

CMSC 430 Practice Problems 6

1. Value Numbering

Consider performing value numbering on the following code:

```
(1) i + 1      // a := i + 1
(2) a := (1)
(3) a + b      // c := a + b
(4) c := (3)
(5) d := 1     // d := 1
(6) i + d      // e := i + d
(7) e := (6)
(8) d + 2      // f := d + 2
(9) f := (8)
```

- (a) What are in the CODE, SYMBOLS, AVAIL, and CONSTANTS tables?
- (b) What is the output code?

2. Static Single Assignment.

Consider the following program:

```
procedure foo
  a, b, c, i, j, k, n : integer

  a = 6
  b = 12
  c = 14
  i = a * b
  j = 9
  read n

  if (i > c) then
    i = i/2
  else
    i = c/2

  if (c < 0) then
    c = -c

  k = 0
  while (k < n) do
    i = i + (i & (1 << k))
    k = k + 1
  end while

  if (j == 9) then
    b = b + a

  return (b + i)
end foo
```

- (a) Construct a control flow graph for the program.
- (b) Construct a dominator tree for the resulting CFG.
- (c) What is the iterated dominance frontier for variables c and i?
- (d) Generate the SSA form for this program.
- (e) Show the result of conditional constant propagation.