

1) $i = m - 1$

2) $j = n$

3) $t1 = 4 * n$

4) $v = a[t1]$

B₁

5) $i = i + 1$

6) $t2 = 4 * i$

7) $t3 = a[t2]$

B₂

8) if $t3 < v$ goto (5) B₃

9) $j = j - 1$

10) $t4 = 4 * j$

11) $t5 = a[t4]$

B₄

12) if $t5 < v$ goto (9) B₅

13) if $i > j$ goto (23) B₆

14) $t6 = 4 * i$

15) $x = a[t6]$

16) $t7 = 4 * i$

17) $t8 = 4 * j$

18) $t9 = a[t8]$

19) $a[t7] = t9$

20) $t10 = 4 * j$

21) $a[t10] = x$

22) goto (5)

23) $t11 = 4 * i$

24) $x = a[t11]$

25) $t12 = 4 * i$

26) $t13 = 4 * n$

27) $t14 = a[t13]$

28) $a[t12] = t14$

29) $t15 = 4 * n$

30) $a[t15] = x$

B1
 $i = m - 1$
 $j = n$
 $t1 = 4 + n$
 $v = a[t1]$

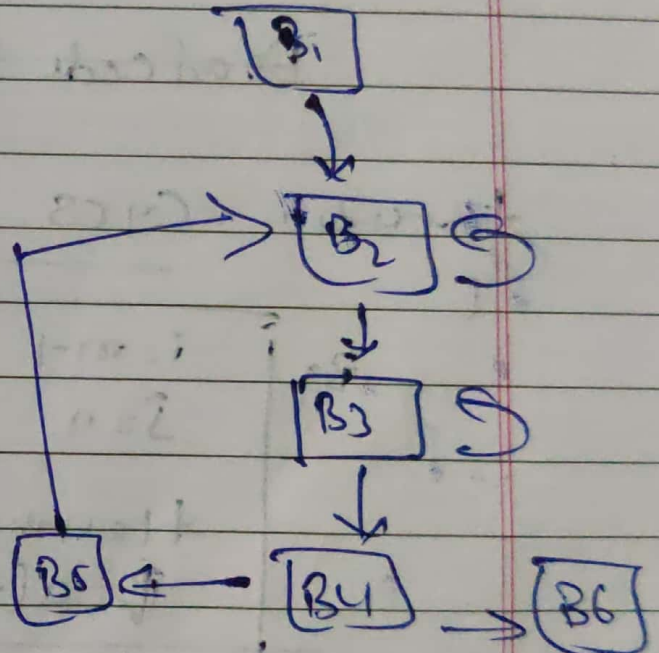
B2
 $i = i + 1$
 $t2 = 4 + i$
 $t3 = a[t2]$
 if $t3 < v$ goto B2

