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

PAPER ID : 1076 Roll No. | | | | | | | | | | |

B.Tech.

FIFTH SEMESTER EXAMINATION, 2006-07

PRINCIPLES OF PROGRAMMING LANGUAGES

Time : 3 Hours *Total Marks : 100*

Note : *(i) Attempt ALL questions.*

(ii) All questions carry equal marks.

(iii) In case of numerical problems assume data wherever not provided.

(iv) Be precise in your answer.

1. Attempt ***any two*** parts of the following : **(10x2=20)**

(a) Choose two high level programming languages of your own choices and contrast their definition of array and pointer data types.

(b) Develop a formula based representation of a stack where, if during a push operation we do not have space to accommodate the new element, a new array of size one bigger than existing is allocated, elements are copied from old array to new one and the old array is deleted. Similarlly, during a pop operation, if the stack size drops to one fourth of the array capacity, a smaller array of half the size is allocated, the elements copied and the old array is deleted.

SL4TO

(c) Suppose that you have designed a programming language which permits procedures and co-routines to be intermixed. If procedure P calls procedure Q, then Q either returns to P via return or it may resume P. Also Q, may recursively call P which may then resume Q. Show how the return and resume statements work together.

2. Attempt *any two* parts of the following : **(10x2=20)**

(a) Give n > 0 processor with critical sections, use semaphores to allow any k of them, 0 < k < n to simultaneously execute their critical sections.

(i) Using generalized semaphores.

(ii) Using binary semaphores.

(b) If one mistakenly write as

```
wait (s)
        Critical section
wait (s)
```

In detail, explain what will happen.

(c) Consider the two program segments

```
for
i : = 1 to A(x) by 1 do
   S
end

i : = 1
while (i < = A(x)) do
        S
      i : = i + 1
end.
```

Under what conditions are these two programs equivalent ? Treat S as any sequence of statements.

3. Attempt *any two* parts of the following : **(10x2=20)**

(a) Consider the following program which computes the nth power of an integer P.

```
var p, r, s, y : integer
 r : =1, x : =P, y : n ;
while (y ≠ 0) do
      begin
        while (even) do
            y : =y/2, x=x* x;
        end
            y : =y−1; r : =r* x;
      end
```

Derive formulae which describe the relationship between the variable at the beginning, end and middle of the program. In case of erroneous program, make suitable changes.

(b) Some languages permit a procedure to have multiple entry points. Discover one such language and write its rules. Why is such a facility useful ?

(c) If a language has features in it which require heap allocation, then perhaps there is no need for a stack at all. Is a stack truly necessary ? If not, provide an implementation of run time storage allocation which uses only a heap.

4. Attempt *any two* parts of the following : **(10x2=20)**

(a) Devise a function F that alters the value of a global variable x as well as returns a value. Also, write a program which uses F and X sensitive to the order of evaluation of expression. Discuss the different possible values which might printed by your function F.

(b) Discuss about Abstract Data Types.

(c) Suppose that one wants to write a function which concatenates two strings and it calls the storage allocator to get space for the new string. Should this be considered a side effect ? Justify your answer.

5. Attempt *any two* parts of the following : **(10x2=20)**

(a) The dynamic scope rule specifies that nonlocals must be evaluated in the calling environment. Explain why MACRO expansion of procedure calls produces the same result as would be obtained under the dynamic scope rule.

(b) Implement a variant of quicksort for lists i.e, sort a list as follows :

Pick an element and call it PIVOT. Partition the list into two sublists of elements smaller than and larger than the PIVOT. Recursively sort the sublists. Combine the sorted sublists and PIVOT together into sorted list.

(c) Discuss about specific features of communicating sequential processes (CSP).

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