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Class	10th	Chapter	02
Subject	Computer Science	Board	Federal

CHAPTER 2: Computational Thinking and Algorithms

Q1. Select the best answer for the following MCQs.

1. Identify the activity that is based on personal preferences rather than algorithmic logic.

- **Options:** a) Sorting numbers in a list. | b) Deciding what to eat for dinner. | c) Determining if a number is a prime number. | d) Calculating the square root of a number.
- **Answer: b) Deciding what to eat for dinner.**

2. Counting Principle Problems could easily be understood by the use of

- **Options:** a) Graph representation | b) Tree representation | c) Clock representation | d) Map representation
- **Answer: b) Tree representation**

3. In how many ways can you choose 2 out of 5 different books to take on a trip? (Order does not matter)

- **Options:** a) 10 | b) 20 | c) 15 | d) 5
- **Answer: a) 10** *(Using combination formula* $\binom{5}{2} = 10$*)*

4. A committee of 3 members is to be selected from a group of 8 people. How many different committees can be formed?

- **Options:** a) 56 | b) 84 | c) 28 | d) 120
- **Answer: a) 56** *(Using combination formula* $\binom{8}{3} = 56$*)*

5. You have 5 different shirts and 4 different pants. How many different outfits can you make by choosing one shirt and one pair of pants?

- **Options:** a) 9 | b) 20 | c) 15 | d) 10
- **Answer: b) 20** *(Using product rule* $5 \times 4 = 20$*)*

6. In how many ways can you select 3 different fruits from a basket of 7 different fruits? (Order does not matter)

- **Options:** a) 35 | b) 21 | c) 56 | d) 84
- **Answer: a) 35** *(Using combination formula* $\binom{7}{3} = 35$*)*

7. The Pigeonhole Principle states that if more items are placed into containers than the number of containers, then:

- **Options:** a) Some containers must be empty | b) At least one container must hold more than one item | c) All containers will be full | d) Each item will be placed in a different container
- **Answer: b) At least one container must hold more than one item**

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8. In a set of 50 students, 30 have completed a math project, 25 have completed a science project, and 15 have completed both. How many students have completed at least one project?

- **Options:** a) 35 | b) 40 | c) 45 | d) 50
- **Answer: b) 40** *(Using inclusion-exclusion principle:* $30 + 25 - 15 = 40$*)*

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9. Which property of an algorithm ensures that it produces at least one output after the calculations?

- **Options:** a) Input | b) Output | c) Definiteness | d) Finiteness
- **Answer: b) Output**

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10. Which property ensures that an algorithm will eventually end after a finite number of steps?

- **Options:** a) Input | b) Finiteness | c) Effectiveness | d) Generality
- **Answer: b) Finiteness**

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Q2. Write answers of the following short response questions.

1. Consider 3 boys and 3 girls want to team up as pair for the 14th August related student performance at the school. Find the total no. of ways these pairs could be formed using Counting Principle Problems.

- **Solution:**
  - Number of choices for a boy = 3
  - Number of choices for a girl = 3
  - Using the fundamental counting principle (product rule), the total number of ways to form a boy-girl pair is:

$$\text{Total ways} = 3 \times 3 = 9 \text{ ways}$$

2. Suppose you have selected black pant to attend school function and have three options of shirt to choose. Find the total no. of ways you can dress up using Counting Principle Problems.

- **Solution:**
  - Number of pants selected = 1 (fixed choice)
  - Number of shirt options = 3
  - Total number of ways to dress up:

$$\text{Total ways} = 1 \times 3 = 3 \text{ ways}$$

3. You are sitting at a study table doing homework. The penholder on the table contains 2 blue pens, 1 black pen, and 2 lead pencils. How many options do you have for writing?

