

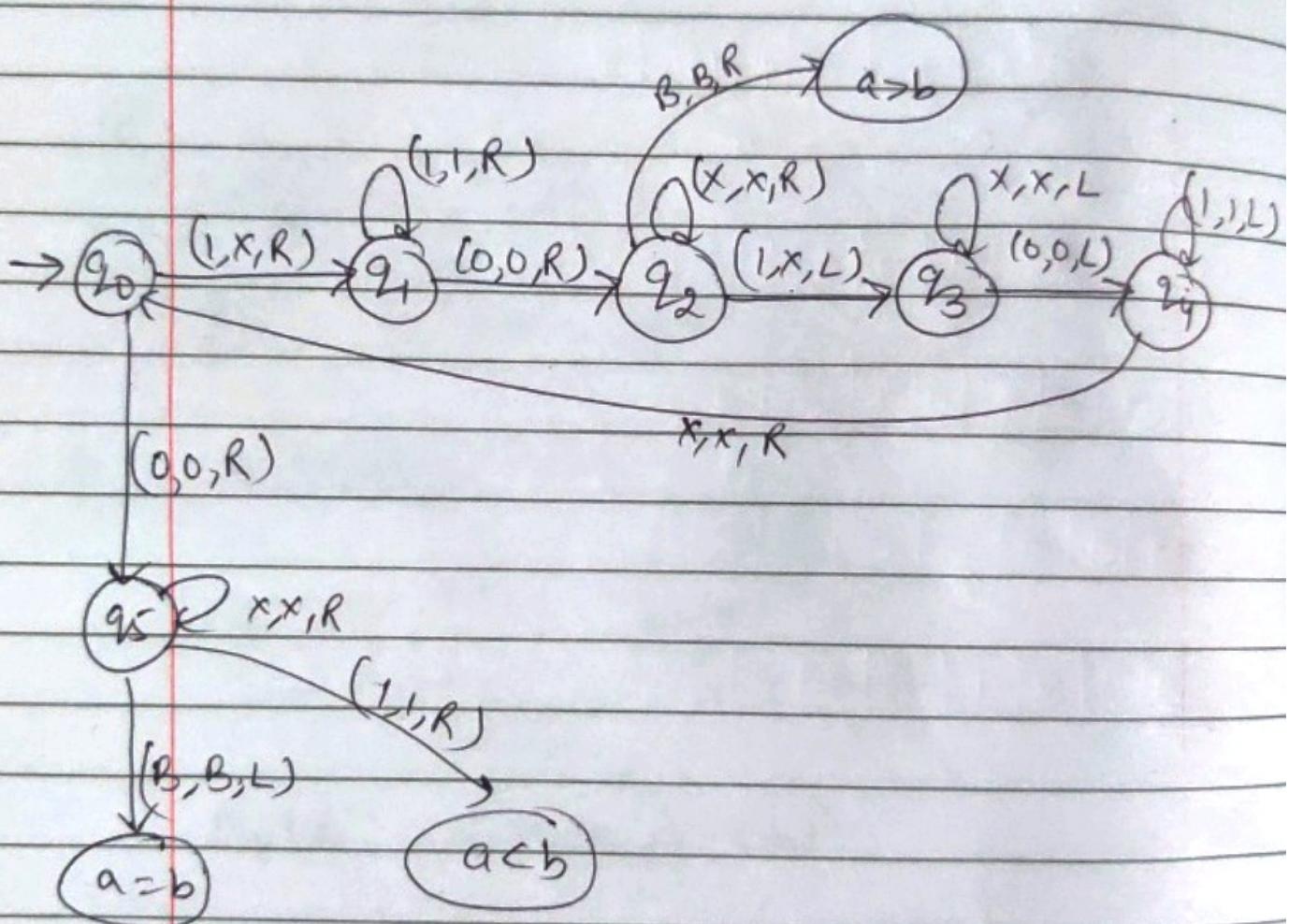
Design a TM as a Comparator

$a = b$

$a > b$

$a < b$

a Separator b
 ||| 0 ||| (a = b)
 ||| | | | (a > b)
 || 0 | | (a < b)



