

CS510 Assignment #1 (Due Jan. 31 in class)

January 18, 2017

1 Control Graph, Dominator and Post-Domintor (25p)

- (a) Construct the control flow graph for the below code snippet. Please also list the dominators and immediate post-dominators for 3, 5, 6, 7, 8, and 17.

```
1.  n=input();
2.  s=0;
3.  if (n>10)
4.      return;
5.  while (n>0) {
6.      if (s>10) {
7.          while (n>0) {
8.              s=s-n;
9.              n=n-1;
10.         }
11.         break;
12.     }
13.     s=s+2;
14.     n=n-1;
15. }
16. if (s>0 &&
17.     s%2==0) {
18.     s=s+1;
19. }
```

- (b) Prove that a statement has only one immediate post-dominator (8p).

2 Program Dependence Graph (20p)

Build the program dependence graph for the code in problem 1. If the graph is too crowded, you can separate it to two subgraphs: data dependence graph and control dependence graph.

3 Trace Compression (10p)

Let a plain text string be

a b a b c d c b a b c b.

Assume the initial lookup table is

Context	Prediction
ab	a
bc	a
cd	b

Use FCM-2 to compress the string. The final compressed string and the final lookup table are required. Intermediate steps are not required but encouraged.

4 Path Profiling (25p)

```
1.   if (p1)
2.     s0;
3.   while (p2) {
4.     if (p3) {
5.       s1;
6.       continue;
7.     }
8.     while (p4) {
9.       s2;
10.      s3;
11.    }
12.  }
13.  if (p5)
14.    s4;
```

- Construct the path enumeration graph for the above program. Show the path encoding.
- Show the final instrumented program, executing which collects the path profile.

5 Predicate Tracing (20p)

Predicate tracing is a control flow tracing technique that records the branch outcomes of predicates. For example,

```
1.   if (...)
2.     if (...)
3.       s0;
4.   if (...)
5.     s1
6.   s2;
```

The trace 1 2 3 4 6 for the above program can be represented as T T F.
Three bits are needed.

- (a) Please list the challenges for making the above idea work on real world programs. You can assume C or Java languages.
- (b) Sketch solutions to such challenges.

Using examples is encouraged.