- **Solution:**
  - Number of blue pens = 2
  - Number of black pens = 1
  - Number of lead pencils = 2
  - Using the sum rule (choosing one writing tool):

$$\text{Total options} = 2 + 1 + 2 = 5 \text{ options}$$

4. For a race on sports day activities, a group of 20 students are given a race lane at random. There are six students selected for the first race. How many different orders of the six lanes for students may be chosen?

- **Solution:**
  - This is a permutation problem where order matters: $P(20,6) = 20 \times 19 \times 18 \times 17 \times 16 \times 15$
  - Total orders $= 27{,}907{,}200$ ways.

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Q3. Write answers of the following extended response questions.

1. Ejaz, Javeria, Liaqat, and Zainab are standing in a line. Here are the clues to determine their positions:

- **Clues:** a) Javeria is standing directly behind Ejaz. b) Zainab is not next to Liaqat. c) Liaqat is not at the end of the line. d) Zainab is standing in the first position.
- **Solution:**
    1. From **clue (d)**, Zainab is in the 1st position: [Zainab, _, _, _]
    2. From **clue (b)**, Zainab (1st) is not next to Liaqat, meaning Liaqat cannot be in the 2nd position.
    3. From **clue (c)**, Liaqat is not at the end of the line (so Liaqat cannot be 4th).
    4. Therefore, Liaqat **must be in the 3rd position**: [Zainab, _, Liaqat, _]
    5. The remaining available slots are 2nd and 4th for Ejaz and Javeria.
    6. From **clue (a)**, Javeria is directly behind Ejaz, placing Ejaz in the 2nd position and Javeria in the 4th position.
- **Final Order (1st to 4th): Zainab, Ejaz, Liaqat, Javeria**

2. Provide students with a detailed map of their school. Ask them to create an abstract version, highlighting only the main buildings and pathways.

- **Solution (Concept of Abstraction):**
    - **Abstraction** involves filtering out non-essential details to focus exclusively on core components necessary for a task.
    - **Steps to create the abstract map:**
        1. Identify critical landmarks (e.g., Administration Block, Science Labs, Library, Sports Ground).
        2. Strip away decorative elements such as individual trees, parking dividers, or benches.
        3. Draw a simplified layout showing only the major buildings as simple geometric blocks connected by primary pathways.

3. Give students a problem that can be solved with a simple program. Encourage them to write functions to handle different parts of the problem, abstracting complex operations into manageable pieces.

- **Solution (Example in Python):**

Python

```
def calculate_percentage(marks_obtained, total_marks):
    return (marks_obtained / total_marks) * 100

def determine_grade(percentage):
    if percentage >= 80:
        return 'A+'
    elif percentage >= 70:
```

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```
    return 'A'
  else:
    return 'B'

# Main program using functional abstraction
pct = calculate_percentage(420, 500)
grade = determine_grade(pct)
print(f"Percentage: {pct}%, Grade: {grade}")
```

4. Given the following web form inputs, identify any syntax errors and correct them

- **Original Inputs:** Name: AmjadAli | Email: amjadali@gmail | Date: 01/01/2024
- **Solution:**
  - **Errors Identified:**
    1. *Name:* Missing a space between the first and last name (Amjad Ali).
    2. *Email:* Missing the top-level domain extension (e.g., .com) at the end of the email address (amjadali@gmail.com).
  - **Corrected Inputs:**
    - Name: Amjad Ali
    - Email: amjadali@gmail.com
    - Date: 01/01/2024

5. You have developed a web application that takes the budget head and provides total. Analyze the following budget and identify any logical errors in the total amount.

- **Budget Example:** Rent: $1000 | Utilities: $150 | Groceries: $200 | Total: $1000 + $150 + $200 = $1500
- **Solution:**
  - **Arithmetic Analysis:** $\$1000 + \$150 + \$200 = \$1350$, not $1500.
  - **Logical Error Identified:** The program contains an incorrect aggregation formula or hardcoded addition bug, as the displayed total ($1500) does not match the actual sum of the individual budget items ($1350).
  - **Correct Total: $1350**

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