Subject: Computer	**Chapter:** Unit 02
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FBISE SLO-Aligned

*(Correct answer is in **bold**)*

1. A problem in computer science is solved by:
   a) Guessing
   b) Magic
   c) Step-by-step computation
   d) Random trials
   ➡ **c) Step-by-step computation**
2. Which of the following is a Decision Problem?
   a) Finding shortest path
   b) Whether a number is prime
   c) Counting number of dresses
   d) Arranging letters of a word
   ➡ **b) Whether a number is prime**
3. In a Search Problem, the solution is found by:
   a) Guessing randomly
   b) Searching among possible options
   c) Ignoring input
   d) Repeating same step
   ➡ **b) Searching among possible options**
4. The 8-puzzle problem is an example of:
   a) Decision problem
   b) Counting problem
   c) Search problem
   d) Logical problem
   ➡ **c) Search problem**
5. If there are 3 shirts and 2 pants, total outfits = ?
   a) 5
   b) 3
   c) 6
   d) 2
   ➡ **c) 6**
6. Which is the first step in problem-solving?
   a) Implement solution
   b) Evaluate plan
   c) Define and analyze problem
   d) Write program
   ➡ **c) Define and analyze problem**
7. For simple problems, how many steps are usually required?
   a) 2
   b) 3

c) 4
d) 6
➡ **c) 4**

8. Decomposition in computational thinking means:
a) Ignoring details
b) Breaking problem into smaller parts
c) Making problem harder
d) Writing a flowchart
➡ **b) Breaking problem into smaller parts**

9. Which property of CT removes unnecessary details?
a) Decomposition
b) Pattern recognition
c) Abstraction
d) Algorithm design
➡ **c) Abstraction**

10. Finding similarities with past solved problems is called:
a) Algorithm design
b) Decomposition
c) Logical thinking
d) Pattern recognition
➡ **d) Pattern recognition**

11. Which property creates a step-by-step plan?
a) Abstraction
b) Algorithm design
c) Decomposition
d) Pattern recognition
➡ **b) Algorithm design**

12. IPO model stands for:
a) Input-Processing-Output
b) Input-Presentation-Outcome
c) Inside-Process-Outside
d) Internal-Program-Operation
➡ **a) Input-Processing-Output**

13. Which chart is used to represent IPO model?
a) Flowchart
b) Concept Map
c) IPO Chart
d) Algorithm
➡ **c) IPO Chart**

14. Flowchart is a:
a) Written program
b) Diagrammatic representation of algorithm
c) Code in C++
d) Computer hardware diagram
➡ **b) Diagrammatic representation of algorithm**

15. Which symbol represents decision in flowchart?
a) Rectangle
b) Diamond
c) Circle
d) Parallelogram
➡ **b) Diamond**

16. In IPO model, multiplication of length × width belongs to:
    a) Input
    b) Process
    c) Output
    d) Algorithm
    ➡ **b) Process**
17. Computational Thinking is an extension of:
    a) Physical thinking
    b) Logical thinking
    c) Guesswork
    d) Programming
    ➡ **b) Logical thinking**
18. Logical thinking requires:
    a) Evidence and facts
    b) Ignoring reasoning
    c) Writing programs
    d) Copying others
    ➡ **a) Evidence and facts**
19. Algorithmic thinking involves:
    a) Random trial and error
    b) Breaking down problem into steps
    c) Writing without planning
    d) Guessing solution
    ➡ **b) Breaking down problem into steps**
20. Which is NOT a method to design solution?
    a) Flowcharts
    b) Concept maps
    c) IPO charts
    d) Mind games
    ➡ **d) Mind games**
21. Which software is commonly used to design flowcharts?
    a) MS Word
    b) MS Paint
    c) MS Visio
    d) Photoshop
    ➡ **c) MS Visio**
22. LARP is used for:
    a) Games
    b) Prototyping algorithms
    c) Hardware assembly
    d) Web browsing
    ➡ **b) Prototyping algorithms**
23. Concept maps show:
    a) Random designs
    b) Knowledge and relationships
    c) Computer hardware
    d) Database tables
    ➡ **b) Knowledge and relationships**
24. Which is an example of logical inference?
    a) If Islamabad is a city, cities have mayors → Islamabad has a mayor
    b) Guessing tomorrow's weather

c) Playing a game
d) Designing a flowchart

➡ **a) If Islamabad is a city, cities have mayors → Islamabad has a mayor**

25. Which property is MOST useful in creating a game?
    a) Abstraction
    b) Pattern recognition
    c) Decomposition
    d) All of the above

    ➡ **d) All of the above**

26. Which problem is solved using counting principle?
    a) Shortest path
    b) How many outfits can be made from shirts & pants
    c) Prime number test
    d) Binary search

