CS 428: Software Quality & Testing
Spring2024

Exercise Sheet 04: White-Box Testing

Data Flow Graph

Exercise 1

Consider the following program fragment for questions a-e below:

```
w = x;          // node 1
if (m > 0)

{
  w++;          // node 2
}
else
{
  w=2*w;        // node 3
}
// node 4
if (y <= 10)
{
  x = 5*y;      // node 5
}
else
{
  x = 3*y+5;    // node 6
}
z = w + x;      // node 7
```

1) Draw a control flow graph for this program fragment. Use the node numbers given above.

2) Which nodes have defs for variable w?

3) Which nodes have uses for variable w?

4) Are there any def-clear with respect to variable W from node 1 to node 7? If not, explain why not. If any exist, show one.

5) List all of the du-paths for variables w and x.

Exercise 2

Consider the following program fragment for questions a-e below:

```
0  #define EOF -1
1  #define YES 1
2  #define NO 0
3  main() {
4      int c, nl, nw, nc, inword;
5      inword = NO;
6      nl = 0;
7      nw = 0;
8      nc = 0;
9      c = getchar();
10     while(c != EOF){
11       nc = nc+1 ;
12       if(c == '\n')
13         nl = nl+1;
14       // end if
15       if((c == ' ') || (c == '\n') || (c == '\t'))
16         inword = NO;
17       else if(inword == NO){
18               inword = YES;
19               nw = nw+1 ;
20             }
21             // end if
22       //end if
23       c = getchar();
24     }
25     printf("%d\n",nl);
26     printf("%d\n",nw);
27     printf("%d\n",nc);
28 }
```

1) Draw a control flow graph for this program fragment. Use the code line numbers of the program.
2) Determine in which nodes the variables of the program are defined and used (distinguish the p- and c- uses of the variables).
3) Are there a control path from node 5 to node 25 that is "def-clear" for the inword variable? If not, explain why. If yes, show it.
4) For each variable of the program determine the "def-use" pairs.
5) Suppose that: **DT="ab c"**. Determine which control path p covers this DT?