B3
 $j = j - 1$
 $t4 = 4 + j$
 $t5 = a[t4]$
 if $t5 < v$ goto B3

B4
 if $i \geq j$ goto B6

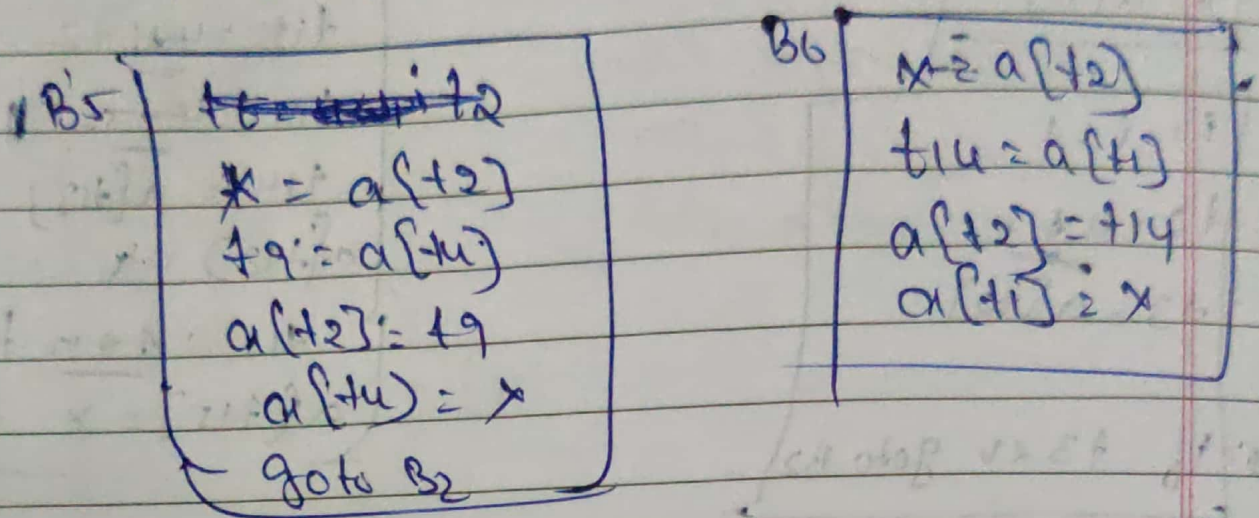
B5
 $t6 = 4 + i + t2$
 $x = a[t6]$
 $t7 = 4 + i + t2$
 $t8 = 4 + t4$
 $t9 = a[t8]$
 $a[t7] = t9$
 $t10 = 4 + i + t4$
 $a[t10] = x$
 goto B2

B6
 $t11 = 4 + i + t2$
 $x = a[t11]$
 $t12 = 4 + i + t2$
 $t13 = 4 + t4 + t2$
 $t14 = a[t13]$
 $a[t12] = t14$
 $t15 = 4 + n + t1$
 $a[t15] = x$



