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Runtime Environment

Complete Course on Compiler Design

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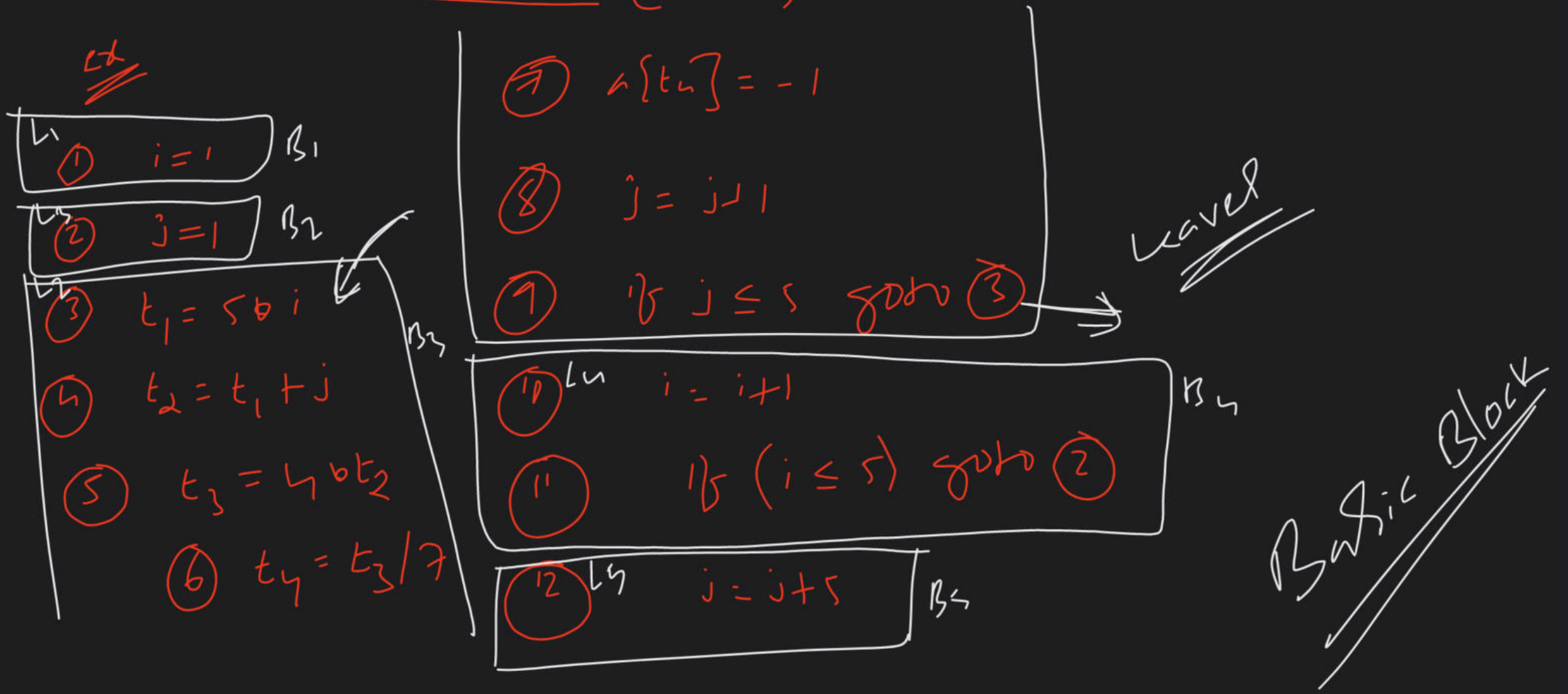
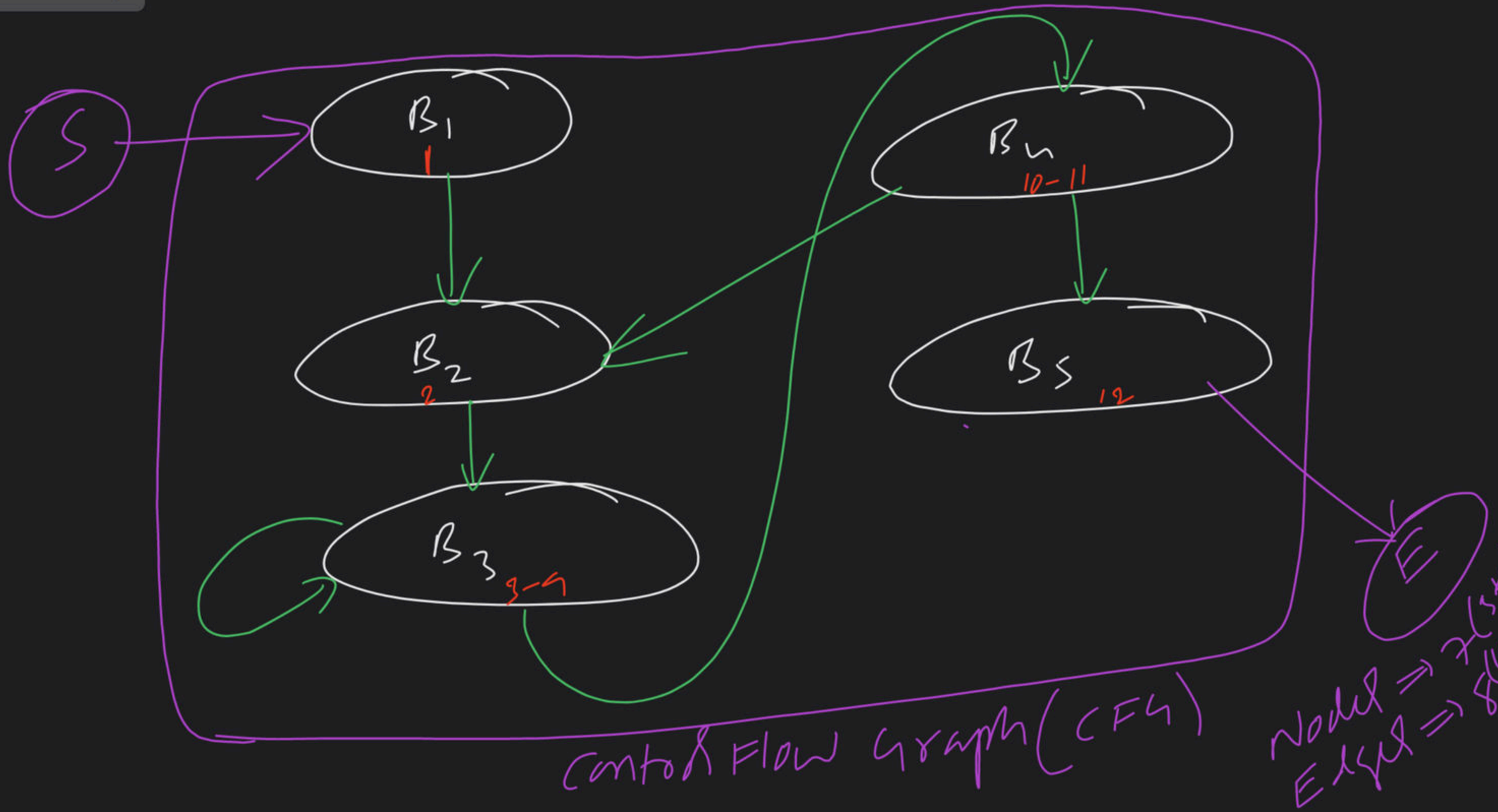
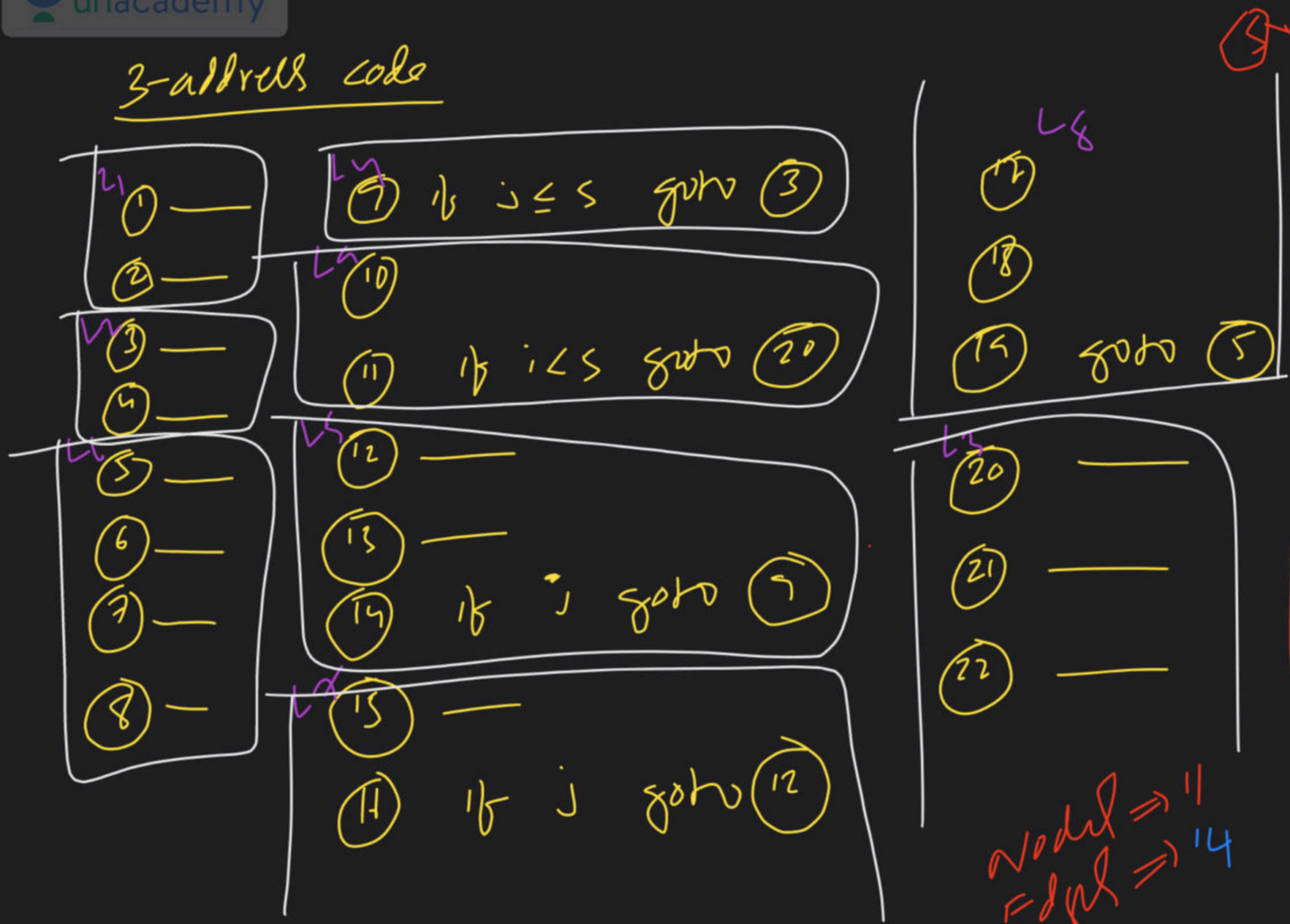
Control Flow Graph (CFG)

