

CS143 Written Assignment 4

Your Name – SUNet ID

Due: June 4th, 2024 EOD

1. (a) Value:

Address	Line Number (Method)
0x8000	⟨line 17⟩ (get)
0x8008	⟨line 18⟩ (pop)
0x8010	⟨line 19⟩ (set)
0x8018	⟨line 20⟩ (push)

MulOp:

Address	Line Number (Method)
0x8000	⟨line 17⟩ (get)
0x8008	⟨line 18⟩ (pop)
0x8010	⟨line 19⟩ (set)
0x8018	⟨line 20⟩ (push)

AddOp:

Address	Line Number (Method)
0x8000	⟨line 17⟩ (get)
0x8008	⟨line 18⟩ (pop)
0x8010	⟨line 19⟩ (set)
0x8018	⟨line 20⟩ (push)

(b) Heap layout:

Address	Value	Meaning
<code><object Main> + 0x0000</code>	5	(class tag)
<code><object Main> + 0x0008</code>	4	(object size)
<code><object Main> + 0x0010</code>	0x8800	(dispatch ptr)
<code><object Main> + 0x0018</code>	void	(stack)

(c) Stack layout:

Address	Value	Meaning
0x7777fff8	0x7ffffff8	(saved frame pointer)
0x7777fff0	⟨object Main ⟩	(argument 0 of main)
0x7777ffe8	0x2000	(return address of main)
0x7777fe0	⟨object IO ⟩	(local variable io)
0x7777fd8	5	(local variable num)
0x7777fd0	0x7777ffe8	(saved frame pointer)
0x7777fc8	5	(argument 1 of init)
0x7777fc0	⟨object Main ⟩	(argument 0 of init)
0x7777fb8	⟨line 53⟩	(return address of init)

2. (a)

$$\frac{so, S_1, E \vdash e_1 \mapsto \text{Int}(i_1), S_2 \quad v_1 = \text{Int}(-i_1)}{so, S_1, E \vdash \sim e_1 \mapsto v_1, S_2} \text{ [Neg]}$$

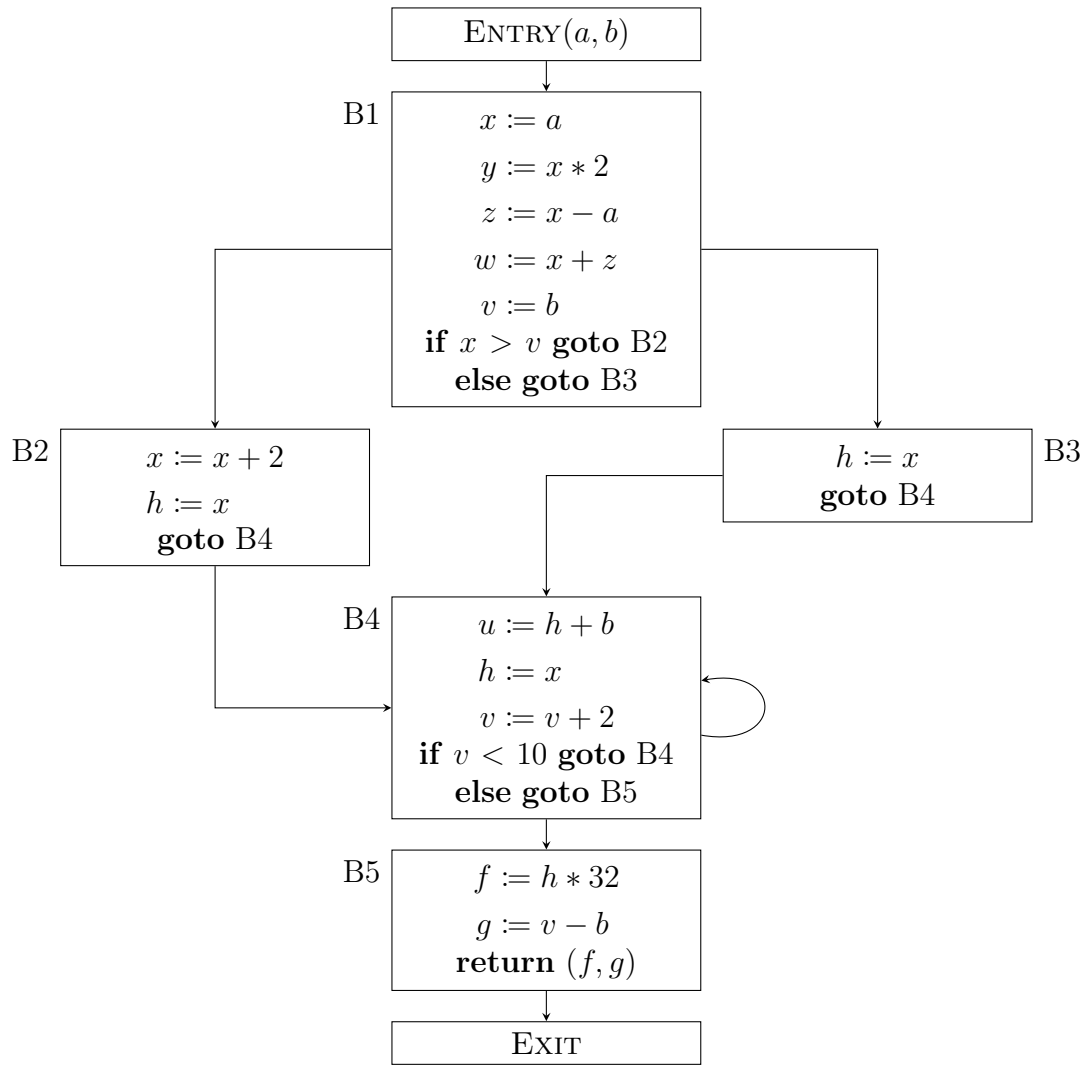
(b)