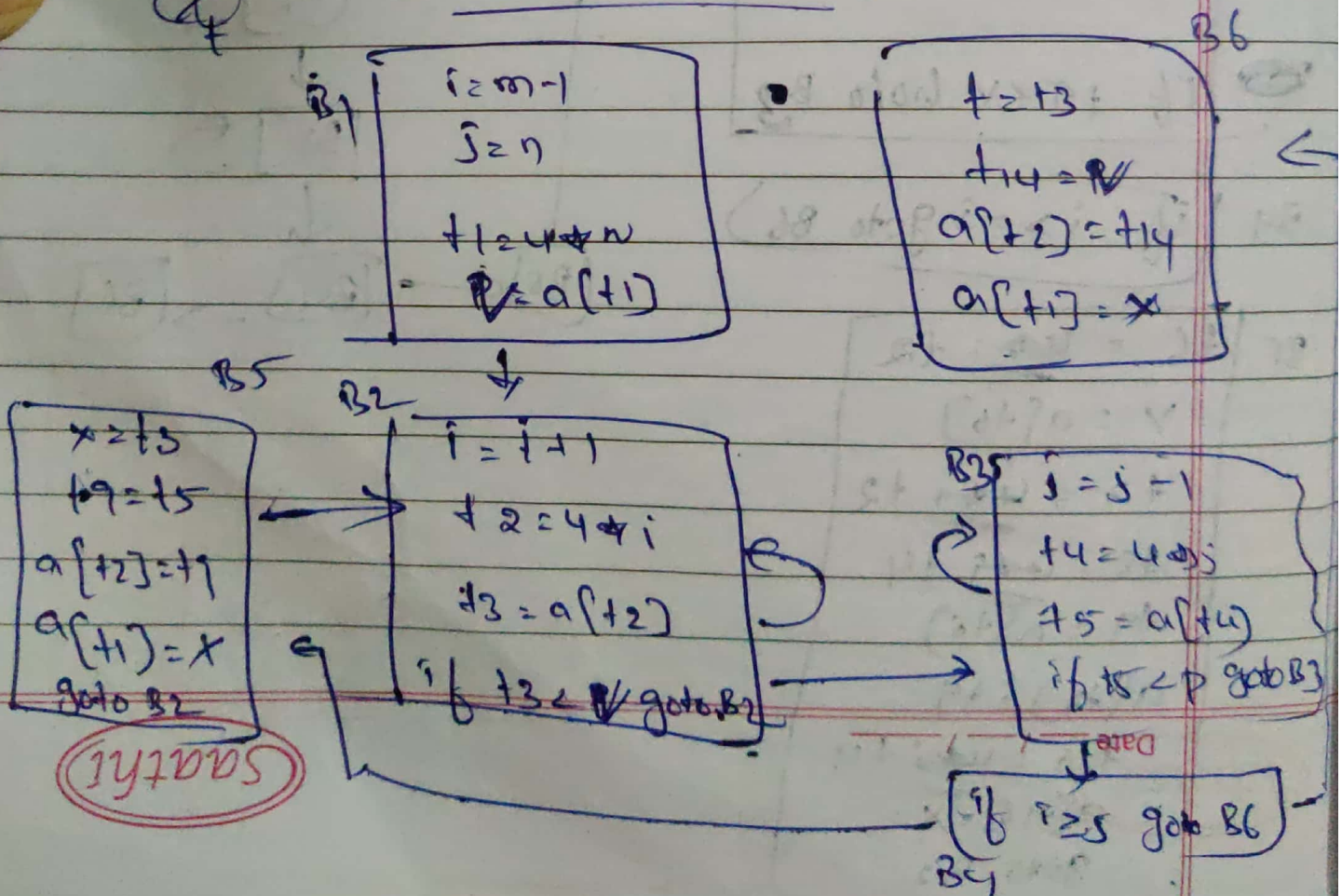
Copy Propagate

Remove $t_6, t_7, t_8, t_{10}, t_{11}, t_{12}, t_{13}, t_{15}$



Deadcode Elimination for $t_9, t_{10}, t_{12}, t_{15}$

CRCS Elimination



Copy propagation on x, t3, t4

B5

$$x = t3$$

$$t9 = t5$$

$$a[t2] = t5$$

$$a[t4] = t3$$

goto B2

B6

$$t = t3$$

$$t14 = v$$

$$a[t2] = v$$

$$a[t1] = t3$$

Deadcode Elimination