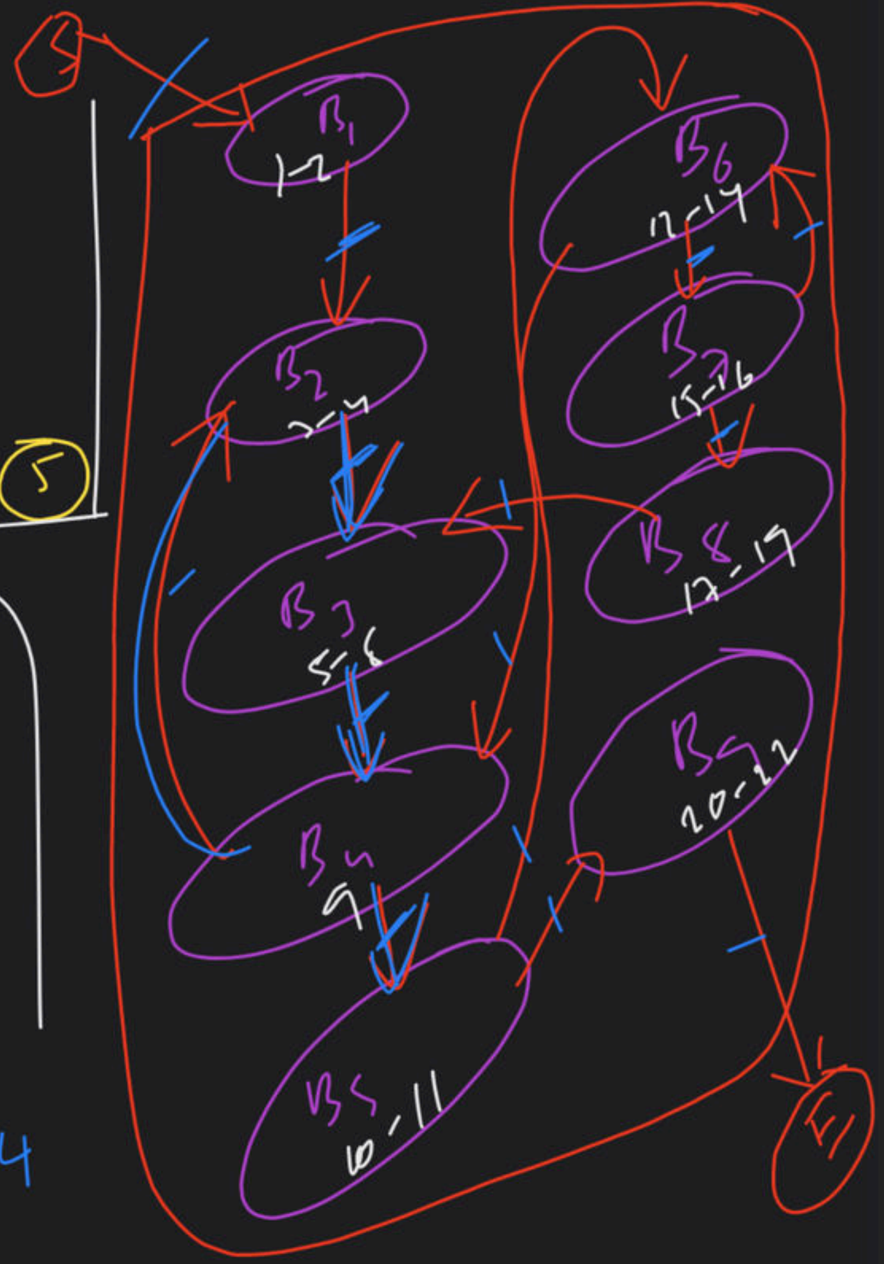


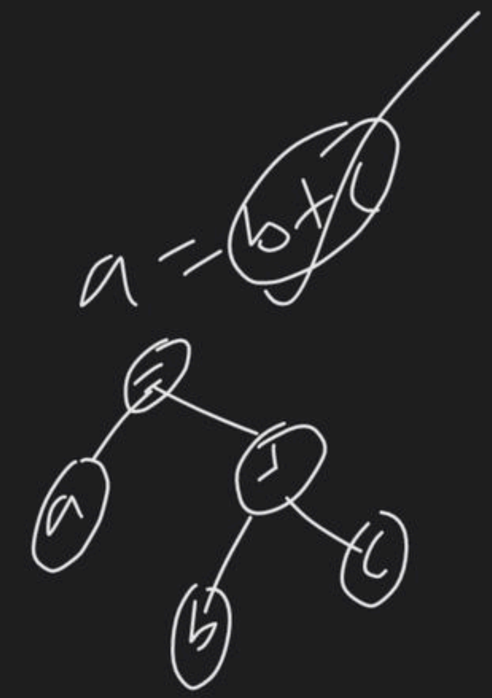

S
B_1
1
B_2
2
B_3
3-9
B_4
10-11
B_5
12
E
Control Flow Graph (CFG)
Nodes ⇒ n
Edges ⇒ e(≤n²)

