COMP 5/6710 Software Quality Assurance

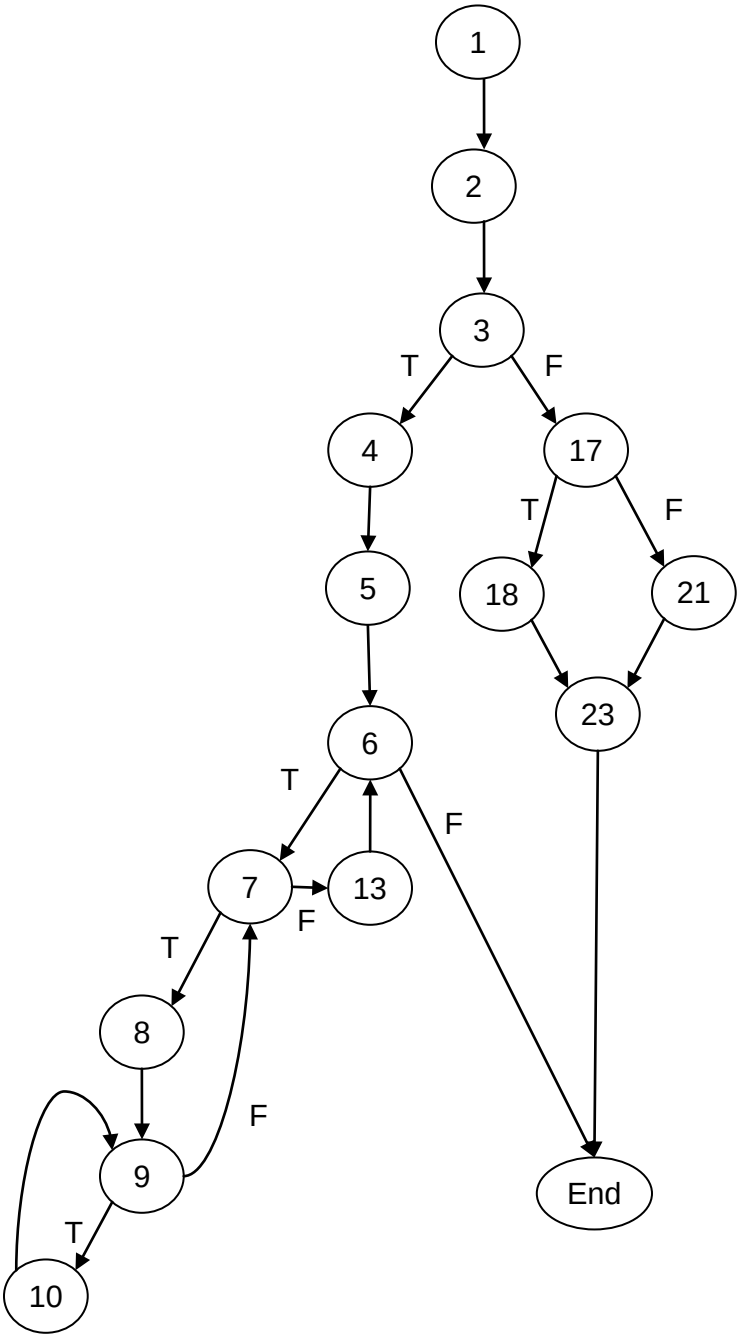
Test 2, April 13, 2011

Total: 100 points Name: _____

1. (a) Derive the control flow graph for the following program: i) Use line numbers to label all nodes in the graph; ii) Mark start point and exit point; iii) Mark "T" and "F" on the two branches of a condition. (15)
   (b) What is the Cyclomatic number for the program? (5)

```
1   void problem 1 () {
2     S1 ();
3     if (C1) {
4       S2 ();
5       for (int i=0; C2; i++) {
6       while (C3) {
7                           S3 ();
8               for (int i=0; C4; j++) {
9                           S4 ();
10              }
11              }
12              S5 ();
13       }
14    }
15    else {
16        if (C5) {
17              S6 ();
18        }
19        else {
20              S7 ();
21        }
22        S8 ();
23    }
24  }
```

