

- if, else, while loop are my control flow statements.
- Control flow statement uses boolean expression related.
- Boolean expression are dependent on boolean operators.
- Boolean operators are applied to
 - Boolean variables $\rightarrow \&&, ||$
 - Relational expression with Relational Operators.
 $<, <=, >, >=, !=, == \rightarrow \text{Relational Operators}$

We will translate control flow statements such as if-else statements, while statements. Translation of control flow statements are tied with Boolean expressions. For writing Boolean expression you will need Boolean operators. Boolean operators are applied to

- Boolean variables $\rightarrow \&&, ||$
- Relational expression with Relational operators.
 $<, <=, >, >=, !=, == \rightarrow \text{Relational Operators}$

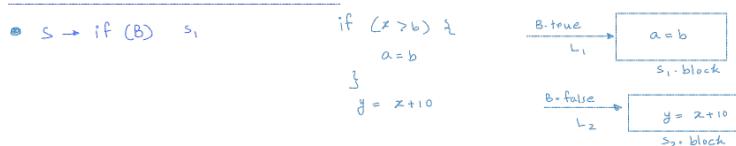
• B denotes Boolean Expression
 • S denotes Statements

In programming language, boolean expressions are often used to

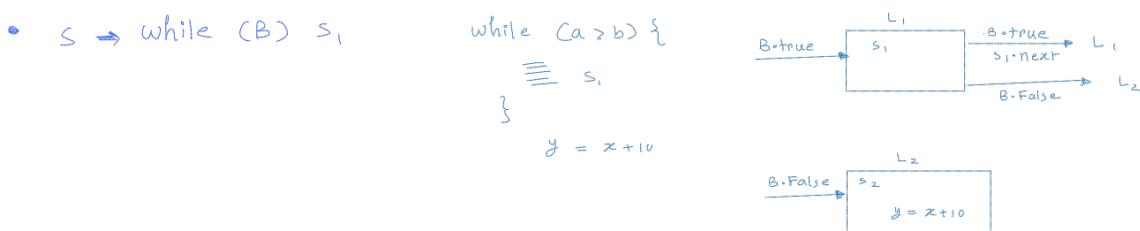
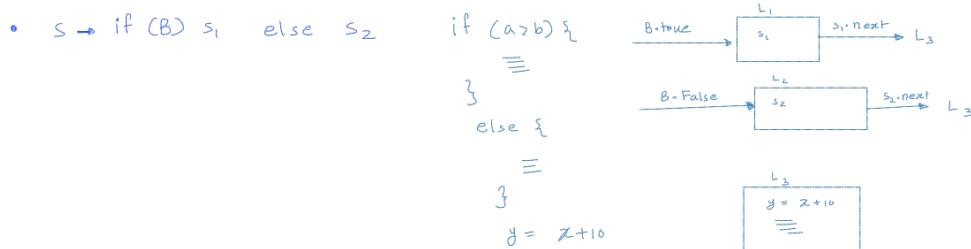
After the flow of Control: Boolean expressions are used as conditional expressions in statements that alter the flow of control. For example, in if (E) S, E must be true to reach S.

Compute Logical Values: A boolean expression can represent true or false as variables.

Flow of Control Statements:



Hence S_1 -block, S_2 block or S_1, S_2 denotes statement block in the diagram.



While generating the TAC write the code attributes in another page.

কোন attribute এর value কেল কামৰ হৈব root node জ reference কৰা আকচন তোৱা root node হৈব
কিন্তু কোন attribute value কেল কামৰ আৰু; কৰা calculation হৈব, finally recursively value calculate কৰত,

Final Suggestion:

- Midterm দ্বিতীয় short theory; no simulation
- Final দ্বিতীয় simulation. (Spread sheets Lecture 9 to Lecture 17)

$S \Rightarrow id = E \quad \{ s.code = E.code \text{ || gen } (\text{top} \cdot \text{get } (id \cdot \text{lexeme}) '=' E \cdot \text{addr}) \}$