3-address code



Node # ⇒ 11
Edge # ⇒ 14





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Consider the following Basic Block

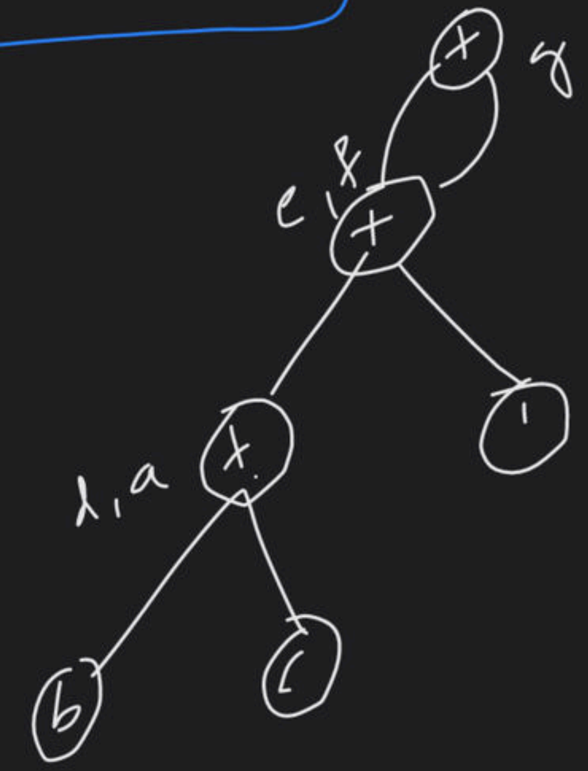
$a = b + c$

$c = a + 1$

$d = b + c$

$f = d + 1$

$g = e + f$

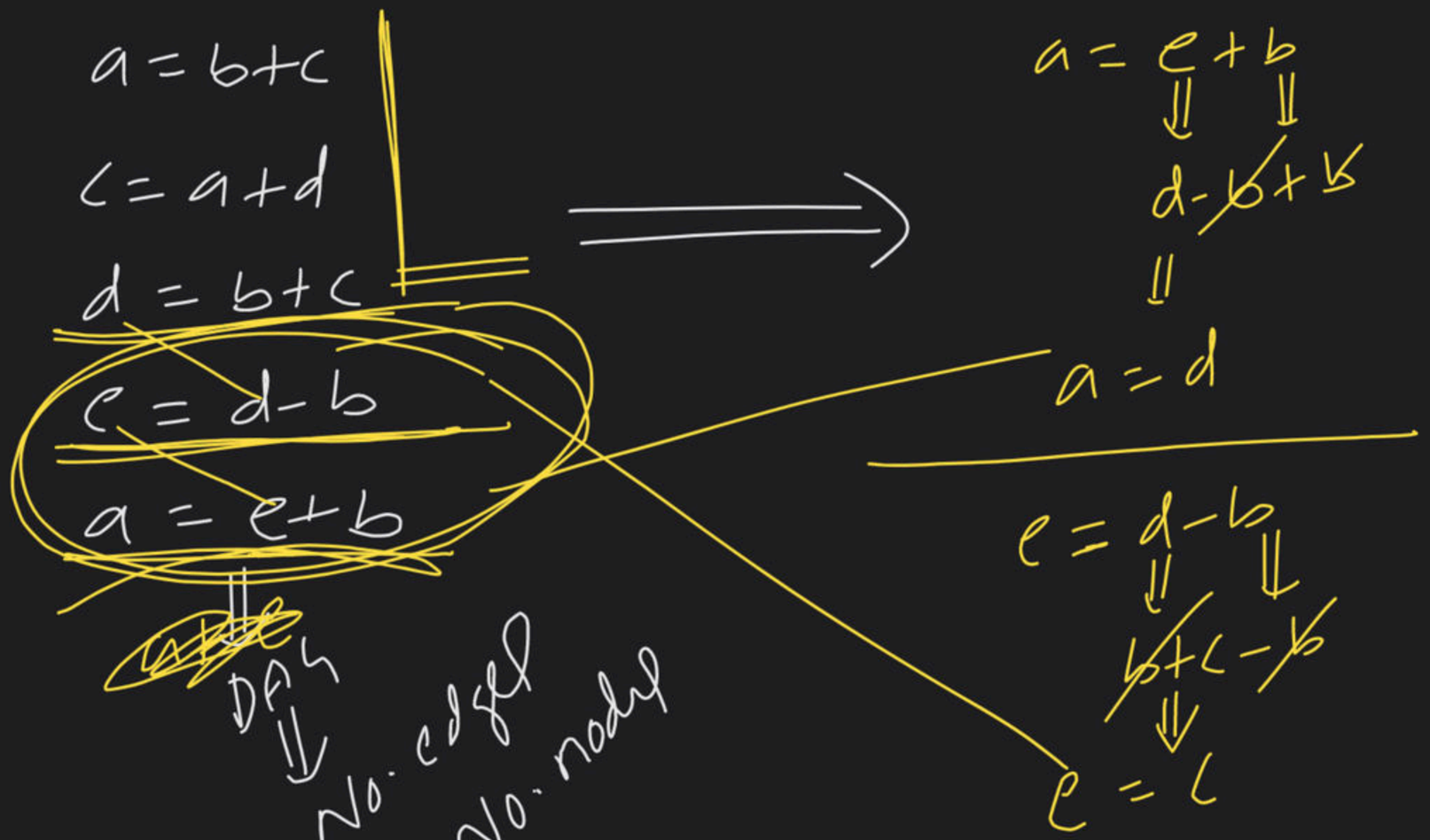