B5

$$a[t2] = t5$$

$$a[t4] = t3$$

goto B2

B6

$$a[t2] = v$$

$$a[t1] = t3$$

Strength Reduction

$$i = m - 1$$

$$j = n$$

$$t1 = 4 * n$$

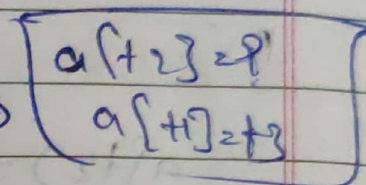
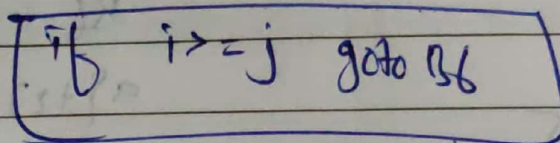
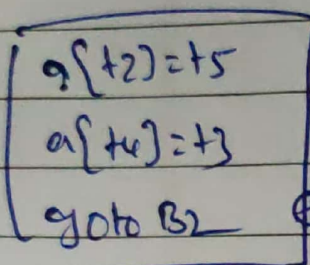
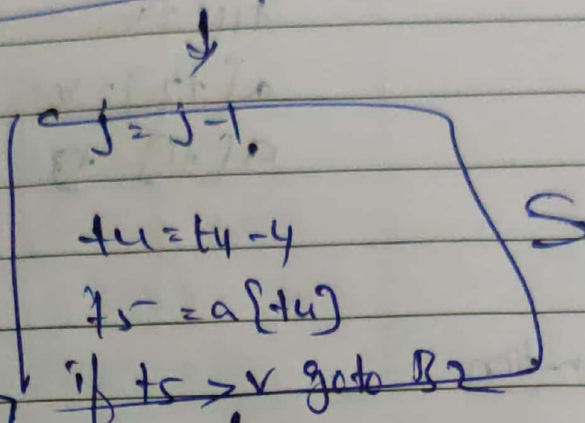
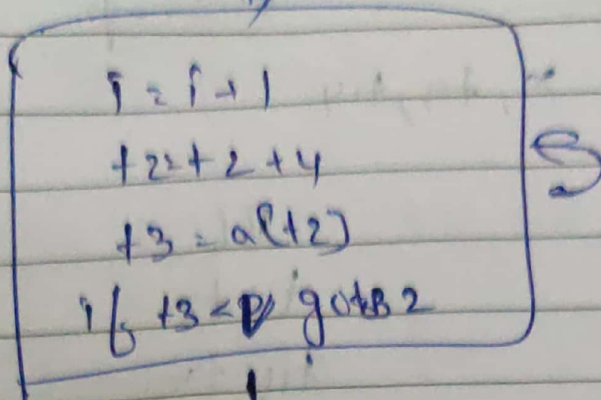
$$v = a[t1]$$