$E \Rightarrow E_1 + E_2 \quad \{ E \cdot \text{addr} = \text{new Temp} ()$
 $\quad E \cdot code = E_1 \cdot code \text{ || } E_2 \cdot code \text{ || gen } (E \cdot \text{addr}' = 'E_1 \cdot \text{addr}' + 'E_2 \cdot \text{addr}') \}$
 $| - E_1 \quad \{ E \cdot \text{addr} = \text{new Temp} ()$
 $\quad E \cdot code = E_1 \cdot code \text{ || gen } (E \cdot \text{addr}' = 'minus' E_1 \cdot \text{addr}) \}$
 $| (E_1) \quad \{ E \cdot \text{addr} = E_1 \cdot \text{addr}$
 $\quad E \cdot code = E_1 \cdot code \}$

$| id \quad \{ E \cdot \text{addr} = \text{top} \cdot \text{get } (id \cdot \text{lexeme})$
 $\quad E \cdot code = '' \}$
 $| num \quad \{ E \cdot \text{addr} = \text{new Temp} ()$
 $\quad E \cdot code = \text{gen } (E \cdot \text{addr}' = num \cdot \text{lex val})$

$P \Rightarrow S \quad \{ s.next = \text{new label} ()$
 $\quad P \cdot code = S \cdot code \text{ || label } (S \cdot next) \}$

$S \Rightarrow \text{assign} \quad \{ S \cdot code = \text{assign} \cdot code \}$

$S \Rightarrow \text{if } (B) S_1 \quad \{ B \cdot \text{true} = \text{new label} ()$
 $\quad B \cdot \text{false} = S_1 \cdot \text{next} = S \cdot \text{next}$
 $\quad S \cdot code = B \cdot code \text{ || label } (B \cdot \text{true}) \text{ || } S_1 \cdot code \}$

$S \Rightarrow \text{if } (B) S_1 \text{ else } S_2 \quad \{ B \cdot \text{true} = \text{new label} ()$
 $\quad B \cdot \text{false} = \text{new label} ()$
 $\quad S_1 \cdot \text{next} = S_2 \cdot \text{next} = S \cdot \text{next}$
 $\quad S \cdot code = B \cdot code \text{ || label } (B \cdot \text{true}) \text{ || } S_1 \cdot code \text{ || gen } ('goto' S \cdot \text{next}) \text{ || label } (B \cdot \text{false}) \text{ || } S_2 \cdot code \}$

$S \Rightarrow \text{while } (B) S_1 \quad \{ \text{begin} = \text{new label} ()$
 $\quad B \cdot \text{true} = \text{new label} ()$
 $\quad B \cdot \text{false} = S \cdot \text{next}$
 $\quad S_1 \cdot \text{next} = \text{begin}$
 $\quad S \cdot code = \text{label } (\text{begin}) \text{ || } B \cdot code \text{ || label } (B \cdot \text{true}) \text{ || } S_1 \cdot code \text{ || gen } ('goto' \text{ begin}) \}$

$S \Rightarrow S_1 S_2 \quad \{ S_1 \cdot \text{next} = \text{new label} ()$
 $\quad S_2 \cdot \text{next} = S \cdot \text{next}$
 $\quad S \cdot code = S_1 \cdot code \text{ || label } (S_1 \cdot \text{next}) \text{ || } S_2 \cdot code \}$

$B \Rightarrow B_1 \text{ || } B_2 \quad \{ B_1 \cdot \text{true} = B \cdot \text{true}$
 $\quad B_1 \cdot \text{false} = \text{new label} ()$
 $\quad B_2 \cdot \text{true} = B \cdot \text{true}$
 $\quad B_2 \cdot \text{false} = B \cdot \text{false}$
 $\quad B \cdot code = B_1 \cdot code \text{ || label } (B_1 \cdot \text{false}) \text{ || } B_2 \cdot code \}$

$B \Rightarrow B_1 \& B_2 \quad \{ B_1 \cdot \text{true} = \text{new label} ()$
 $\quad B_1 \cdot \text{false} = B \cdot \text{false}$
 $\quad B_2 \cdot \text{true} = B \cdot \text{true}$
 $\quad B_2 \cdot \text{false} = B \cdot \text{false}$
 $\quad B \cdot code = B_1 \cdot code \text{ || label } (B_1 \cdot \text{true}) \text{ || } B_2 \cdot code \}$

$B \Rightarrow !B_1 \quad \{ B_1 \cdot \text{true} = B \cdot \text{false}$
 $\quad B_1 \cdot \text{false} = B \cdot \text{true}$
 $\quad B \cdot code = B_1 \cdot code \}$