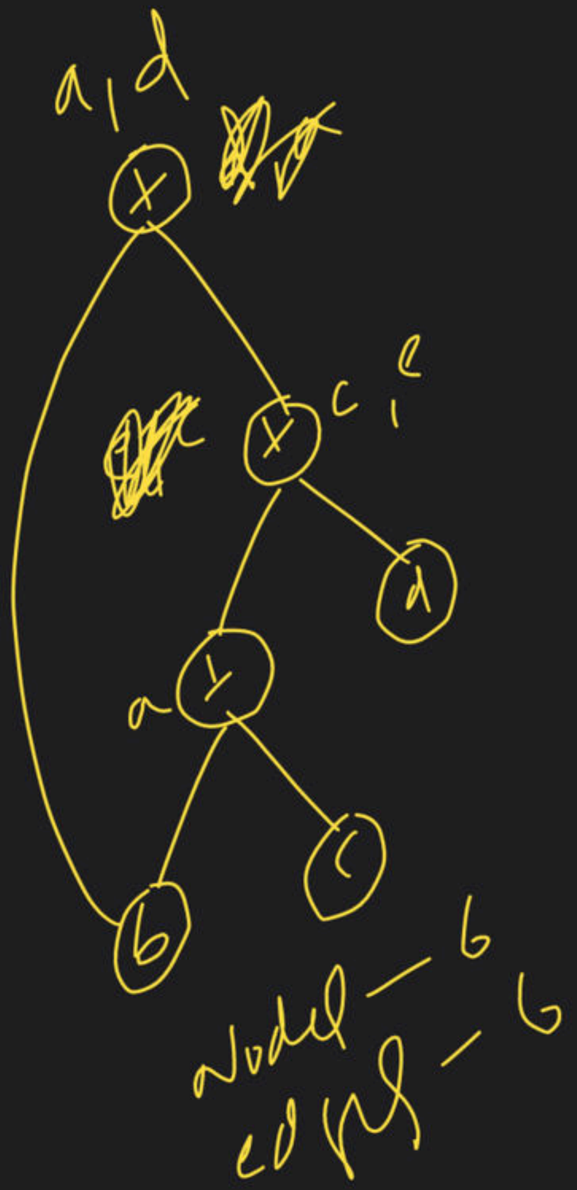
If you create DAG

Find No. of nodes $\Rightarrow$ 6

No. of edges $\Rightarrow$ 6

Consider the following 3-address code





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Consider the following Basic Block

