

Master in Computer Technology  
1<sup>st</sup> Year, 1<sup>st</sup> Semester, 2024-2025  
Semester Examination  
Principles of Programming Language

Full Marks : 100

Time : 3 Hrs

Write answers to the point. Make and state all the assumptions (wherever made).  
**ALL PARTS OF A QUESTION SHOULD BE ANSWERED TOGETHER**

(Q1) Answer all questions : (4 × 5 = 20)

- Which produces faster program execution, a compiler or a pure interpreter? Give reasons.
- What are the three fundamental features of an object-oriented programming language?
- Using Prolog, write a goal to find the existence of an element in a list  $L1$ , which is defined over a finite number of integers.
- What are  $\alpha$ ,  $\beta$  and  $\eta$  reduction? Explain with example

(Q2) Answer any five questions: (5 × 4 = 20)

- (a) Consider the following C program segment. Rewrite it using no gotos or breaks.

```
j = -3;
for (i = 0; i < 3; i++) {
    switch (j + 2) {
        case 3:
        case 2:
            j--; break;
        case 0: j += 2; break;
        default: j = 0;
    }
    if (j > 0) break;
    j = 3 - i
}
```

- Some programming languages have static variables. What are the obvious advantages and disadvantages of having static variables? Give an example
- What is the lifetime of a variable? Give an example
- What are unary and infix operators? Give examples.
- When might you want the compiler to ignore type differences in an expression?
- Should automatic type conversion be included in a programming language? Why or why not?
- What is the role of the default segment in a switch statement? What is the use of a break statement in switch statements? Give an example

(Q3) Answer giving examples (any OOP language) any five questions: (5 × 4 = 20)

- What is the difference between a class variable and an instance variable? Give an example
- What is multiple inheritance? Give an example
- What is a polymorphic variable? Give an example
- What is an overriding method? Give an example

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- (e) What is a virtual method? Give an example
- (f) What is an abstract method? What is an abstract class? Give an example
- (g) Explain why operator overloading increases the semantic capability of a language.

(Q4) Answer any two questions. Give the trace of the attempted goals. (10 × 2 = 30)

- (a) Define a goal which reverses a list.
- (b) Write a rule using recursion for generating the  $N^{th}$  fibonacci number.
- (c) Define the predicate **palindrome(List)**. A list is a palindrome if it reads the same in the forward and in the backward direction.
- (d) Write a Prolog predicate *split(TheList, Evens, Odds)* that asserts the following: (i) *Odds* contains all the items in the odd positions of *TheList* that are not the empty list (ii) *Evens* contains all the items in the even positions of *TheList*, including the empty list. [ Use = and \ = to distinguish cases].

(Q5) Evaluate any four of the  $\lambda$  expressions (4 × 5 = 20)

- (i)  $\lambda x.\lambda y.\lambda z((z\ x)\ (z\ y))$
- (ii)  $(\lambda f.\lambda g.(\lambda h.(g\ h)\ f)\ \lambda p.\lambda q.p)$
- (iii)  $((((\lambda f.\lambda g.\lambda x.(f\ (g\ x))\ \lambda s.(s\ s))\ \lambda a.\lambda b.b)\ \lambda x.\lambda y.x)$
- (iv)  $((\lambda p.\lambda q.(pq)(\lambda x.x\ \lambda a.\lambda b.a))\ \lambda k.k)$