Design a TM as an Adder (Addition)

$$a = 4$$

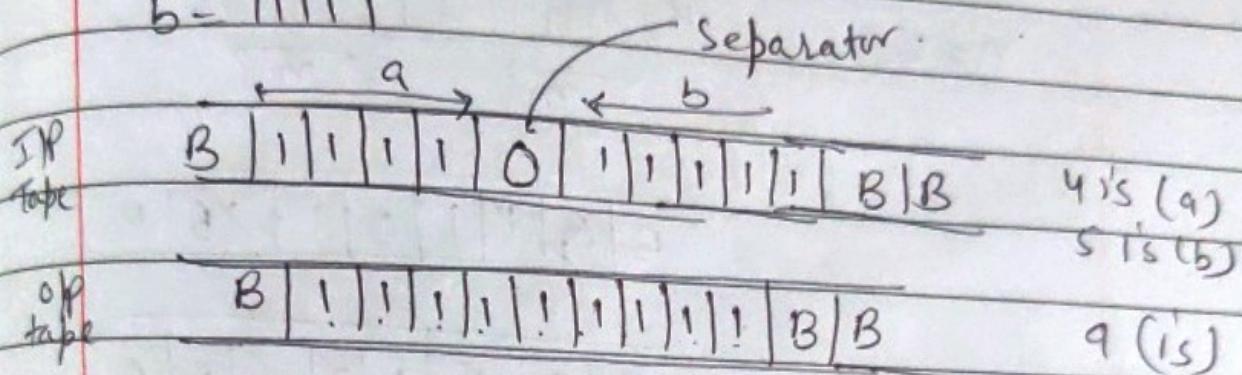
$$a+b = 9$$

$$b = 5$$

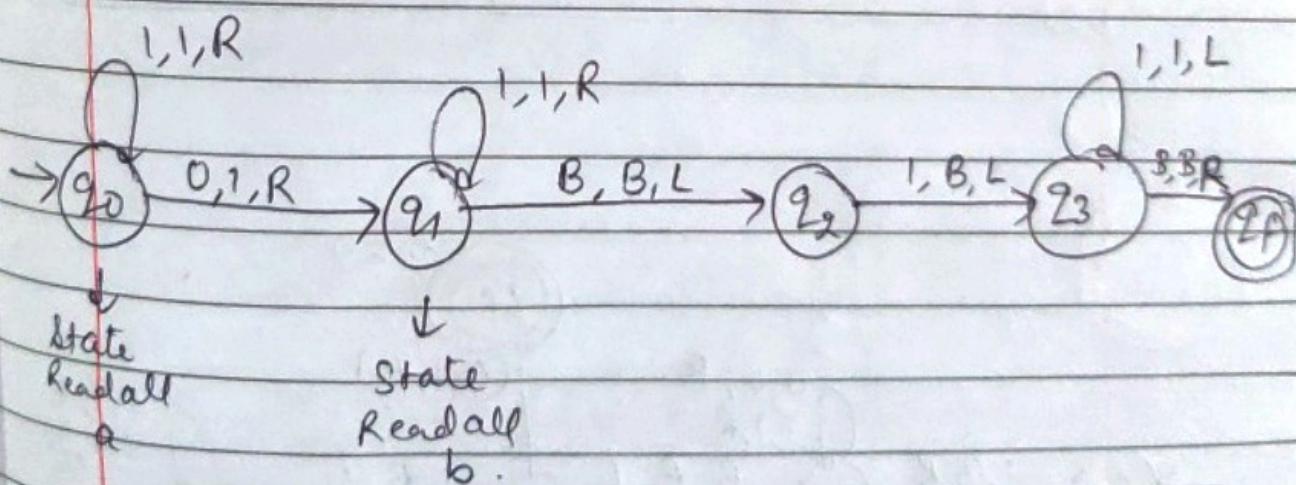
Convert a in unary

$$a = 1111$$

$$b = 11111$$



OP tape: $B|1|1|1|1|1|1|1|1|1|1|B|B$ 9 (1's)