$$\frac{\frac{\overline{\vdash 2 \mapsto \text{Int}(2), S} \quad [\text{Int}] \quad \frac{\overline{\vdash 1 \mapsto \text{Int}(1), S} \quad [\text{Int}]}{\vdash \sim 1 \mapsto \text{Int}(-1), S} \quad [\text{Neg}]}{\vdash 2 * \sim 1 \mapsto \text{Int}(-2), S} \quad [\text{Arith}]}$$

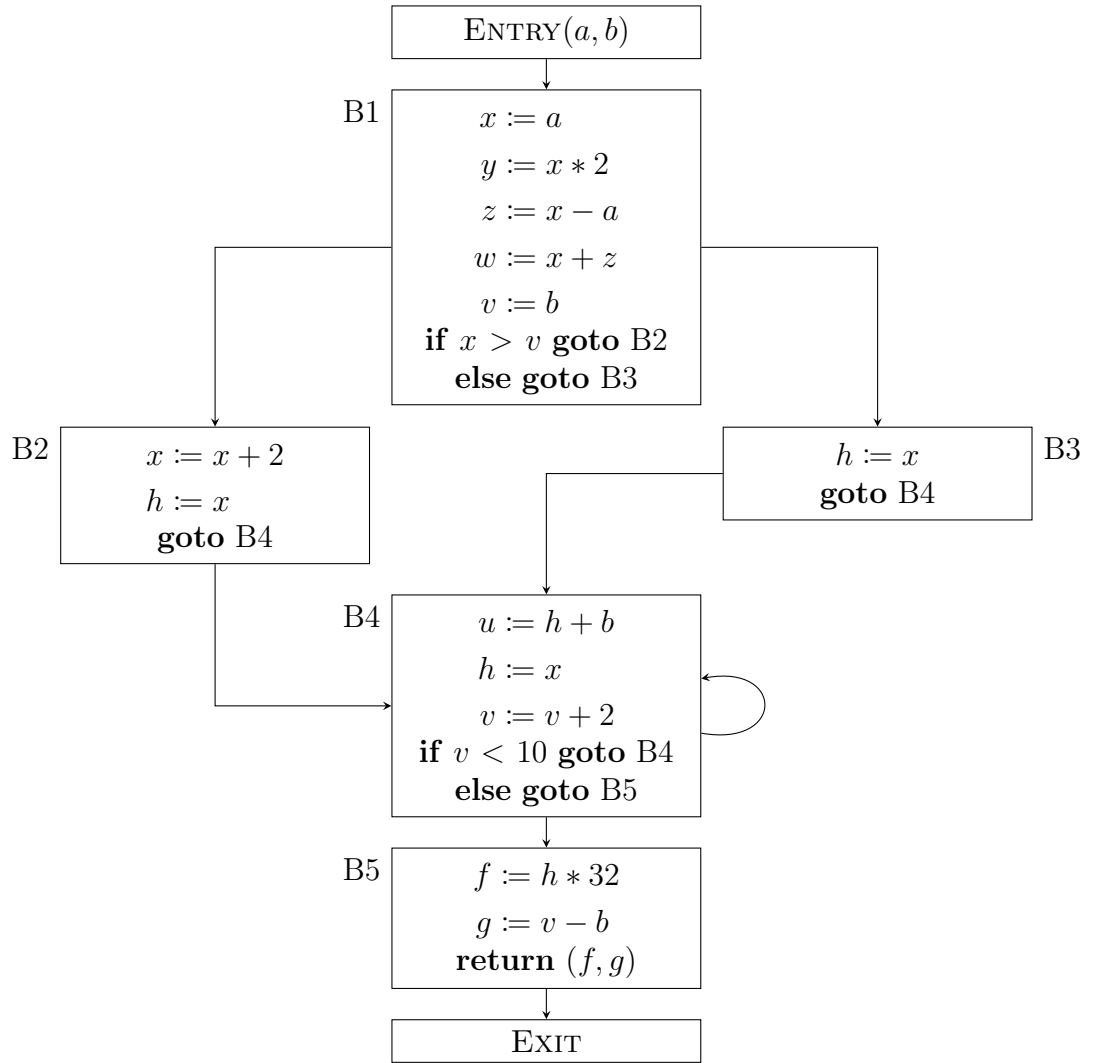
(c) Simple Simplicio...

```
1 class Main {  
2     main() : Int {  
3         1 + 1  
4     };  
5 };
```