$E = A + B$

$F = E - C$

$G = F * D$

$H = A + B$

$I = I - C$

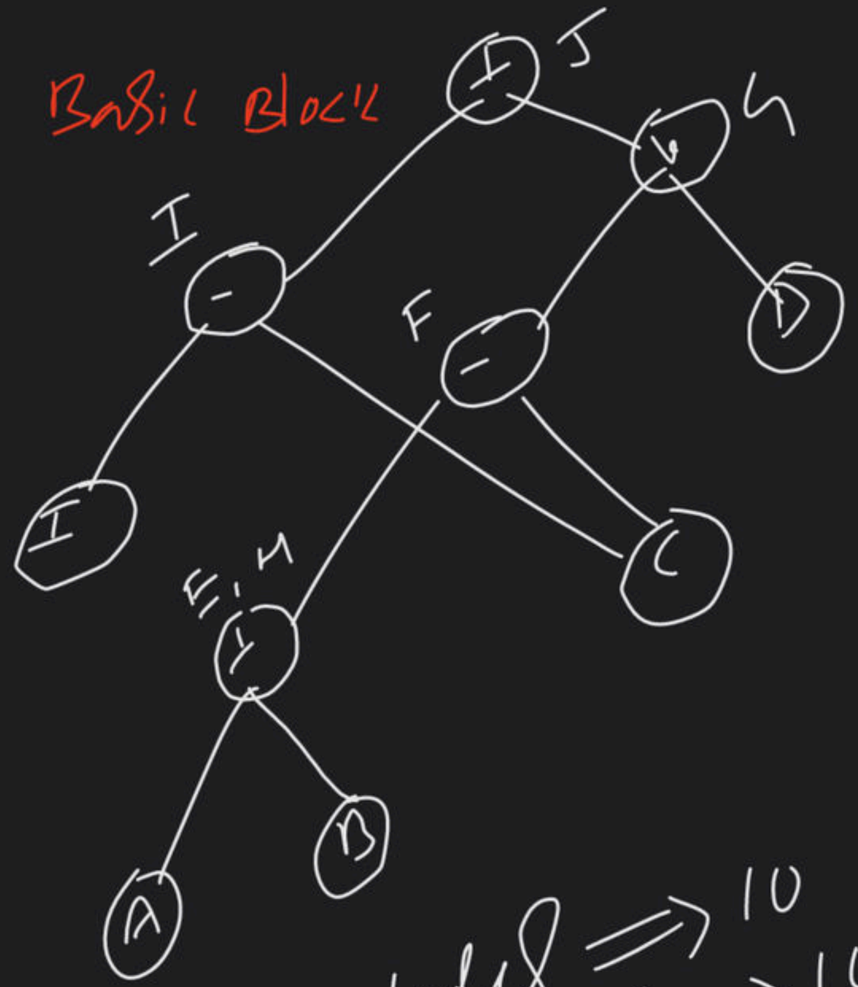
$J = I + G$

$\Downarrow$

DAG

$\Downarrow$

N ? | E ?



Nodes $\Rightarrow$ 10

Edges $\Rightarrow$ 10

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For a C-program accessing x[i][j][k] the following IC is generated by a compiler. Assume integer 4B, char = 1B

$t_0 = i * 1024$

$t_1 = j * 32$

$t_2 = k * 4$

$t_3 = t_1 + t_0$

$t_4 = t_3 + t_2$

$t_5 = x[t_4]$

which one of the following is correct C-declaration for the above data?

(a) int x[32][32][8] ✓

(b) int x[4][1024][32]

(c) char x[4][32][8]

(d) char x[32][16][2]

$i * 32 * 8$

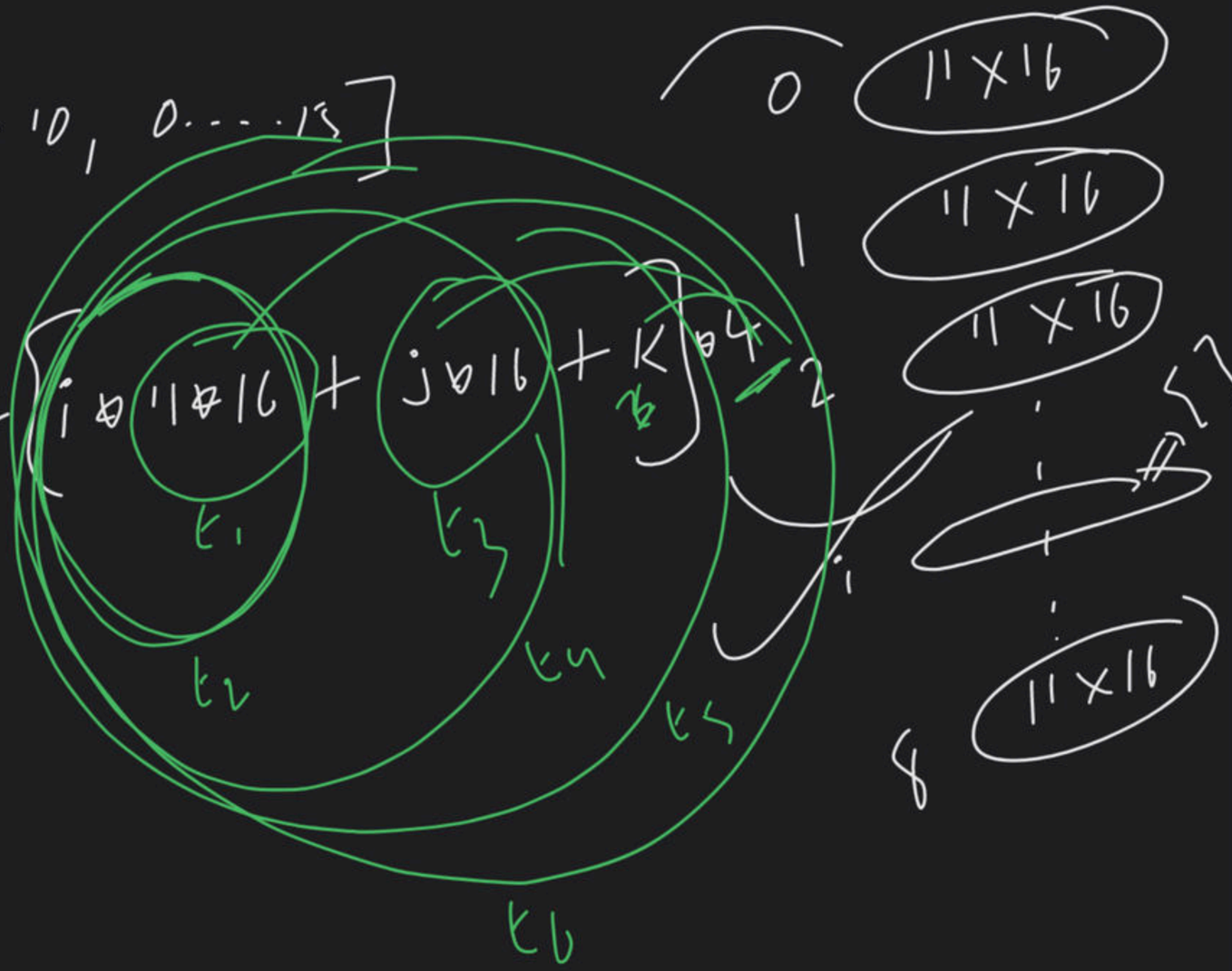
$i * 256$

int a[0....8, 0....10, 0....15]

