



Printed Pages : 7

TCS-504

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1076

Roll No.

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B. Tech.**(SEM. V) EXAMINATION, 2008-09****PRINCIPLES OF PROGRAMMING LANGUAGES***Time : 3 Hours]**[Total Marks : 100*

- Note :**
- (1) Attempt **all** questions.
 - (2) You may choose the programming language with which you are familiar while answering.
 - (3) Make **suitable** assumptions, wherever necessary.

1 Attempt any **four** of the following :

- (a) What are the most important properties of a good programming language?
- (b) Describe the concept of orthogonality in programming language design.
- (c) Differentiate between compile time binding and run time binding.
- (d) What is loader? Explain.
- (e) Explain the concept of virtual computer with a suitable example.
- (f) Some languages, notably C and Java, distinguish between uppercase and lowercase in identifiers. What are the pros and cons of this design decision?



- 2 (a) Give the accessing formula for computing the location of component $A(I)(J)$ of a matrix A declared as
- ```
int A[m][n];
```
- where  $m$  and  $n$  are constants, and  $A$  is stored in row major order.
- (b) For an elementary datatype in a language with which you are familiar, do the following :
- (i) Show a situation during execution where a data object of that type exists that is neither a variable nor a constant.
  - (ii) Explain the difference between data objects of that type and the values that those data objects may contain.
- (c) Write an algorithm for finding the location of the component  $V[N]$  of a vector  $V$  if  $V$  is stored in linked representation. Assume the address of the descriptor is  $\alpha$ , its link field is at offset  $j$  and each component is stored in a separate block with the link stored at offset  $k$  in that block.
- (d) For a language that provides a pointer type for programmer-constructed data objects and operations such as new and dispose that allocate and free storage for data objects, write a program segment that generates garbage (in the storage management sense). Write a program segment that generates a dangling reference. If one or the other program segment cannot be written explain why.



- (e) For a language with which you are familiar, find an example of a primitive operation
  - (i) That has an implicit argument.
  - (ii) That is undefined for some data objects in its specified domain.
- (f) In a language of your choice, define an abstract data type "stack of integers" and the operations PUSH and POP that insert and delete elements in a stack.

3 (a) Differentiate between call by reference and call by value result parameter passing mechanisms.

What will be the output of the following program assuming that parameter passing is

- (i) Call by value
- (ii) Call by reference
- (iii) Call by value result

Procedure P (x,y,z)

begin

y := y+1;

z := z+x;

end;

begin

a := 2;

b := 3;

P (a+b, a, a);

print (a);

end.



- (b) Consider the following C program

```
void abc (char *s)
{
 if (S[0]= '=) 1o')
 return;
 abc (s+1);
 abc (s+1);
 printf ("% C", S[0]);
}
```

```
main ()
{ abc("123");
}
```

- (i) What will be the output of the program?
- (ii) If abc (s) is called with a null terminated string S of length n characters (not counting the null ('10') character), how many characters will be printed by abc (r)?
- (c) Consider the following program in pseudo pascal syntax.

```
Program main;
Var x: integer;
procedure θ (z: integer);
begin
 z: = z+x;
 writeln (z)
end;
```





Procedure P (y: integer);

Var x: integer;

begin

x: y+z;

θ (x);

write ln (x)

end;

begin

X: = 5;

P (x);

Q (x);

write ln (x)

end.

What is the output of the program, when

- (i) The parameter passing mechanism is call-by-value and the scope rule is static scoping.
- (ii) The parameter passing mechanism is call-by-reference and the scope rule is dynamic scoping.

4 Attempt any **two** of the following :

- (a) Give regular expressions for the following:
  - (i) Binary strings whose decimal representation is divisible by 5.
  - (ii) Binary strings consisting of an even number of 0's and one even number of 1's.



- (b) (i) Let  $S$  be a regular set. Show that  $S^R$  ( $S$ -reversed, i.e., the set of strings in  $S$  written backward) is a regular set.
- (ii) Show that the set of odd-length strings over the alphabet  $\{a,b\}$  that are not palindromes is context free.

(Note: Palindrome is a string that reads the same forward and backward.

- (c) Write short notes on any **two** of the following :
- (i) Static storage management
- (ii) Heap-based storage management
- (iii) Stack based storage management

- 5 (a) Suppose that sets are implemented as lists, where each element of a set appears exactly once in its list. Define functions that implement the following operations:

- (i) Test whether an element is a member of a set.
- (ii) Construct the union of two sets
- (iii) Construct the intersection of two sets
- (iv) Construct the difference of two sets that is the set of elements that are in the first set but not in the second.

- (b) Verify the following equalities :

- (i)  $SIII = \beta I$ , where  $S$  is  $\lambda xyz. (xz) (yz)$  and  $I$  is  $\lambda x. x$



- (ii) twice (twice)  $f\ x = \beta\ f(f(f\ fx))$ ,  
where twice is  $\lambda\ f\ x. f(fx)$
- (c) Write short notes on any **two** of the following
- (i) Object Oriented Languages
  - (ii) Coroutines
  - (iii) Functional Programming.
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