SE 4367, Software Testing
Homework #4, ASTs and CFGs

1. Draw the abstract syntax trees for the following predicates, AST(p_r), where a, b, c, and d are Boolean variables:
   a) a + b + c + d
   b) abcd
   c) a + !(bc) + d
   d) a!bc + d

2. Program P1 CFG.
   a) Identify the basic blocks for the following program P1 written in pseudo-code.
   b) Draw the control flow graph.

Program P1

```
1)   integer A, B;
2)   input (A);
3)   if (A == 0)
4)        B = A + 1;
5)   else
6)        B = A - 2;
7)   output (A,B);
8)   end;
```

3. Program P2 CFG.
   a) Identify the basic blocks for the following program P2 written in pseudo-code.
   b) Draw the control flow graph.

Program P2

```
1)   integer A, B;
2)   input (A);
3)   B = 1;
4)   while (int i=1; i<=A; i++)
5)   {
6)        B = B * i;
7)        if (B>13)
8)            B = B / 2;
9)       else
10)           B = B * 2;
11)  }
12)  output (A,B);
13)  end;
```

4. Program P3 CFG.
   a) Identify the basic blocks for the following program P3 written in pseudo-code.
   b) Draw the control flow graph.

Program P3

```
1)   integer A, B;
2)   input (A);
3)   if (A > 7)
4)   {
5)        B = 1;
6)   } // end if A>7
7)   else
8)   {
9)        B = 2;
10)       if (A < 2)
11)            B = 3;
12)  } // end else A≤7
13)  while (int i=1; i<=A; i++)
14)  {
15)       if (A<4)
16)             B = B + 4;
17)       else
18)             B = B - 5;
19)  } // end for loop
20)  output (A,B);
21)  end;
```

5. Program P4 CFG.
   a) Identify the basic blocks for the following program P4 written in pseudo-code. Note the post-test loop at line 7!
   b) Draw the control flow graph.

Program P4

```
1)   integer A, B;
2)   input (A);
3)   B = 1;
4)   do {
5)        B = B * A;
6)        A = A - 1;
7)   } while (A<=0);
8)   output (A,B);
9)   end;
```

Grading Rubric

Each of the five problems is worth 20 points.

For #1, each AST is worth 5 points.

For #2-5, each of the eight (4*a,b) parts above is worth 10 points each.

Each basic block and each node & edge is worth a proportional part of its 10 points. For example,

- if there are 5 basic blocks for part a, correctly defining each is worth 2 points apiece
- if there are 5 nodes and 5 edges in the CFG for part b, each node and edge correctly drawn is worth 1 point

Missing the class, assignment, or your name at the beginning of your submission or in the filename, -5 points each