⇓

4B

$$Loc(A[i][j][k]) = BA + [i * 11 * 16 + j * 16 + k] * 4$$



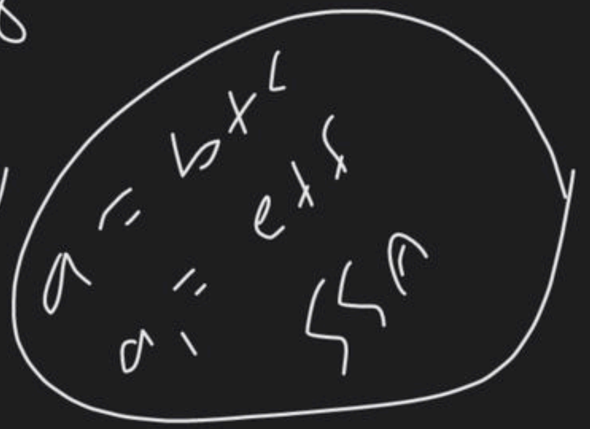
$a = b + c$

$a = e + f$

Static Single Assignment

SSA

above is not SSA
becz a is having more than 1 meaning



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Convert following code into SSA

$x = u - t$

$y = x * v$

$x = y + w$

$y = t - x$

$y = x * y$

x, y, u, t, v

$5V$

$x = u - t$

$y = x * v$

$x_1 = y + w$

$y_1 = t - x_1$

$y_2 = x_1 * y_1$

x, y, x_1, u, y_2

u, v, t, w

$7V$

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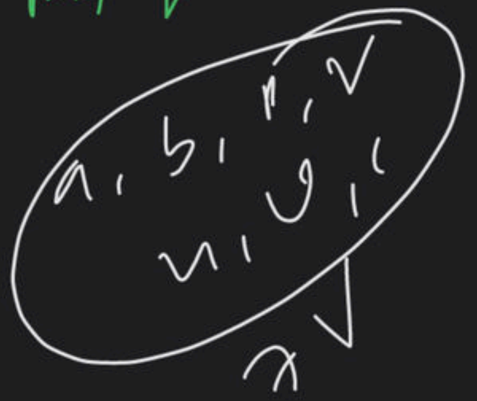
Consider the following 3-address code