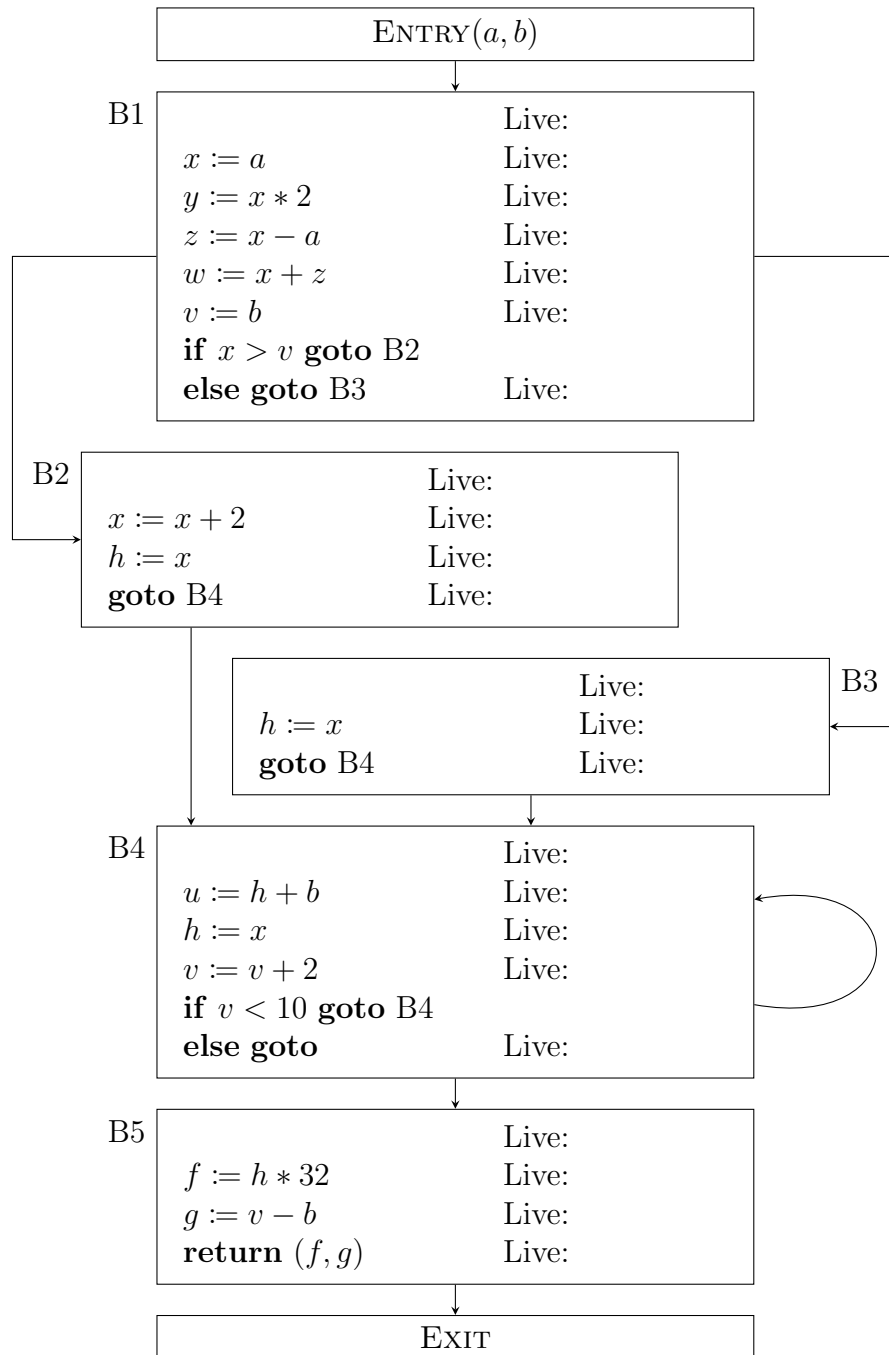
3. (a) Optimized CFG:



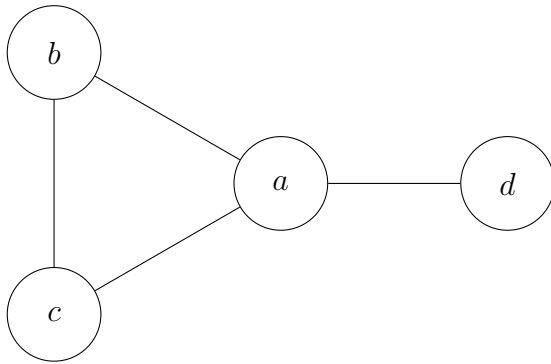
(b) Optimized CFG:



4. (a) Live variables:



(b) Interference graph:



Edge list:

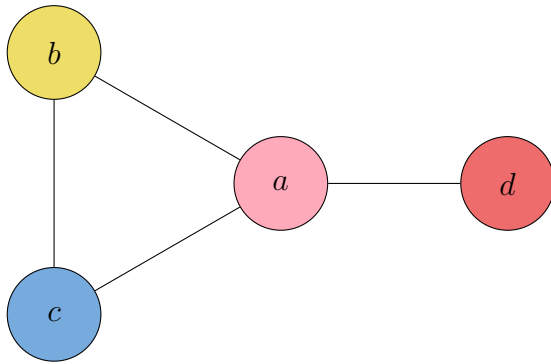
a - *b*;

b - *c*;

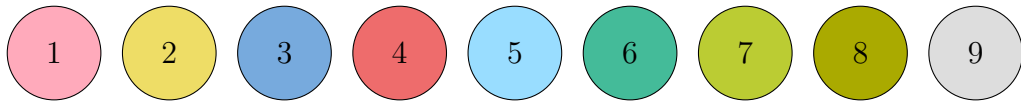
a - *c*;

a - *d*;

(c) Coloring:



Here are 9 colors chosen to be reasonably distinct for color-blind and non-color-blind vision:



You may also label nodes using numbers or patterns instead of colors, if that is more convenient.