

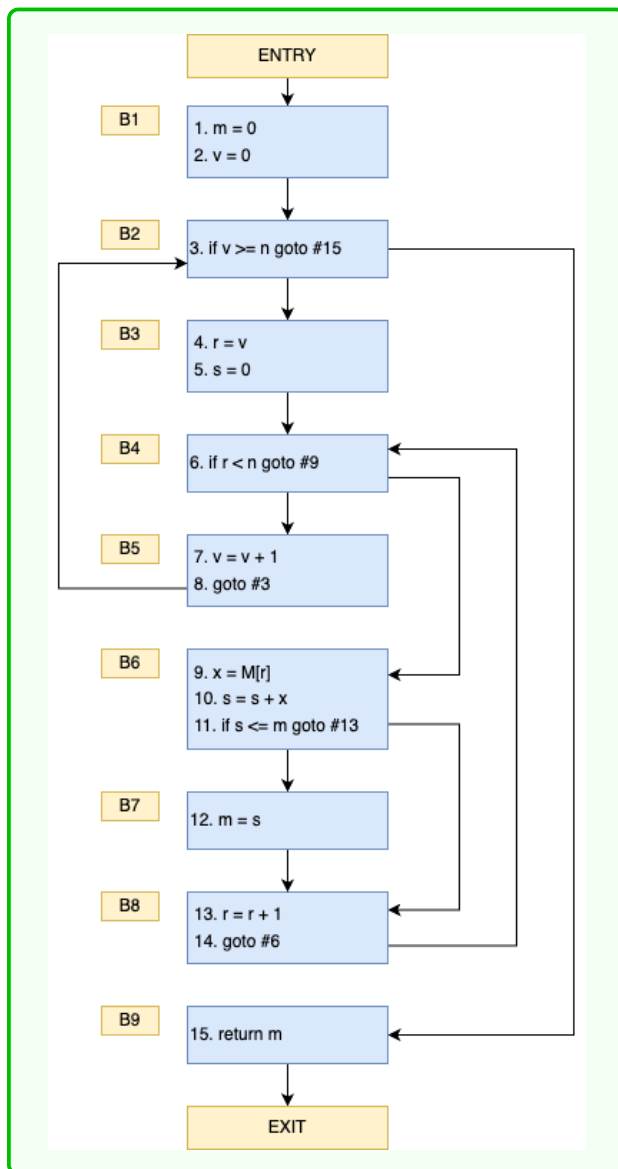
Homework 4

Question 1

(a)

Leaders: {1,3,4,6,7,9,12,13,15}

(b)



Question 2

(a)

	I				II		III	
block	use	def	out	in	out	in	out	in
9	m	–	–	m	–	m	–	m
8	r	r	–	r	r, n, v, s, m	r, n, v, s, m	r, n, v, s, m	r, n, v, s, m
7	s	m	r	s, r	r, n, v, s, m	r, n, v, s	r, n, v, s, m	r, n, v, s
6	r, s, m	x, s	s, r	r, s, m	r, n, v, s, m	r, n, v, s, m	r, n, v, s, m	r, n, v, s, m
5	v	v	–	v	v, n, m	v, n, m	n, v, m	n, v, m
4	r, n	–	v, r, s, m	r, n, v, s, m	r, n, v, s, m	r, n, v, s, m	r, n, v, s, m	r, n, v, s, m
3	v	r, s	r, n, v, s, m	v, n, m	r, n, v, s, m	n, v, m	r, n, v, s, m	n, v, m
2	v, n	–	v, n, m	v, n, m	n, v, m	n, v, m	n, v, m	n, v, m
1	–	m, v	v, n, m	n	n, v, m	n	n, v, m	n

Set of variables that are live at the beginning of each basic block:

- **B1:** {n}
- **B2:** {n, v, m}
- **B3:** {n, v, m}
- **B4:** {r, n, v, s, m}
- **B5:** {n, v, m}
- **B6:** {r, n, v, s, m}
- **B7:** {r, n, v, s}
- **B8:** {r, n, v, s, m}
- **B9:** {m}

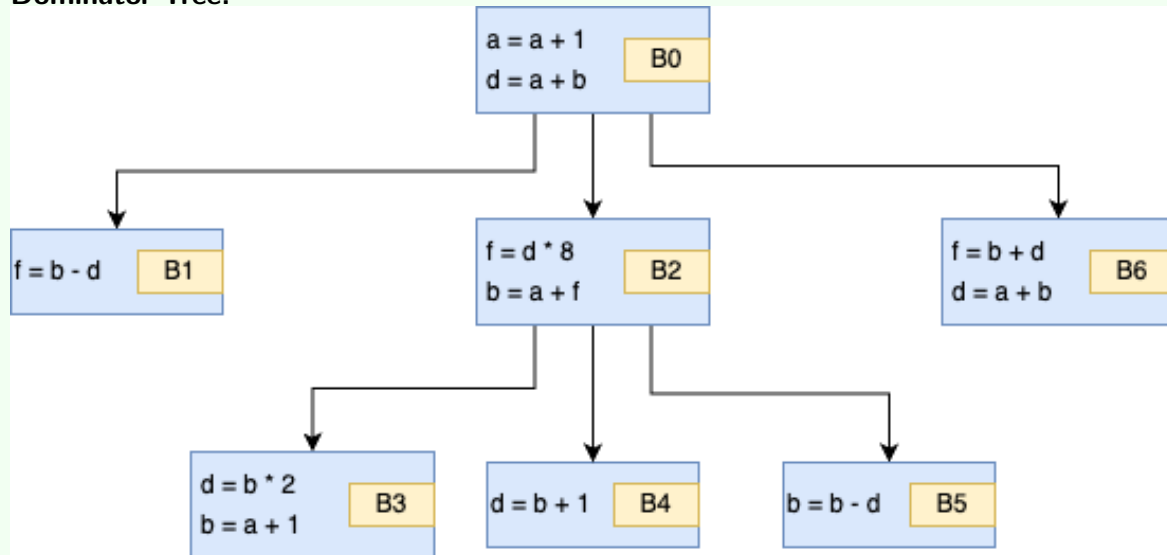
(b)

Uninitialized variable: n

From the live variable analysis, we can see that the variable n is live at the beginning of block 1, but block 1 is the first block in the program (does not have any predecessors). Therefore, the variable n used in block 2 and 4 is uninitialized. All other variables are initialized before they are used.

Question 3

Dominator Tree:



Dominance Frontiers:

B0: {B0}
B1: {B6}
B2: {B2, B6}
B3: {B5}
B4: {B5}
B5: {B2, B6}
B6: {B0}

Question 4