$p = a - b$

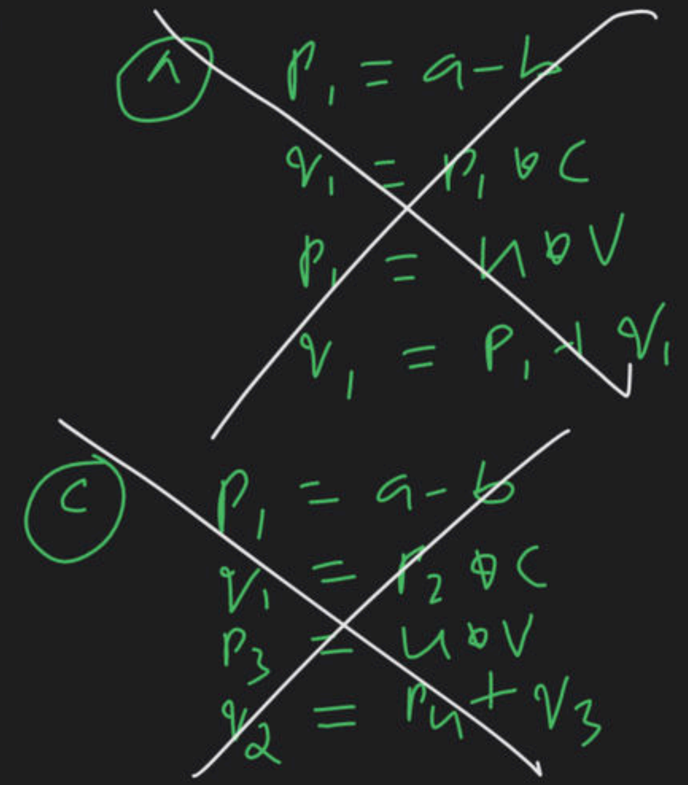
$q = p \vee c$

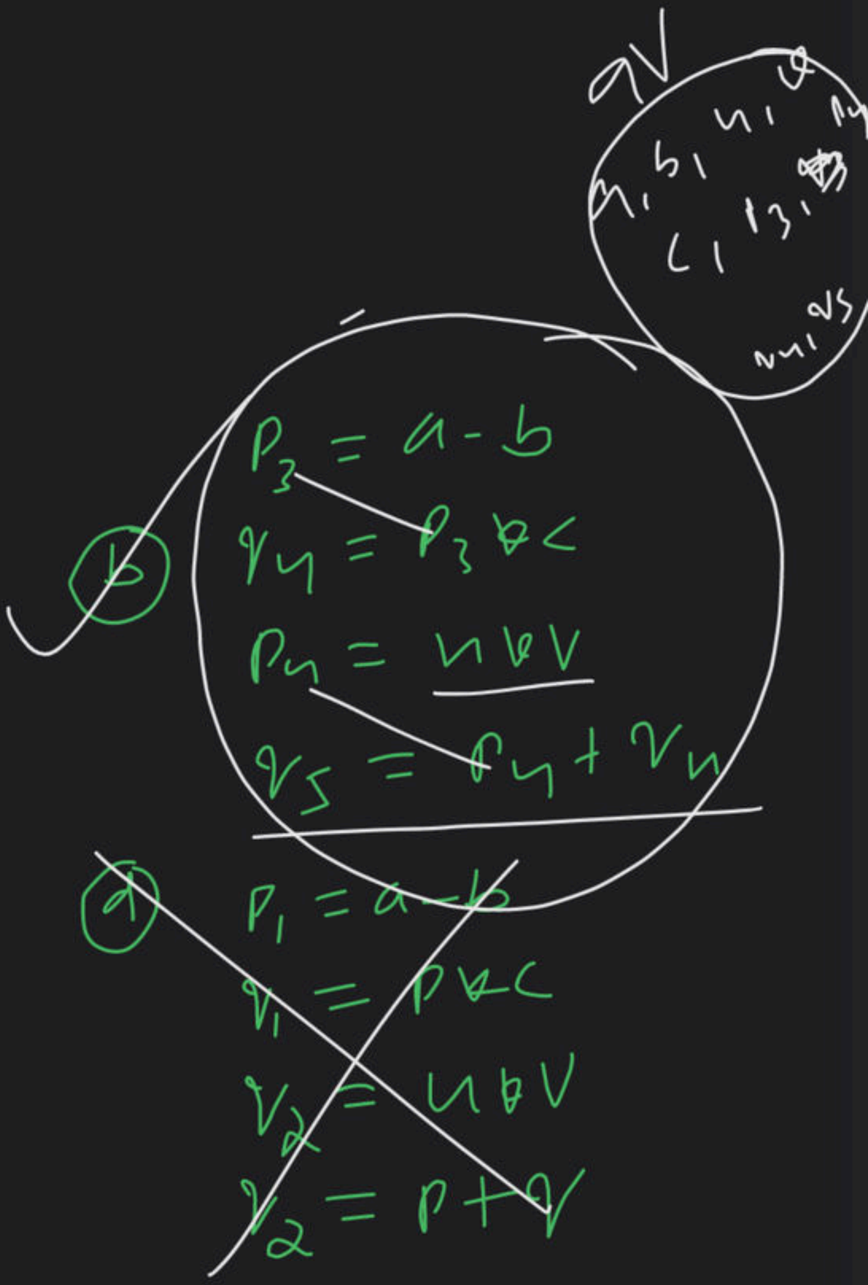
$p = u \vee v$

$r = p + q$

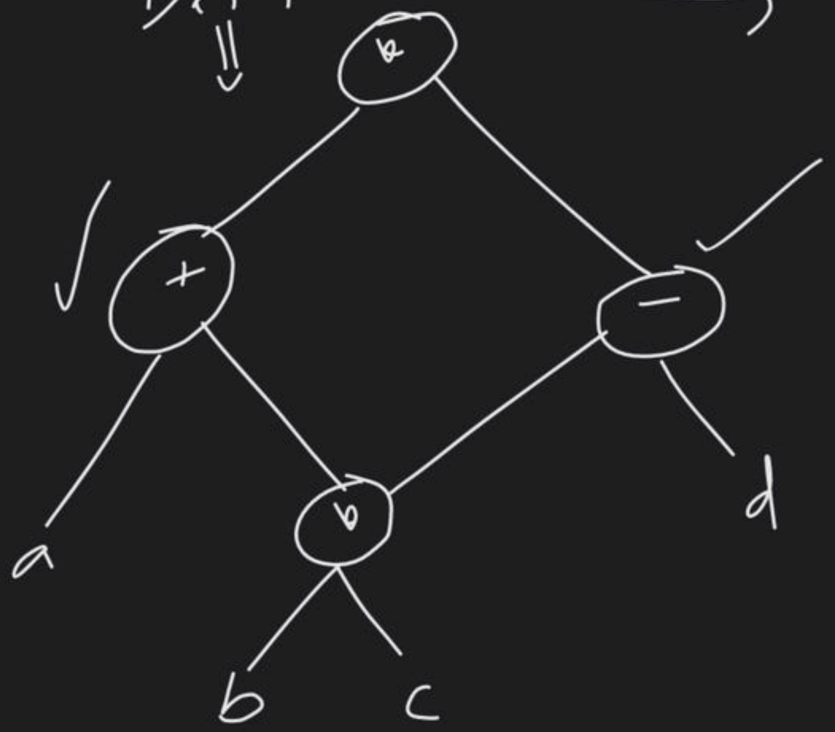


SSA





DAG ⟹ Common subexpression elimination



⇓ write expression

$$(a \wedge (b \vee c)) \vee ((b \vee c) \wedge d)$$