$B \Rightarrow E_1 \text{ rel } E_2 \quad \{ B \cdot code = E_1 \cdot code \text{ || } E_2 \cdot code$
 $\quad \text{|| gen } ('if' E_1 \cdot \text{addr} \text{ rel op } E_2 \cdot \text{addr} 'goto' B \cdot \text{true})$
 $\quad \text{|| gen } ('goto' B \cdot \text{false})$

$B \Rightarrow \text{true} \quad \{ B \cdot code = \text{gen } ('goto' B \cdot \text{true}) \}$

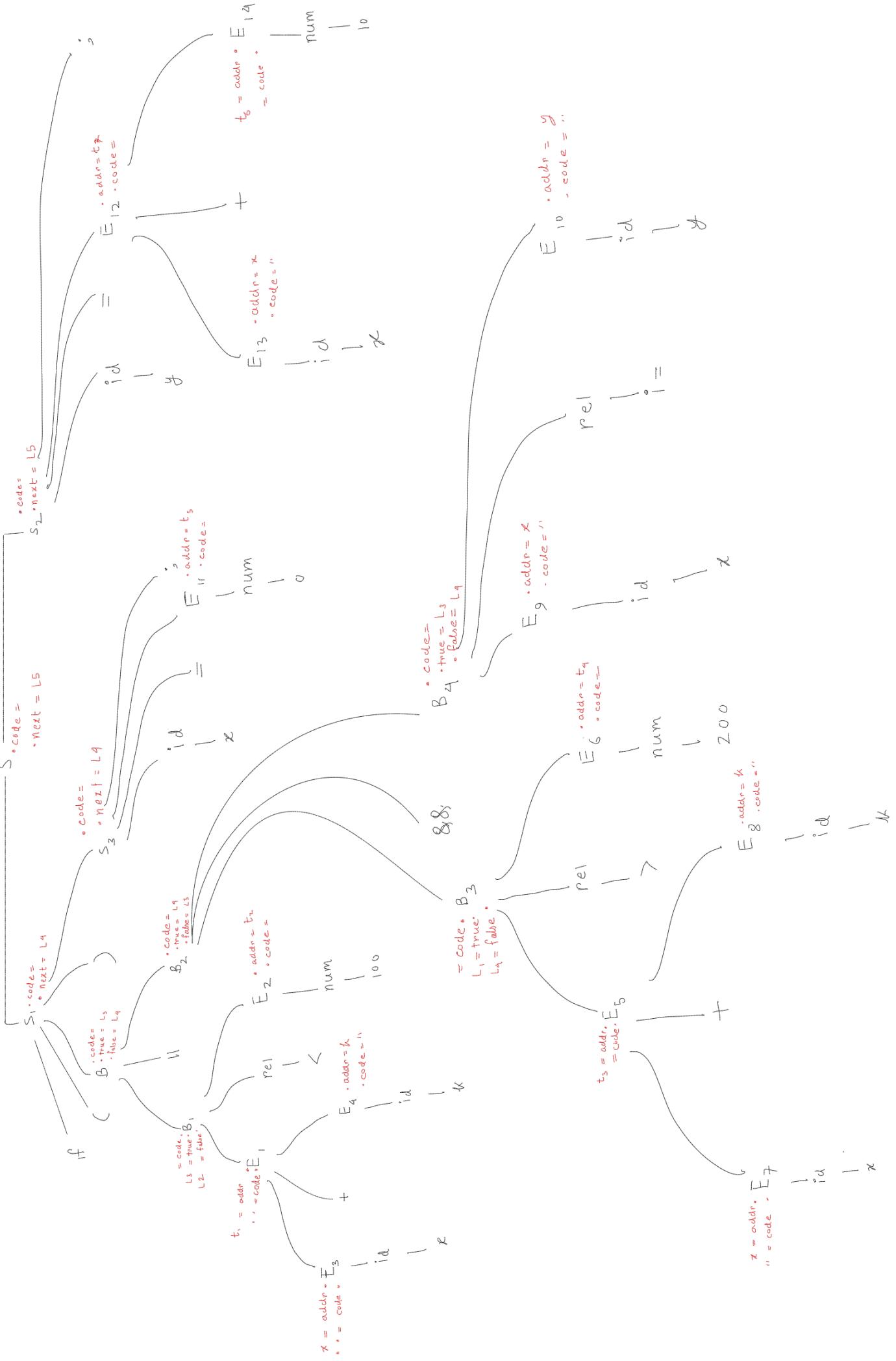
$B \Rightarrow \text{false} \quad \{ B \cdot code = \text{gen } ('goto' B \cdot \text{false}) \}$

Now generate TAC for the following input string using the given SDD.