$$t2 = 4 * j$$

$$t4 = 4 * i$$

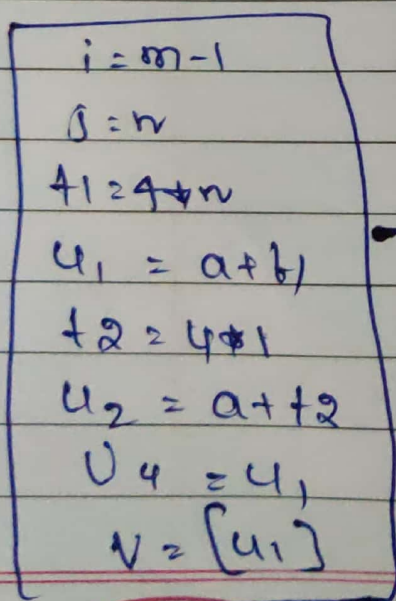


Date

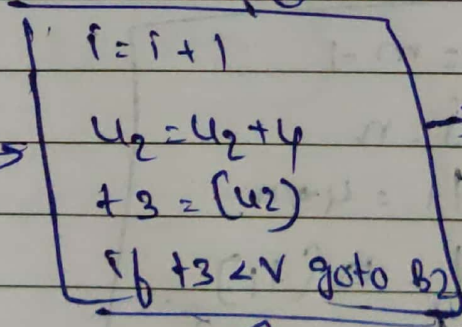


Induction Variables

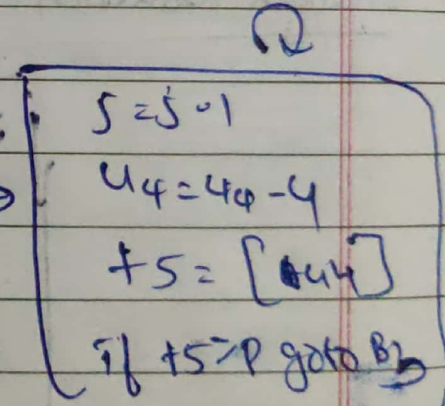
B1



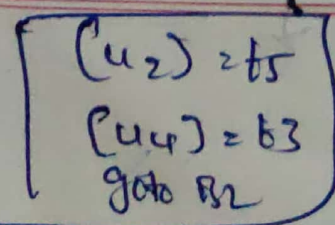
B2



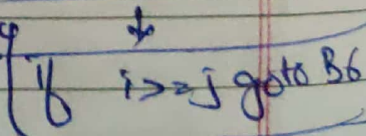
B2



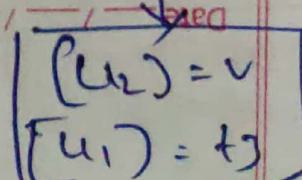
B5



B4



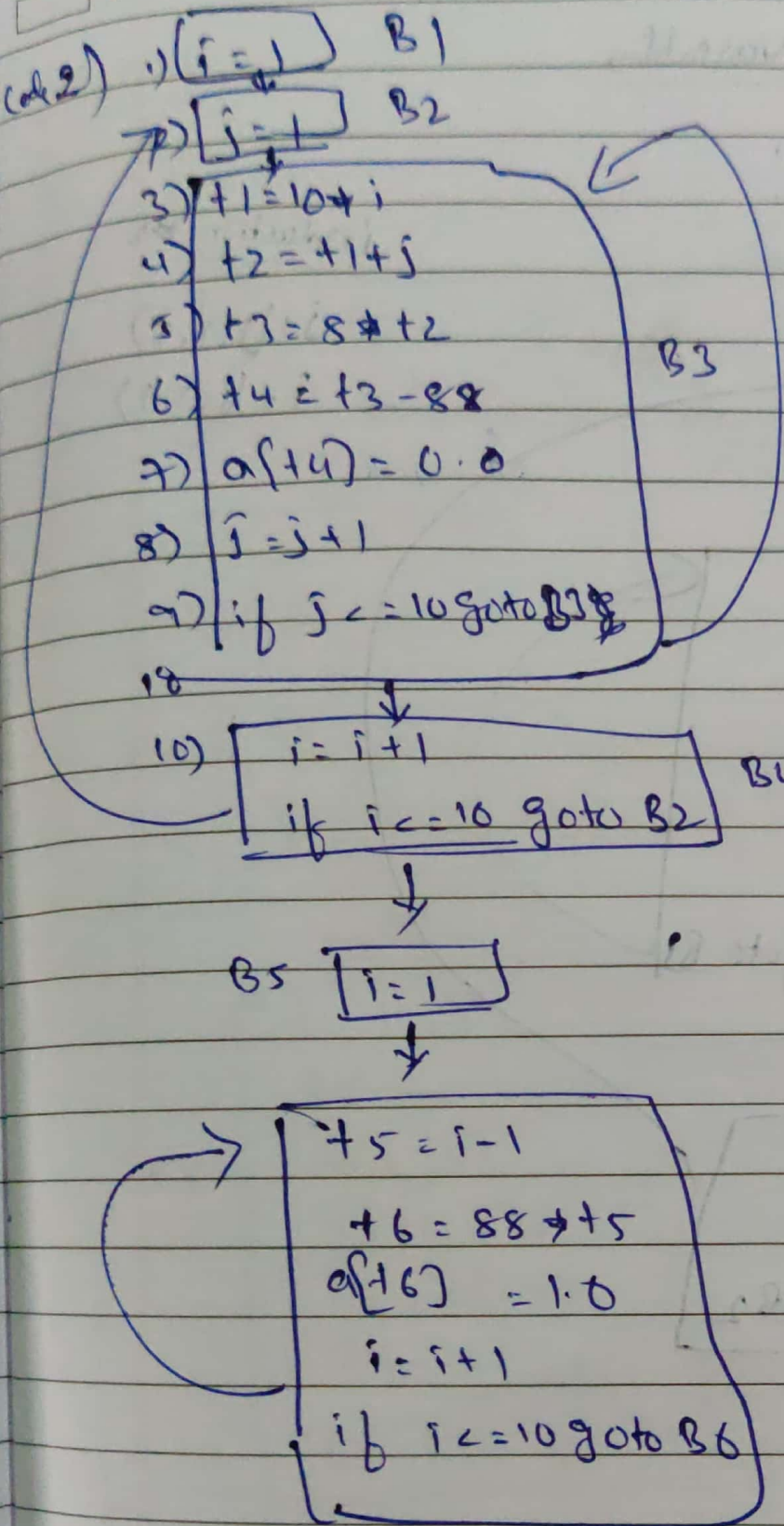
B6



Saathi

N. Niranjan

N. Niranjan



- NO GCSE
- No copy prop
- No loop invariant
- Induction variable

Eliminating Induction Variables

B1 $i \geq 1$
 $A1 = 10 \div i$

B2 $j \geq 1$

B3 $t2 = t1 + j$
 $t3 = 8 \times t2$
 $t4 = t3 - 88$
 $a[t4] = 0.0$
 $j = j + 1$
 $\text{if } j < 10 \text{ goto B3}$