    ➡ **b) How many outfits can be made from shirts & pants**

27. Which of these is a Search Problem?
    a) Finding a path between two cities
    b) Even/odd number
    c) Counting dresses
    d) Multiplying numbers

    ➡ **a) Finding a path between two cities**

28. Which property makes solution simple by focusing only on required details?
    a) Abstraction
    b) Logical thinking
    c) Algorithmic thinking
    d) Flowchart

    ➡ **a) Abstraction**

29. Problem solving for complex problems usually has how many steps?
    a) 2
    b) 4
    c) 6
    d) 8

    ➡ **c) 6**

30. IPO charts are mostly used by:
    a) Carpenters
    b) Software designers
    c) Doctors
    d) Architects

    ➡ **b) Software designers**

Exercise MCQS

1. For a problem, we face in real world situations. In what sequence we follow the steps.

I. make some solution. II. understand the real-world problem.

III. instruct the computer to behave accordingly.

a) I, II, III
b) I, III, II
c) II, I, III
d) II, III, I

2. Following are types of computing problems
I. Counting Problems II. Search Problems III. Decision Problem

a) I and II
b) I and III
c) II and III
d) I and II and III

3. Computational thinking is
a) Programming
b) Thinking like a computer
c) Coding
d) Logically solving problems

4. To solve Search problems, we need to
a) Provide the moves.
b) Provide start state.
c) Provide the end state.
d) a, b and c

5. The eight queens puzzle is the problem of
a) Sorting
b) Searching
c) Counting
d) Both a and b

6. Finding the location of the element with a given value is
a) Search
b) Traversal
c) Sort
d) None of above

7. In IPO Charts, we have
a) Input, Plan, Output
b) Input, Program, Output
c) Input, Process, Output
d) Input, Proceed, Output

Short Questions

Q1) What is the major difference in solving simple problems and complex problems?
Ans: Simple problems are usually handled with a **four-step cycle**—define/analyze, design a plan (algorithm), implement, and evaluate—because the task is small and well-scoped. Complex problems need the **six-step process** that adds *decomposition* and *selecting the best plan* for sub-problems before implementation and evaluation.

Q2) Why do software designers prefer to use IPO charts?
Ans: IPO charts give a clear, tabular picture of **Inputs, Processes, and Outputs**, so designers can verify that required inputs and operations are identified and that the expected outputs are explicit. The text emphasizes IPO charts as a **handy tool** frequently used before coding to structure solutions.

Q3) Differentiate between Computational thinking and Logical thinking.
Ans: **Logical thinking** is reasoning from facts and evidence to sensible conclusions (e.g., inferring from known facts), while **Computational thinking (CT)** is a broader, systematic problem-solving approach (decomposition, abstraction, pattern recognition, algorithm design) used to create repeatable, automated solutions—an *extension of logical thinking*.

Q4) Write four properties of Computational thinking.
Ans: The four core properties are **Decomposition** (break a big problem into sub-problems), **Abstraction** (remove unnecessary details), **Pattern Recognition** (spot similarities to solved problems), and **Algorithm Design** (create a step-by-step plan).

Q5) What are the methods used to design a solution?
Ans: The chapter lists **two design methods**: **Flowcharts** (diagrammatic algorithms showing operation sequence and decisions) and **Concept Maps** (graphical knowledge maps showing concepts and their relationships).

Q6) Which Computational thinking technique breaks down the problem into smaller parts?
Ans: **Decomposition**—it divides a larger task into **smaller, manageable sub-problems** so each can be solved more easily and then combined into a full solution.

Q7) Identify 3 computing problems from other subjects that you are studying in your class.
Ans: Examples include **calculating velocity** in Physics, **solving linear equations** in Mathematics, and **balancing chemical equations** in Chemistry; all fit the text's idea that computing problems occur across fields and are solved step-by-step with computation.

Q8) Why do we need to think computationally?
Ans: Computational Thinking helps us **reflect clearly on a problem** and design a **repeatable/automated solution** that works for many similar instances, not just one case; the text frames Computational Thinking as an extension of logical thinking that improves efficiency and consistency.

Q9) The telephone numbers usually have 9 digits…(first two fixed as area code; last 7 cannot start with 0). How many different telephone numbers are possible with a given area code?
Ans: By the **counting principle**, first digit of the 7-digit part has 9 choices (1–9) and the remaining six have 10 each, giving 9×106=9,000,0009 \times 10^{6} = 9{,}000{,}0009×106=9,000,000 numbers per fixed area code.

