King Fahd University of Petroleum and Minerals

Department of Information and Computer Science

ICS 313-02
(002)

Fundamentals of Programming Languages

Final Exam

(120 Minutes)

Dr. Mamdouh Najjar

Name : _____

Student ID :_____

Question No	Maximum points	Student points
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
Total	80	

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Question 1: **(10 points)**

Consider the following definition of a **SET** statement.

A SET statement defines a set of characters called **setname**, as specified by **setspec**. The general format of a SET statement is:

SET setname (setspec);

Where **setspec** can have two types of elements:

1. Single character, like “A”
2. A range of characters like “a” .. “z”

And these elements may be joined together by the **OR** operator.

Give a BNF grammer for the SET statement.

Question 2: **(10 points)**

Consider the following ALGOL program segement**:**

```
SUM := 0;
N := 1;
Y := 16;
for X := 1 step N until Y do
begin
        SUM := SUM + A[X];
        N := N + X;
        Y := Y – N;
end;
```

Which elements of the array A will be summed under each of the following evaluation strategies for evaluation of variable N and Y in the iteration head?

i. Evaluate Y once on initial entry; evaluate N once on entry and again after each execution of the body.

b. Evaluate both N and Y on entry and re-evaluate after each execution of the body.

Question 3: **(10 points)**

3.1 **What are the fundamental semantic models of parameter passing?**

3.2 **Hand execute the procedure under the following assumptions, and complete the table.**

```
Proceure BIGSUB;
    Integer GLOBAL;
    Integer array LIST [1:2];
    Procedure SUB (PARAM);
        Integer PARAM;
        Begin
            PARAM := 3;
            GLOBAL := GLOBAL + 1;
            PARAM := 5;
        End;
    Begin
        LIST[1] := 3;
        LIST[2] := 1;
        GLOBAL := 1;
        SUB (LIST[GLOBAL]);
    End;
```

Parameter Passing by	Contents of LIST[1:2] after the return from SUB
Value	
Reference	
Name	
Value-result	

Question 4: **(10 points)**

Show the stack with all activation record instances, including static and dynamic chains, when execution reaches **position 1** in the following skeletal program:

```
procedure BIGSUB;
        procedure A;
                procedure B;
                begin { B }
                …                    ←---------- (1)
                end; { B }
                procedure C;
                begin { C }
                …
                B;
                …
                end: { C }
        begin { A }
        …
        C;
        …
        end: { A }
begin { BIGSUB }
…
A;
…
end; { BIGSUB }
```

Question 5: **(10 points)**

5.1 What are the design issues for subprograms? (**list five of them**)

5.2 Define *separate* and *independent compilation*.

Question 6: **(10 points)**

6.1 Define the deep and shallow access methods of implementing dynamic scoping.

6.2 In a language that allows parameters that are subprogram names, is the correct activation record instance of a static parent always the nearest instance of the parent that is currently in the stack?

Question 7: **(10 points)**

Show the stack with all activation record instances, including static and dynamic chains, when execution reaches position 1 in the following skeletal porgram:

```
procedure BIGSUB;
        procedure C; forward;
        procedure A (flag : boolean);
                procedure B;
                …
                A (false)
                end; { B }
        begin  { A }
        if  flag
          then B
          else C
        …
        end; { A }
        procedure C;
                procedure D;
                … <---------- ( 1 )
                end;  { D }
        …
        D
        end; { C }
    A (true);
        …
end; { BIGSUB }
```

The calling sequence for this program for execution to reach D is

BIGSUB calls A
A calls B
B calls A
A calls C
C calls D

Question 8: **(10 points)**

8.1 What is the difference between ***physical*** and ***logical*** concurrency?

8.2 What are ***two*** advantages to have exception handling built into a language?

8.3 What are the ***three*** main characteristic of an object-oriented language?

Question 9: **(10 points)**

You are asked to design and implement a special purpose language for teaching programming to 1st grade students. In your opinion, what are the ***design and implementation*** issues from a language-desiger point of view.