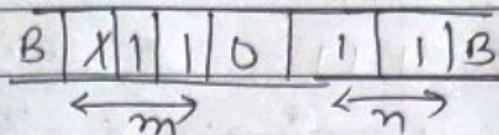


Design a TM for subtract 2 nos.

$$f(m, n) = \begin{cases} m-n & \text{if } m > n \\ 0 & \text{if } m \leq n \end{cases}$$

$$m = 3$$

$$n = 2$$

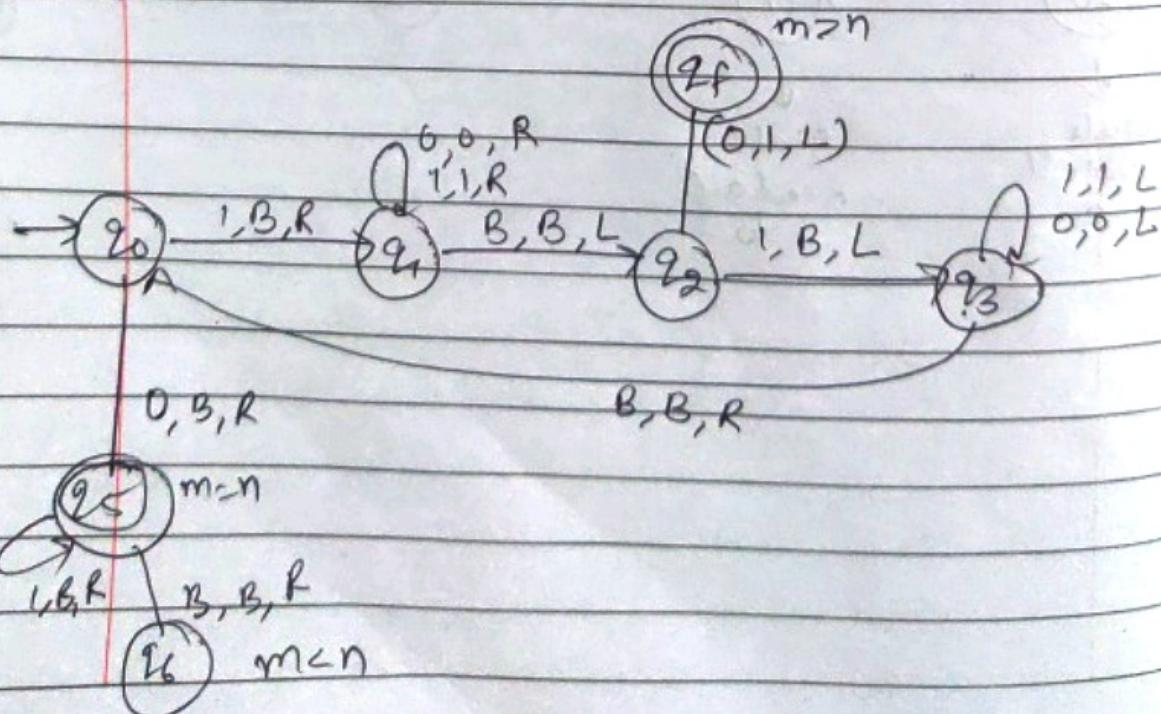


B | B | x | 1 | 0 | 1 | xB | B

B | B | x_B | 1 | 0 | 1_B | B | B