Q10) From city A to city B there are 4 roads and from B to C there are 2 roads…How many routes from A to C via B?
Ans: Apply the **product rule**: choices multiply across stages, so total routes =4×2=8= 4 \times 2 = 8=4×2=8. A simple map would show four A→B links and two B→C links, yielding eight A→B→C paths.

Q11) Define Decision Problem.
Ans: A **Decision Problem** asks for a binary **Yes/No (True/False)** outcome on a given input (e.g., "Is this number prime?"). The text notes decisions can involve multiple criteria in complex cases.

Q12) Define Counting Problem.
Ans: A **Counting Problem** determines **how many distinct outcomes** are possible when combining choices; if one event has A choices and another has B, the total is A×BA \times BA×B.

Q13) Define Search Problem.
Ans: A **Search Problem** requires **finding a solution among many possibilities**, typically modeled with graphs (nodes, links), with an initial state, allowed operations, and a goal (e.g., route finding, 8-puzzle).

Q14) Give one advantage of flowcharts.
Ans: Flowcharts **visually show the sequence of operations** before coding, which makes it easier to analyze the logic, communicate with others, and **detect logical errors** early.

Q15) Define Abstraction with example.
Ans: **Abstraction** means **focusing on essential information** and removing irrelevant details; for instance, in a game, track the **exit location and enemies** while ignoring **weather** because it doesn't affect the solution.

Q16) What is Algorithmic thinking?
Ans: **Algorithmic thinking** is planning a solution as a **clear, logical sequence of steps**, often by breaking a complex task into manageable parts and implementing the steps efficiently (e.g., finding the largest of three numbers).

Q17) What is Logical thinking?
Ans: **Logical thinking** is analyzing a situation using **reason and evidence** to reach sound conclusions (e.g., inferring from facts); it underpins CT but by itself is not automation-oriented.

Q18) Name two tools for designing concept maps.
Ans: Common tools mentioned are **CmapTools** and **Mind Manager**, which help draw concepts as nodes and relationships as labeled links.

Q19) What does LARP stand for?
Ans: **LARP** stands for **Logics of Algorithms and Resolution of Problems**—a rapid-prototyping language with semi-natural syntax that can also **express algorithms as flowcharts**.

Q20) Why are flowcharts useful before coding?
Ans: Programmers often draw flowcharts **before writing programs** because the diagrammatic sequence makes it easier to **analyze the solution, communicate it, and remove logical errors**, leading to smoother coding.

Detailed Questions
Q1) Identify whether the given problems are Decision, Counting, or Search Problems.
Ans:
• A **Decision Problem** returns a binary answer (Yes/No or True/False) for a given input. because the answer is either yes (even) or no (odd).
• **Counting Problems** use the product rule: if one choice has A options and the next has B, total unique outcomes are A×B. Hence it is a **Counting Problem**.
• **Search Problems** involve searching for a solution among many possibilities, often modeled as graphs with an **initial state**, **allowed operations**, and a **goal** condition. Hence it is a **Search Problem**.

Q2) A student has to take one course of physics (P1, P2, P3), one of science (S1, S2) and one of mathematics (M1, M2). In how many ways can this student select the 3 courses?
Ans:
This is a direct application of the **counting (product) principle**. The selections are independent: 3 choices for Physics, 2 for Science, and 2 for Mathematics. Total ways = 3×2×2=123 \times 2 \times 2 = 123×2×2=12. The reasoning follows the text's examples (shirts & pants; computer shop choices), which multiply options across stages to obtain total combinations. Hence, the student can choose the courses in **12 distinct ways**.

Q3) Create an IPO chart which will accept the ages of four boys and calculate their total age and average age. The program must display both the total age and the average age.
Ans:

Input	Process	Output
Ages of four boys: A1, A2, A3, A4	1) Total = A1 + A2 + A3 + A4 2) Average = Total ÷ 4	Display Total and Average

In the **IPO model**, we identify required inputs (the four ages), the exact processing (sum and average), and the outputs (both values).

Q4) Create an IPO chart of a scenario that allows a user to enter two numbers. The operation to be performed is either addition, subtraction, multiplication or division and accordingly the output should be given to the user.
Ans:

Input	Process	Output
Number1 (X), Number2 (Y), Operator (op ∈ {+, −, ×, ÷})	If op = + then R = X + Y; if op = − then R = X − Y; if op = × then R = X × Y; if op = ÷ then R = X ÷ Y (check Y ≠ 0)	Display R

The **IPO chart** captures inputs (two numbers + operator), **processing** (a selection among four operations), and **output** (the result).

