METCE 1st YEAR 1st SEMESTER EXAMINATION

Programming Methodology

Session 2023-24

Answer all questions in order. Full Marks 100

Part A

Fill in the blanks: Answer any ten questions. **Marks 10x2**

1. An expression that results from replacing an identifier by an atomic expression is called a _____ .
2. BNF grammar is defined as G={alphabet,_____, <start>}.
3. For a grammar with leftmost derivation, the next rule is applied to the _____ non-terminal symbol.
4. The three types of semantics in computer programming language are operational semantics, axiomatic semantics, _____ semantics.
5. A type is either one of a small group of _____ types or a user-defined _____ .
6. Coercion in computer programming language means values are forced automatically to another _____ for the given context.
7. Recursive type is one whose objects may contain _____ to other objects of the same type.
8. Dynamically typed data is that whose type checking is delayed until _____ _____ .
9. C/C++ use _____ _____ equivalence.
10. Define the alternative construct principle to prevent abortion of program.
11. _____ needs refinement to suit the outcome of the programs, rather than the _____ .
12. Virtual function in C++ are an example of _____ _____ binding.
13. Inheritance in OOP is a feature that enables a class to acquire _____ and _____ of another class.

Part B

Answer any 8 of the following questions in order: **Marks 10x8=80**

1. Define wp(S,R). state and prove all the properties of wp(S,R)

2. What is a guarded command? How can such commands be used to derive repetitive construct. Also, explain the role of non-determinacy in such a construct.

3. Write a program that given a fixed integer n>0, sets variable i to the highest power of 2 that is at most n. The precondition Q, postcondition R, loop invariant P and bound function R are as follows-
   a. Q: $0<n$
   b. R: $0<i\leq n<2*i \wedge (Ep:i=2^p)$
   c. P: $0<i\leq n \wedge (Ep:i=2^p)$
   d. t: n-i

4. Write a program for the following problem: A fixed 3-D array c[0:m-1,0:n-1, 0:p-1], where m,n,p≥0 is given. A fixed variable x is given. Using 3 variables i, j and k, find a value c[i.j.k] with value x: if $\exists x \in c$, set i to m.

5. Suppose x contains the number of odd integers in array b[0:k-1] where k≥0. Write a program to add 1 to k, keeping the property of x the same. Hence write the principle which states the reason for making the guards of an alternative command strong.

6. Given a fixed x, fixed n>0 and fixed array b[0:n-1] where $x \in b$, find a suitable procedure to determine the position of x in b thus establishing x=b[i].

7. Write the strategy for developing a loop. Hence write an algorithm that given a fixed array of arrays b[0:m-1][0:n-1], where 0<m and 0<n, searches b for a fixed value x. Position of x in b does not matter.

8. Write a program that permits the values of integer variables x and y so that x≤y. State the steps used in deriving the required preconditions, postconditions and the guarded commands.

9. Explain the role of guarded commands to derive repetitive construct? Give an example to prove it.

10. What are cohesion and coupling in software engineering? What is their significance and state their differences. Mention an example of a bad cohesion.