B4 $i = i + 1$
 $t1 = t1 + 10$
 $\text{if } i < 10 \text{ goto B2}$

B5 $i = 1$

B6 $t5 = i - 1$
 $t6 = 88 \div t5$
 $a[t6] = 1.0$
 $i = i + 1$
 $\text{if } i > 10 \text{ goto B5}$

induction var

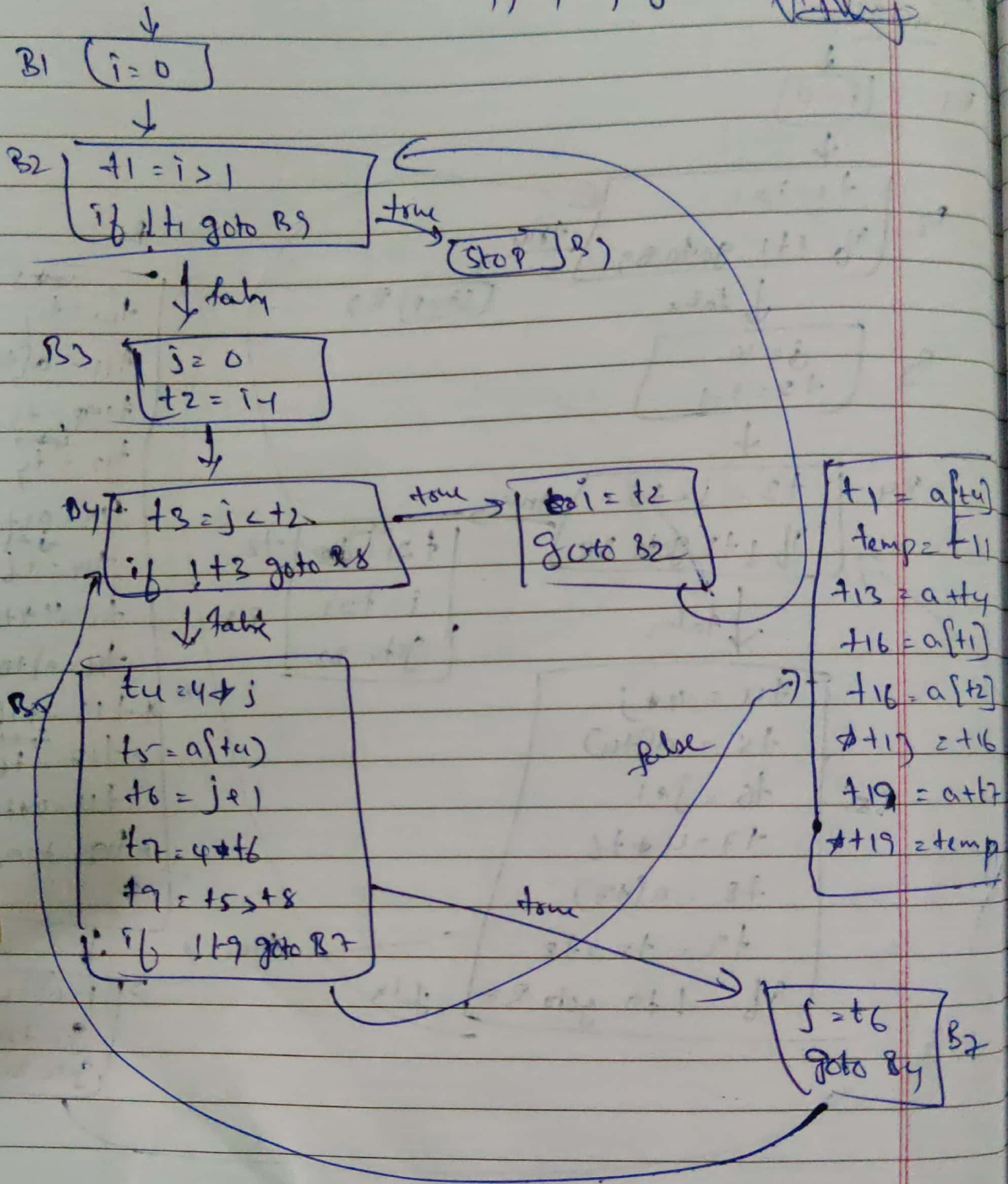
$j: (j, 1, 1)$
 $i: (i, 1, 1)$

Saathi

Date ____/____/____

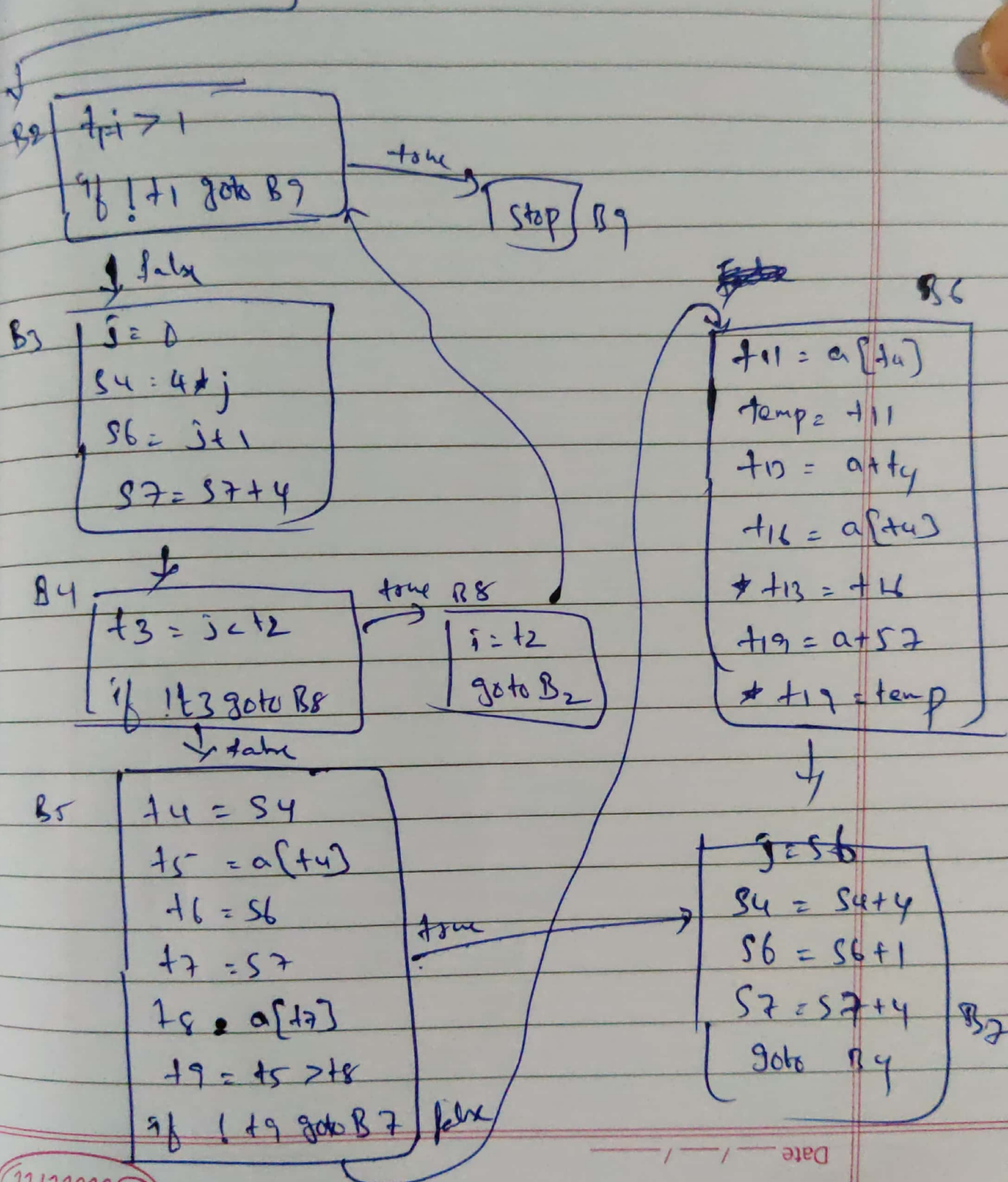
Wahp





IV detection & CSB + ripple for IV

$i = 0$



Saathi