

2 Answer any **four** parts of the following : **5×4=20**

a. Why use structuring concepts such as Cartesian product and power sets to define a language composite types? Explain the relationship between types and sets. **5**

b. Consider the following code fragment **5**
void multiply (int m, int n)
{
 m = m * n;
 cout <<m<<”,”<<n;
}

Suppose the function is called with actual parameters i, j when I = 2, j = 3, what is printed when called with

(i) multiply (i, j) (ii) multiply (i, i) by using call by value and call-by-value-result parameter transmission scheme.

c. State the visibility, lifetime initialized value and purpose of local, global and static variables in programming languages. **5**

d. Show the lifetimes of the variables in the following **5**

C programme and indicate which are statically vs. dynamically allocated

```
Int m;  
    Void s( ) {  
        Float z;  
        Z=1.0;  
    }  
Void R (int n) {  
    If (n>0)  
        R (n-1)  
        S( );  
}  
Int main ( ) {  
    M = 3;  
    R (1);  
    Return 1 ;  
}
```

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- e. What is an activation record? Describe the role of current instruction pointer (CIP) and current environment pointer (CEP) in the implementation of recursive sub-programs. **5**
- f. In many programming languages strings are defined to be arrays of characters. Compare the consequences of this when a string variable is : **5**
1. a static array
 2. a dynamic array
 3. a flexible array.

3 Attempt any **two** parts of the following : **10×2=20**

- a. Define the following terms : **10**
- i) object
 - ii) class
 - iii) polymorphism
 - iv) inheritance
 - v) abstraction
- b. Why virtual functions are required? Illustrate the use through an example in any object oriented language. **10**
- c. Define a polymorphic function “reverse” in M/L that takes a list of objects of some type and reverses the order. **10**

4 Attempt any **two** parts of the following : **10×2=20**

- a. What are eager, normal-order and lazy evaluation? Consider the following ML functions. **10**
- Fun sgr (n ; int) = n * n ; and function call Sqr (p + q) with p=2 & q=5 show the binding and evaluation of the function in case of eager, normal – order and lazy evaluation.

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- b. What are curried functions in functional programming? Write a procedure to merge two sorted lists (with arbitrary lengths) producing a third list. **10**
- c. Discuss the advantages and disadvantages of functional programming. **10**
5. Attempt any **two** parts of the following : **10×2=20**
- a. Given that : **10**
- i) $\forall x$ [physician) (x) \rightarrow knows surgery (x)]
- ii) physician (Bhaskar)
- Prove that knows_surgery (Bhaskar)
- b. What is first order predicate logic? Convert the following formula into clause form. **10**
- $$\forall x [\forall y P(x, y) \rightarrow \forall y (Q(x, y) \rightarrow R(x, y))]$$
- c. What is the unification algorithm? Find the most general unifier (MGU) of $A(x, f(g(x)), 9)$ and $A(b, y, z)$ **10**
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