2. Given the following program, derive a set of basis paths and the path predicates for each path. (20)



3. Given the following program.
   a. Find all the *Define* and *Use* nodes for variable *small*. (10)
   b. Find the DU-paths for variable small. Use line numbers for node identification. (10)

```
01 public class Assign
02 { //This program rearranges numbers in ascending order
03       public static void main (String args [ ])
04       {
05             double a, b, c;
06             a = 123.45678;   b = 12.345678;   c = 12345.678;
07             double large = 0, medium = 0, small = 0;
08             for (int i =1, i <= 4, i ++)
09             {
10                   if (a > b)
11                   {
12                         large = a;
13                         small = b;
14                   }
15                   else
16                   {
17                         large = b;
18                         small = a;
19                   }
20                   if(c > large)
21                   {
22                         medium = large;
23                         large = c;
24                   }
25                   else
26                   {
27                         if(c > small)
28                         {
29                               medium = c;
30                         }
31                         else
32                         {
33                               medium = small;
34                               small = c;
35                         }
36                   }
37                   system.out.println (large+“>”+medium+“>”+small);
38             }
39       }
40 }
```

4. For the following program, list the program slice by ONLY USING LINE NUMBERS for "pivotNewIndex" in statement 10. (15)

```
1.int Quick(int *TestArray, int left, int right, int k)
2.{
3.          int pivotIndex, pivotNewIndex;
4.
5.          srand((unsigned)time(NULL));
6.          pivotIndex = (rand()%(right - left + 1)) + left;
7.
8.          pivotNewIndex = partition(TestArray, left, right, pivotIndex);
9.
10.         if( k == pivotNewIndex )
11.                   return TestArray[k];
12.         else
13.         {
14.                   if( k < pivotNewIndex )
15.                   {
16.                             return Quick(TestArray, left, pivotNewIndex - 1, k);
17.                   }
18.                   else
19.                   {
20.                             return Quick(TestArray, pivotNewIndex + 1, right, k);
21.                   }
22.         }
23.}
24.
25.int partition(int *TestArray,int left, int right, int pivotIndex)
26.{
27.         int pivotValue, storeIndex, Temp;
28.
29.         pivotValue = TestArray[pivotIndex];
30.         TestArray[pivotIndex] = TestArray[right];
31.         TestArray[right] = pivotValue;
32.
33.         storeIndex = left;
34.
35.         for(int i = left; i <= right - 1 ; i++)
36.         {
37.                   if( TestArray[i] > pivotValue )
38.                   {
39.                             Temp = TestArray[i];
40.                             TestArray[i] = TestArray[storeIndex];
41.                             TestArray[storeIndex] = Temp;
42.                             storeIndex = storeIndex + 1;
43.                   }
44.         }
45.
46.         Temp = TestArray[right];
47.         TestArray[right] = TestArray[storeIndex];
48.         TestArray[storeIndex] = Temp;
49.
50.         return storeIndex;
51.}
```

Since we did not cover program slicing in depth, this question would be replaced with several short answer questions on testing.

5. If we define P* to be the total number of syntactic paths defined by a unit of code, what is P* for the following Java source code? You may show P* in terms of an expression. (15)

```
1
2       procedure PROCEDURE_NAME (PARM1 : TYPE1;
3                                 PARM2 : TYPE2) is
4
5       begin
6           S1;
7           if C1 then
8              S2;
9           else
10             S3;
11          end if;
12          S4;
13          for C2 in VALUE_RANGE loop – exactly 4 times
14              S5;
15              while C3 loop – 0 – 3 times
16                      S6;
17              end loop;
18              S7;
19              S8;
20              if C4 then
21                 S9;
22              else
23                 S10;
24              end if;
25              S11;
26          end loop;
27          S12;
28      end PROCEDURE_NAME;
```

6. What information should be included in a test case? (3)

7. What kinds of coverage does IP-path (basis set) provide? (4)

8. Briefly describe why randomly generated test cases may not be useful. (3)