Assignment 2 of CE2004

Principles of Programming Languages

Number of questions: 10

Total Score: 100 points

Due day: 5:00 PM 3rd June 2019

P.S.: (1) You need to type your answers and print them out in papers. And then submit the answer sheets to TAs.

(2) Late submission will not be accepted.

(3) Copying other student's answers is strictly prohibited.

(1) (9 points)

What follows is a C program excerpt.

```
void bar()
{  int  tuv[10][10];
         :
}
```

(a) Could we change the value of `tuv`?

(b) Could we change the value of `tuv[1]`?

(c) Could we change the value of `tuv[1][1]`?

Ans.

(2) (9 points)

What follows is a Java program excerpt.

```
class xyz{
     :
  void bar()
  {  int  tuv[][]=new int[10][10];
         :
  }
}
```

(a) Could we change the value of `tuv`?

(b) Could we change the value of `tuv[1]`?

(c) Could we change the value of `tuv[1][1]`?

Ans.

(3) (9 points)

An object is a variable whose type is a `class`. However primitive types, such as type `int` , are not `class`. What follows is a Java program `ShowArea.java`.

```
class Circle
{
  int setVariable(int s)
  {  int r;

     r=6;                              //location 1
     return s+r;
  }
}
public class ShowArea
{
   public static void main(String args[])
   {
     Circle cir= new Circle();
     int a, b;                         //location 2


     a= cir.setVariable(8);
     b=a;                             //location 3
   }
}
```

When executing the above program, if we type the following commend “`java ShowArea Hello World`”. In the above program, (i) At location 2, how many **objects** exist and what are they? (ii) At location 1, how many **variables** exist and what are they? (iii) At location 3, how many **variables** exist and what are they?

Hint: A parameter is also deemed as a variable or an object.

Ans.

(4) (12 points)

C, C++, and Fortran do not specify range checking of array subscripts. Assume a C compiler allocates memories for arrays declared in the same declaration statement in adjacent areas. For example for the following declaration statement, `int t[10], u[10], v[10];`, the compiler allocates memory for array `t` first. The memory of array `u`'is right after the memory of array `t`. The memory of array `v`'is right after the memory of array `u`. Assume the compiler utilizes row major order to store elements in an array. What follows is a C program.

```
#include<stdio.h>

main()

{ int a[10][10], b[10][10], c[10][10];

  int i,j;


  for(i=0;i<10;i++)

    for(j=0;j<10;j++)

    {

      a[i][j] = 1;

      b[i][j] = 2;

      c[i][j] = 3;

    }

    b[17][9]=4;     /*location 1*/

    b[17][16]=5;    /*location 2*/

    b[-3][7]=6;     /*location 3*/

    b[-3][-6]=7;    /*location 4*/

}
```

(a) The value of which array element will be changed by the statement at location 1?

(b) The value of which array element will be changed by the statement at location 2?

(c) The value of which array element will be changed by the statement at location 3?

(d) The value of which array element will be changed by the statement at location 4?

Ans.

(5) (10 points)

In the following **C** program excerpt,

(a) what problem does this program have?

(b) why does this problem happen?

```
#define BufferSize 60

char *poi=”The summer break is around the corner.”;

char sentence[BufferSize];

int ppp(char *s, char *d, unsigned len)

{ unsigned i;

  for( i=0 ;i<len; ++i )

  {

    *(d+i)=*(s+i);

  }

}


void goo(char *s, char *d, int length)

{

   if(length<BufferSize)

     ppp(poi,sentence,length);

}
```

Ans.

(6) (10 points)

(a) `String s=new String("Welcome");`

Assume the above statement is contained in a Java program and `"Welcome"` does not appear in any other statement in the program, how many `String` objects are created by this Java statement?

(b)
```
 String t=new String("Welcome"); // statement 1

String s=new String("Welcome"); // statement 2
```

Assume the above two Java statements are contained in a Java program and statement 1 is right before statement 2, how many `String` objects are created by statement 2?

Ans.

(7) **(10 points)** In the following **C** program,

In the following **C** program,

(a) Right after the execution of the statement commented as ``Location 1" is finished, do variable `j, h,` and `g` have the same value?

(b) Right after the execution of the statement commented as ``Location 2" is finished, do variable `j, h,` and `g` have the same value?

```
#include<stdio.h>

main()

{ float c,d,e,f,g,h;

  int   i,j,k;



  i=0.01;

  f=0.01;

  j=i*0.01;

  h=j;

  g=f*0.01;           /*Location 1*/

  i=123;

  f=123;

  j=123*123;

  h=j;

  g=f*123;           /*Location 2*/

 }
```

Ans.

(8) (12 points)

If dynamic scope is used in the following program. at location 10 (a) what is the value of variable a? (b) what is the value of variable b?

```
int car()

{ int e, f;


  e=7;

  f=8;

  return e+c+a;   //location 1

}

int bar()

{ int c=4, d=5, e=6;

  c=car()+b;  //location 2

  a=5;        //location 3

  e=9;        //location 4

  return c;   //location 5

}

int main()

{ int a, b, c;


  a=1;       //location 6

  b=2;       //location 7

  c=3;       //location 8

  b=bar()+c;  //location 9

  return 1;   //location 10

}
```

Ans.

(9) (7 points) Consider the following program:

```
procedure Main is
  X, Y, Z : Integer;
  procedure Subl is
     A,Y,Z : Integer;
     procedure Sub2 is
     A,B,Z : Integer;
     begin  -- of Sub2
       . . .
     end;   -- of Sub2
  begin – of Subl
    . . .
  end;  -- of Subl
  procedure Sub3 is
     A,X,W : Integer;
     begin  -- of Sub3
       . . .
     end;   -- of Sub3
begin  -- of Main
 . . .
end;   -- of Main
```

List all the variables, along with the program units where they are declared, that are visible in the bodies of `Subl`, `Sub2`, and `Sub3`, assuming static scoping is used.

Ans.

(10) (12 points) Consider the following program:

```
procedure Main is
   X, Y, Z : Integer;
   procedure Subl is
     A, Y, Z : Integer;
   begin -- of Subl
    . . .
   end;   -- of Subl
   procedure Sub2 is
     A, B, Z : Integer;
   begin -- of Sub2
    . . .
   end;   -- of Sub2
   procedure Sub3 is
     A, X, W : Integer;
   begin -- of Sub3
    . . .
   end;   -- of Sub3
begin  -- of Main
 . . .
end;   --  of Main
```

Given the following calling sequences and assuming that dynamic scoping is used, what variables are visible during execution of the last subprogram activated? Include with each visible variable the name of the unit where it is declared.

(a) Main calls Subl; Subl calls Sub2; Sub2 calls Sub3.

(b) Main calls Subl; Subl calls Sub3.

(c) Main calls Sub2; Sub2 calls Sub3; Sub3 calls Subl.

(d) Main calls Sub3; Sub3 calls Subl.

(e) Main calls Subl; Subl calls Sub3; Sub3 calls Sub2.

(f) Main calls Sub3; Sub3 calls Sub2; Sub2 calls Subl.

Ans.