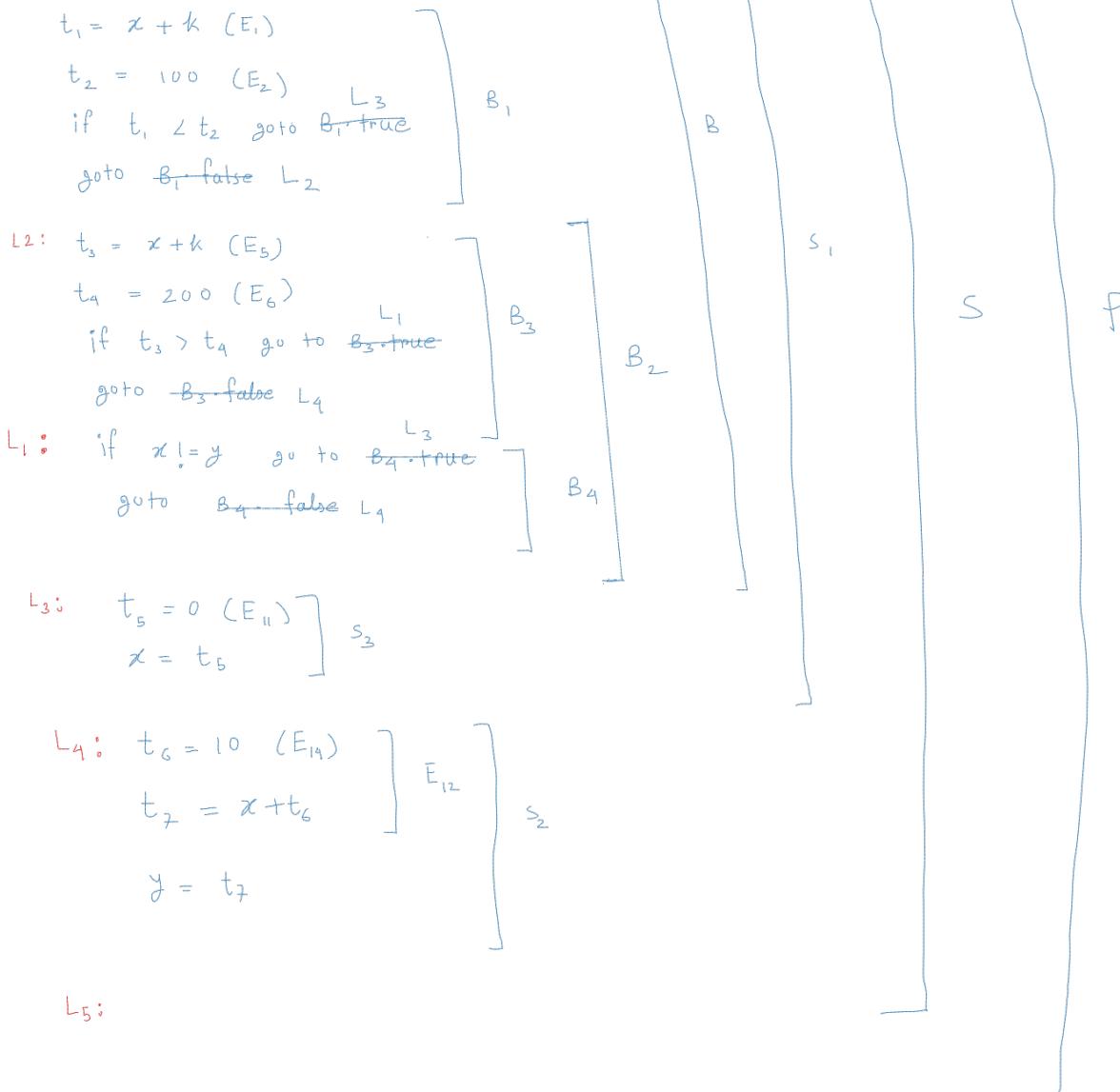
$\text{if } (x+k < 100 \text{ || } x+k > 200 \text{ && } x \neq y)$

