bar{A}BC + A\bar{B}C + ABC$

Step 1: Plot on K-Map

Three-variable K-Map:

	$\bar{B}\bar{C}$	$\bar{B}C$	BC	$B\bar{C}$
$\bar{A}$	0	1	1	0
A	0	1	1	0

Step 2: Group the cells

All four 1s form one group of four (column C = 1)

Step 3: Eliminate variables

In the group of four, both A and B appear in normal and complemented form ($\bar{A}$, A, $\bar{B}$, B) both eliminated. C remains.

Step 4: Simplified result

F = C

Truth Table for F = C:

A	B	C	F = C
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0

1	0	1	1
1	1	0	0
1	1	1	1

Logic Circuit for F = C:

- Input C directly connected to output F (no gates needed)

Q36. Trace and Output

(a) Trace Table (Partial — Key Variables):

Step	x	y	temp	numbers	total	i	squares
1	5	3	0	-	-	-	-
2	5	3	0	-	-	-	-
3	5	3	5	-	-	-	-
4	3	3	5	-	-	-	-

5	3	5	5	-	-	-	-
6	3	5	5	[12,31,25,8,32,17]	0	-	-
7	3	5	5	-	0	0	-
8	3	5	5	-	12	0	-
9	3	5	5	-	12	1	-
10	3	5	5	-	12	2	-
11	3	5	5	-	20	3	-
12	3	5	5	-	52	4	-
13	3	5	5	-	52	5	-
14	3	5	5	-	52	-	[1,4,9,16,25]

(b) Final Output:

text

Initial: 5 3

After Swap: 3 5
Sum of even numbers: 52
Average: 20.833333333333332
Squares: [1, 4, 9, 16, 25]

Calculations:

- Sum of even numbers: 12 + 8 + 32 = 52
- Average: (12+31+25+8+32+17) / 6 = 125/6 □ 20.83
- Squares: [1, 4, 9, 16, 25]

(c) Iterations:

- For loop over numbers: 6 iterations
- List comprehension: 5 iterations

(d) Even numbers in the list: 12, 8, 32

Q37. Data Bias and Digital Divide

(a) Data Bias:

Definition: Mistakes or problems in information that can make conclusions not quite right.

Four types of human bias:

1. Sampling Bias: Sample does not accurately represent the population. Example: Survey conducted only in urban areas.
2. Selection Bias: Certain individuals or groups are systematically excluded. Example: Interviewers only select candidates from one university.
3. Observer Bias: Researcher's expectations influence results. Example: Scientist believing medicine is effective analyzes results

accordingly.
4. Data Interpretation Bias: Interpreting data to fit pre-existing beliefs. Example: Analyst interprets results to support preferred model.

How to reduce bias:

- Use random sampling
- Be aware of unconscious bias
- Use blind or double-blind studies
- Have multiple observers/analysts
- Use standardized procedures
- Cross-check findings

(b) Digital Divide:

Definition: The gap between those who have access to digital technologies and the internet and those who do not.

Two factors:

1. Income: Wealthier people can afford technology; poor people cannot.
2. Location: Urban areas have better infrastructure; rural areas may have limited or no internet access.

Two solutions:

1. Affordable Access: Subsidized devices, low-cost internet plans, free public Wi-Fi.
2. Infrastructure Development: Expand internet coverage to rural areas, build infrastructure in developing countries.

Q38. Building and Launching an MVP

(a) MVP Process:

Steps to build an MVP:

1. Identify the core problem
2. Define core features
3. Build the MVP
4. Test the MVP
5. Launch the MVP
6. Learn and iterate

What to include:

- Core value proposition
- Essential features
- Basic usability

What to leave out:

- Non-essential features
- Complex functionality
- Perfect design

Launching strategies:

- Prepare marketing materials
- Choose launch channel
- Release to target users
- Monitor performance

Learning and iterating:

- Analyze feedback
- Identify improvements

- Add features
- Fix problems
- Launch new version

(b) Real-world MVPs:

1. Airbnb:
    - Started with air mattresses in founders' apartment
    - Simple website, few listings
    - Learned: People want to stay in homes, not hotels
2. Uber:
    - Started with black cars in San Francisco
    - Simple app, few drivers
    - Learned: People want convenient rides
3. Facebook:
    - Started for Harvard students only
    - Basic profiles, friend requests
    - Learned: People want to connect online
4. Dropbox:
    - Started with a simple video demo
    - Basic file sync
    - Learned: People want easy file sharing

(c) MVP Plan for Food Delivery App:

Core Problem: People want convenient food delivery from local restaurants.

Core Features:

1. Restaurant listings with menus
2. Order placement
3. Basic payment option (cash on delivery)
4. Order tracking

What to leave out:

- Ratings and reviews
- Multiple payment options
- Loyalty programs
- Advanced search filters

Target Users: Young professionals and students in the city

Launch Strategy: Launch in one neighborhood, partner with 5-10 local restaurants

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END OF ANSWER KEY