Q5) The child wants to plan a birthday party for their friend. (a) Draw an IPO chart of this situation. (b) Write down properties of computational thinking used.
Ans:
(a) IPO Chart:

Input	Process	Output
Budget, date/time, guest list, venue options, cake & food choices, games/activities	1) Make checklist; 2) Book venue/date; 3) Order cake/food; 4) Arrange decorations & schedule games; 5) Assign tasks; 6) Confirm invites	Successful party executed as per plan (guests entertained, cake served, activities run)

(b) **Computational Thinking properties applied**:
• **Decomposition**: Split the party into sub-tasks—venue booking, invitations, catering, games—so each is manageable and can be scheduled and assigned.
• **Abstraction**: Focus on essential details (headcount, budget, timing, suppliers) and ignore non-impactful details (e.g., outside weather if it's an indoor venue).
• **Pattern Recognition**: Reuse checklists/timelines that worked in previous parties or school events (order tasks similarly).
• **Algorithm Design**: Create a step-by-step plan with timelines (what to do first, dependencies, and deadlines).
These properties and their roles are explained in Section 2.6 (Fig. 2.10–2.11).

Q6) Explain the **six-step problem solving** process with a suitable example.
Ans:

. The six steps are: (1) **Define & analyze** the problem, (2) **Decompose** into sub-problems, (3) **Identify potential plans** for each sub-problem (Plan A/B/C), (4) **Select & design the best plan**, (5) **Implement**, and (6) **Evaluate** the outcome.
Example (school timetable):

1. Define: We must schedule classes so rooms, teachers, and subjects don't clash.
2. Decompose: Sub-problems—room allocation, teacher availability, subject periods, break times.

3. Identify plans: Try different allocation strategies (by teacher first; by class first; by room constraints).
4. Select best: Choose the plan minimizing conflicts and teacher gaps.
5. Implement: Produce the actual timetable grid.
6. Evaluate: Check for overlaps; adjust until all constraints are met.
   This matches the text's emphasis on deeper analysis, decomposition, and plan selection for complex tasks.

Q7) Differentiate the **IPO model** and **IPO chart** with an example.
Ans:
The **IPO model** is the underlying concept that any computing solution is structured as **Input → Process → Output**—we must correctly identify what data comes in, what operations run, and what results are produced. The **IPO chart** is a **tabular representation** of this model used by software designers to lay out a specific problem's inputs, processing steps (often summarized), and expected outputs.
Example: For computing rectangle area, the IPO **model** idea says: accept length & width (Input), multiply them (Process), present area (Output). The **IPO chart** then explicitly tabulates "Length, Width" under Input; "Area = Length × Width" under Process; and "Area" under Output, as illustrated in Fig. 2.8. Charts make verification easy before coding.

Q8) Explain the **properties of Computational Thinking** with the example of game design.
Ans:
The text identifies four properties: **Decomposition, Abstraction, Pattern Recognition, Algorithm Design**. In a game context (Fig. 2.11):
• **Decomposition**: Split objectives—navigate levels, avoid enemies, collect items, reach exit—into separate mechanics to implement one by one.
• **Abstraction**: Keep **necessary** details (exit position, enemy locations, player state) and ignore **unnecessary** ones (e.g., weather graphics, if they don't affect gameplay).
• **Pattern Recognition**: Treat multiple similar enemies with a single behavior pattern (e.g., same patrol logic), reducing code duplication.
• **Algorithm Design**: Create ordered steps for movement, collision checks, scoring updates, level transitions.

Q9) Explain **Logical thinking** vs **Algorithmic thinking** with examples.
Ans:
Logical thinking is reasoning from facts to reach sensible conclusions. Example from the text: given facts "Islamabad is a city" and "Cities have a mayor," we infer "Islamabad has a mayor." Similarly, seeing water on the floor leads us to hypothesize plausible causes using evidence. Logical thinking **underpins** computational thinking but does not by itself specify exact operational steps.
Algorithmic thinking is planning a solution as an **ordered, efficient sequence of steps**, often after decomposing the problem. The example "Find the largest of three numbers" shows an IPO followed by a stepwise algorithm that checks A, then B, then C, stopping when the largest is found.

Q10) Explain **Flowcharts** and **Concept maps** with advantages.
Ans:
A **flowchart** is a **diagrammatic representation of an algorithm** showing the sequence of operations and decisions using standard symbols (oval for start/end, parallelogram for input/output, rectangle for process, diamond for decision). Steps for drawing a flowchart (identifying start, input, processing, decision, output, end) and common tools (Microsoft Visio, LARP) are also provided.
A **concept map** is a **graphical tool** for representing knowledge as concepts (nodes) and relationships (labeled links). It is useful when organizing domain knowledge, requirements, or design relationships rather than control flow.
Advantages (together): use flowcharts when you need executable logic and control structures; use concept maps when you need to structure and communicate conceptual relationships. Both support clearer thinking and better design.