$x = 0;$
 $y = x + 10;$

$p \cdot code =$



Three Address Code:



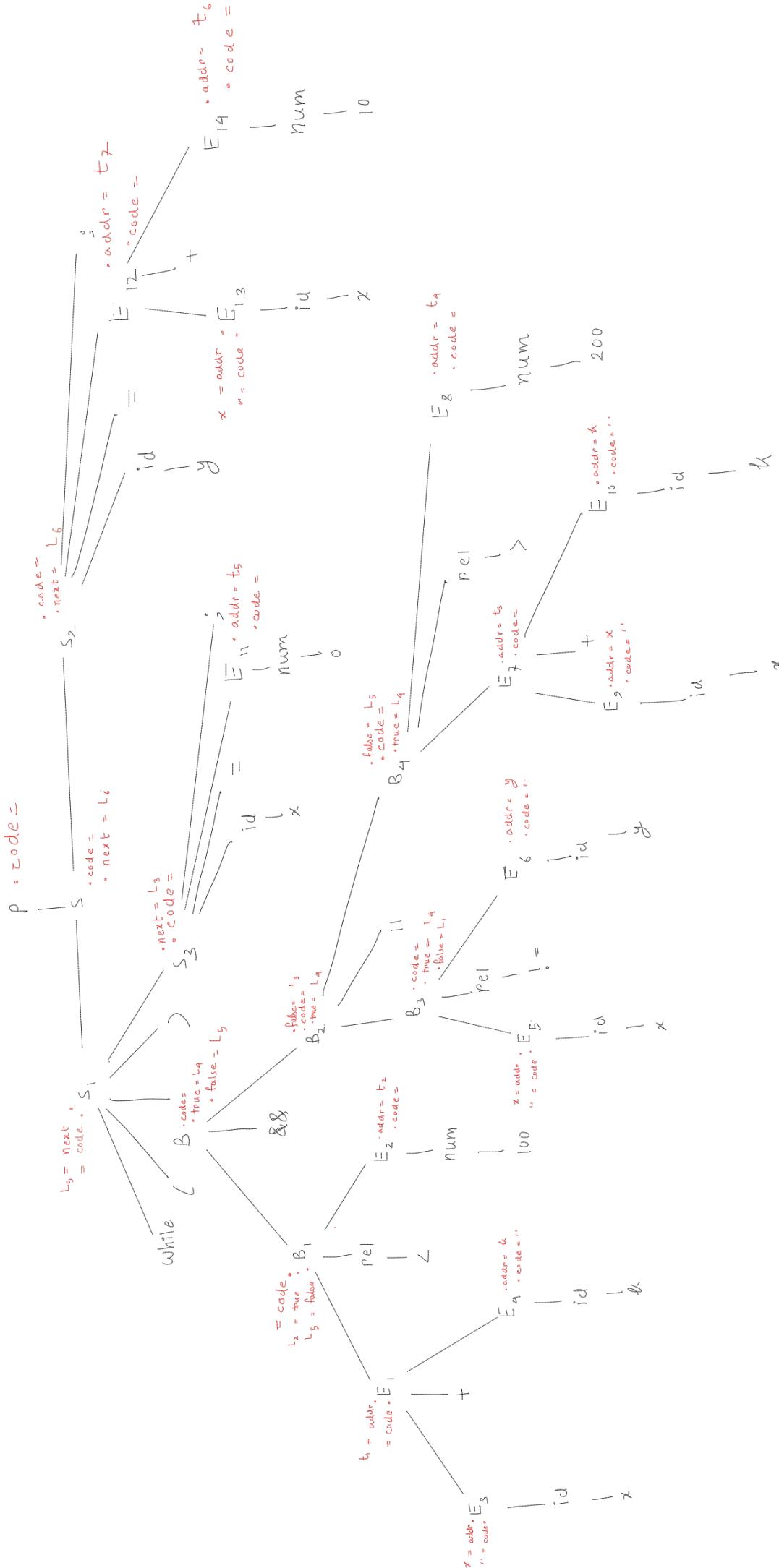
Generate the TAC for the following input string given the SDD rules.

