



I. Answer any 3 of the following questions:

[3 x 2 = 6]

1. Distinguish between a condition and a statement.
2. How do we refine a statement?
3. Define a loop invariant.
4. What is recursive problem solving?

II. Answer any 3 of the following questions:

[3 x 3 = 9]

5. Define a function to double a number in two different ways: (1) $n + n$, (2) $2 \times n$.
6. A knockout tournament is a series of games. Two players compete in each game; the loser is knocked out (i.e. does not play any more), the winner carries on. The winner of the tournament is the player that is left after all other players have been knocked out. Suppose there are 1234 players in a tournament. How many games are played before the tournament winner is decided?
7. What is case analysis?
8. Draw a flowchart for case analysis using alternative statements.

III. Answer any 2 of the following questions:

[2 x 5 = 10]

9. Trace the step-by-step execution of the algorithm for factorial(4).

factorial(n)

-- inputs : n is an integer , $n \geq 0$

-- outputs : $f = n!$

f, i := 1, 1

while $i \leq n$

f, i := $f \times i$, $i+1$

10. Power can also be defined recursively as

$$a^n = \begin{cases} 1 & \text{if } n = 0 \\ a \times a^{n-1} & \text{if } n \text{ is odd} \\ a^{n/2} \times a^{n/2} & \text{if } n \text{ is even} \end{cases}$$

11. Construct a recursive algorithm using this definition. How many multiplications are needed to calculate a^{10} ?

-----ALL THE BEST-----

- Test should be written under the supervision of your parents and get the answer paper signed from them.
- No corrections should be made after the test timings. We expect your honesty.
- Test Papers have to be submitted after the completion of all the 4 tests.
- Submission Date of Test Papers: 27th Aug - 30th Aug 2021. Timings: 9.30 AM - 1.00 PM / 5.00 PM - 8.00 PM