Roll No: _____

CS6843 Program Analysis at IIT Madras

MidSem Mar 2, 2015

Duration: 75 minutes Number of questions: 6 **compulsory** questions

1. Guess the country who will win the Cricket World Cup this year. Why? [1 mark]

2. We say reaching definitions (RD) is a monotonic analysis. We define KILL set for RD, then how can the information monotonically increase? [2 marks]

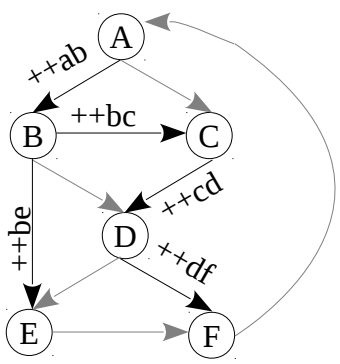
3.

   a. Your analysis has two bits AB to keep track of conditions x > 2 and y < 2. Analyze the following program and mention the values of the bits AB at every step. Assume that they are initialized to 01 and that the analysis knows that all the variables are non-negative integers. [5 marks]

```
{ 01  }
x = y + 2;
{     }
x = x + 1;
{     }
x = 5;
{     }
y = y + 2;
{     }
y = x - y;
{     }
```

   b. What conditions will you track using bits AB so that for the above program your analysis will precisely answer YES for the query, “Does x equal 5 at the end of the execution?”. [2 marks]

4. Given the following control-flow graph and the instrumentation across edges as shown, find formulae for computing the edge-frequencies of uninstrumented edges **only in terms of the instrumented edges**. [5 marks]



ac =

bd =

de =

ef =

fa =

5. Compute a backward slice for criteria <13, z> for the following program. Circle the line numbers in the slice. [5 marks]

```
                    void main() {
1.                      int y, z, ii, n;
2.                      int *a;

3.                      scanf("%d", &n);
4.                      a = (int *)malloc(n);

5.                      for (ii = 0; ii < n; ) {
6.                          scanf("%d", a + ii);
7.                          ++ii;
                        }

8.                      y = 0;
9.                      z = 1;

10.                     for (ii = 0; ii < n; ++ii) {
11.                         y += a[ii];
12.                         z *= y;
                        }
13.                     printf("%d\n", z);
                    }
```

6. For the following nested loop, formulate the set of linear inequations to find out if **WAW** dependence exists across any two **different** iterations. Enter entries in the matrices and vectors below, you do not need to solve the equations. [5 marks]

```
for (i = 0; i < 10; ++i)
    for (j = 1; j < 5; ++j)
        a[2*i + 3*j – 4] = 5 * a[6*i + 7*j – 8] – 9;
```