while ($x+k < 100 \& \& x \neq y \text{ || } x+k > 200$)

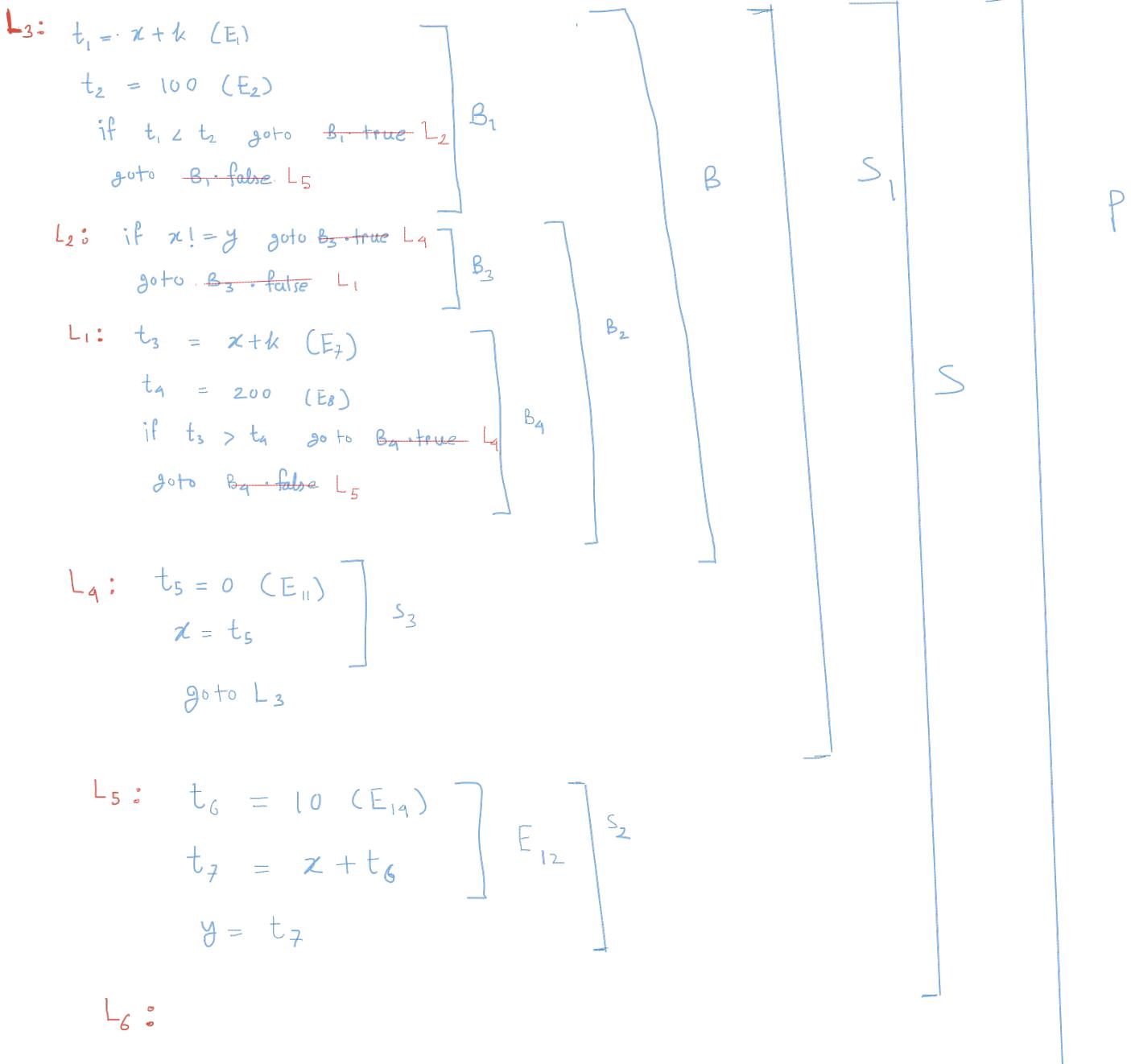
$x = 0;$

$y = x+10$

`begin = L3 且 T3?`



Three Address Code:



while ($x + k \leq 100 \text{ \& \& } x \neq y \text{ || } x + k > 200$)

$x = 0;$

$y = x + 10$