TDT4205: Problem Set 6

Compiler Construction

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April 27, 2017

Theory

1.

(a) `for(a; b; c) d; e;`

(b) `a; while(b){d; c;} e;`

(c) `a; do{d ; c; } while(b); e;`

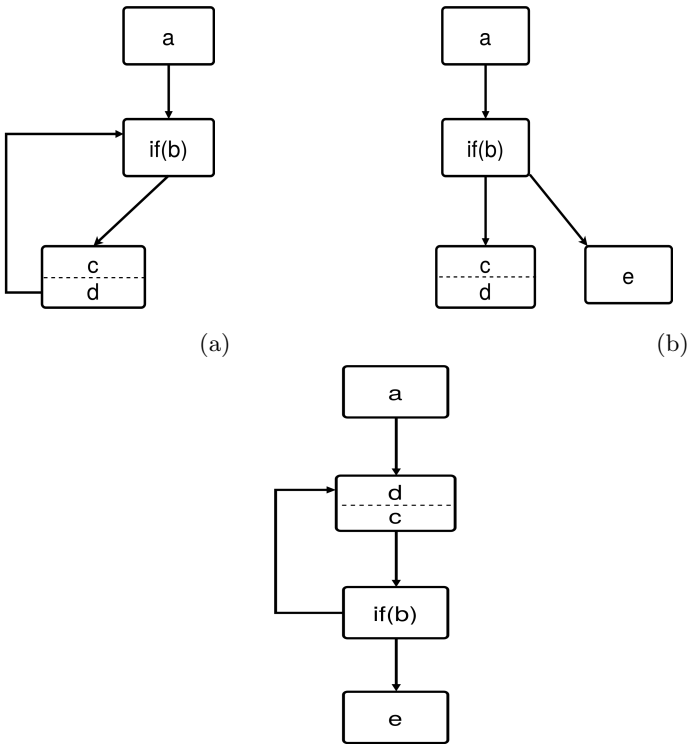

Figure 1: Problem 1.1. Control flow graphs.

2.

Program fragment :

```
for ( i=0; i<n; i++ ) {
    int sum =4*i;
    for (int j=0; j<m; j=j+i ) {
        a = a + b * 2;
    }
}
```

2.1 Control flow graph with three-address instructions

```
node 1:     i = 0
node 2:     if i < n
node 3:     sum = 4 * i
node 4:     j = 0
node 5:     if j < m
node 6:     t1 = b * 2
node 7:     a = a + t1
node 8:     j = j + 1
node 9:     i = i + 1
node 10:    exit
```

Label(e	Node	Expression
e_1	(3)	`4 * i`
e_2	(6)	`b * 2`
e_3	(7)	`a + t1`
e_4	(8)	`j + i`
e_5	(9)	`i + 1`

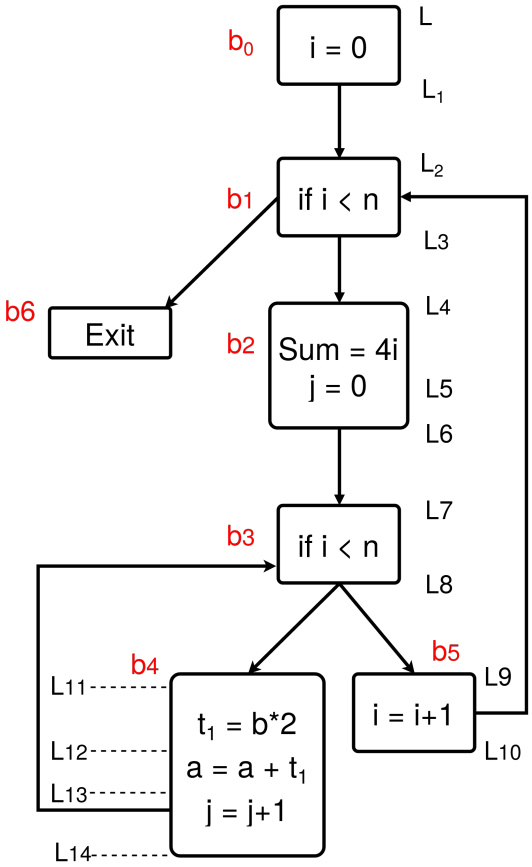

Figure 2: Problem 1.2. Control flow graph with three-adress encoding.

2.2 Dataflow equations for the dominator relation

$D(1) = \{1\}$
$D(2) = \{2\} \cup (D(1) \cap D(9)) = \{2\} \cup (\{1\} \cup \{1, 2, 3, 4, 5, 9\}) = \{1, 2\}$
$D(3) = \{3\} \cup D(2) = \{1, 2, 3\}$
$D(4) = \{4\} \cup D(3) = \{1, 2, 3, 4\}$
$D(5) = \{5\} \cup (D(4) \cap D(8)) = \{5\} \cup (\{1, 2, 3, 4\} \cap \{1, 2, 3, 4, 5, 6, 7, 8\} = \{1, 2, 3, 4, 5\}$
$D(6) = \{6\} \cup D(5) = \{1, 2, 3, 4, 5, 6\}$
$D(7) = \{7\} \cup D(6) = \{1, 2, 3, 4, 5, 6, 7\}$
$D(8) = \{8\} \cup D(7) = \{1, 2, 3, 4, 5, 6, 7, 8\}$
$D(1) = \{1\} \cup D(8) = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$
$D(10) = \{10\} \cup (D(2) \cap D(1)) = \{1, 2, 10\}$

2.3 Dominator tree

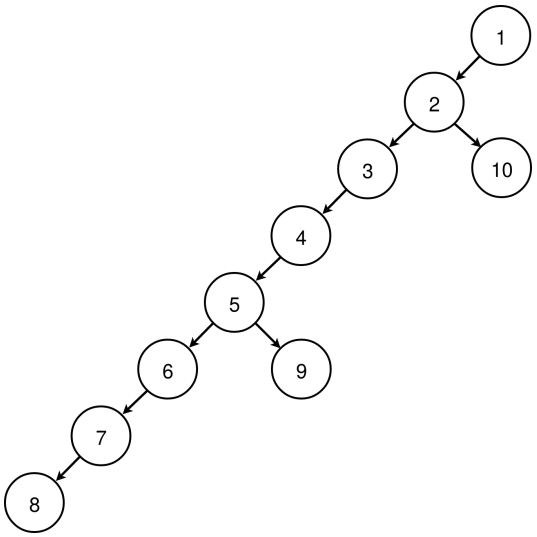

Figure 3: Problem 1.2. Dominator tree.