B | B | B | x_B | 0 | B | B | B

B | B | B | B | 1 | B | B | B



Design a TM for multiplication

$$x=3$$

$$y=2$$

$$x \times y = 6$$

$B|B|1|1|0|1|1|1|0|B|B|B$

$B|B|x|1|0|x|1|1|0|B|B|B$

$B|B|B|1|0|x|x|x|0|1|B|B|$

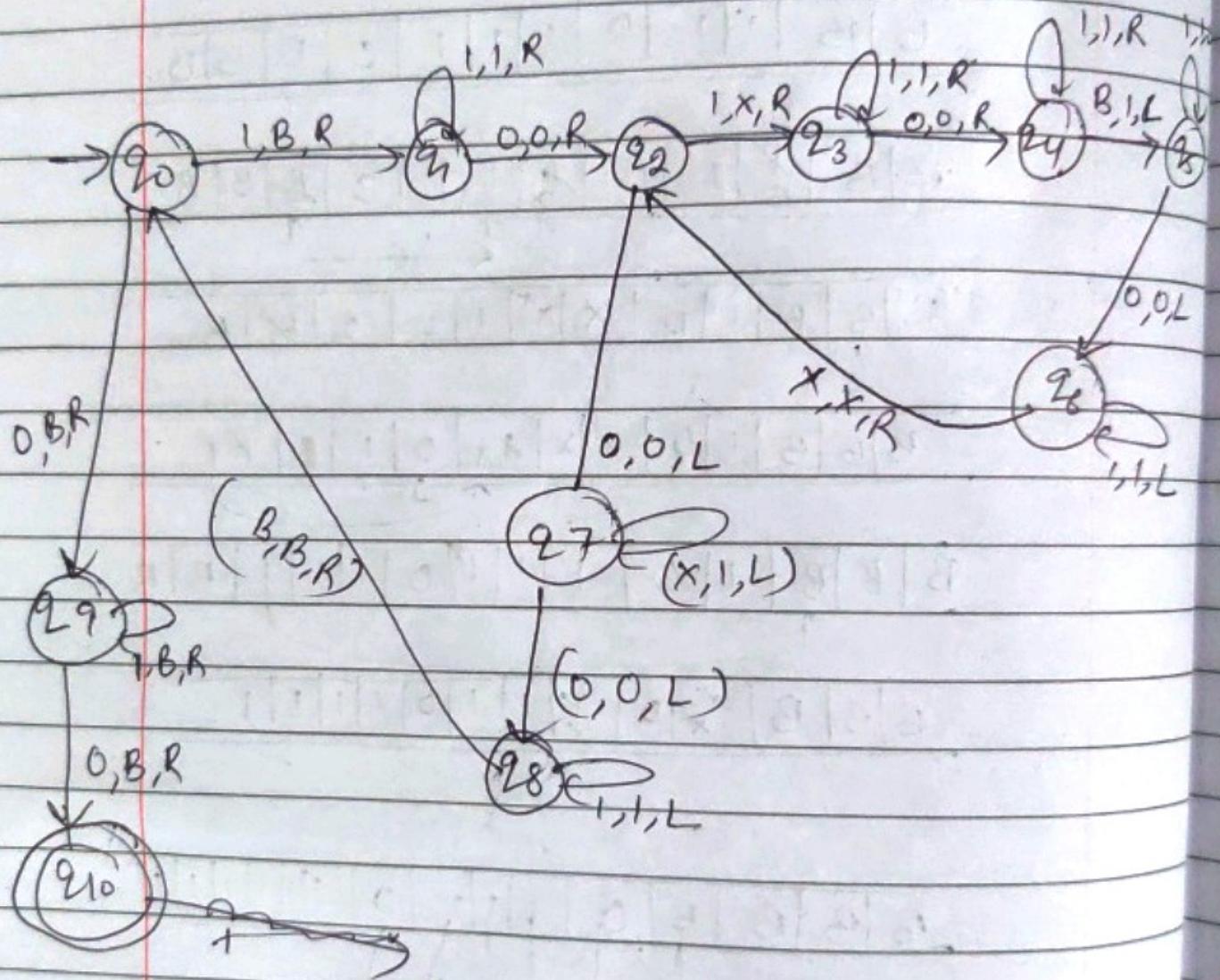
$B|B|B|1|0|x|x|x|0|1|B|B|$

$B|B|B|1|0|1|x|x|x|0|1|1|B|B$

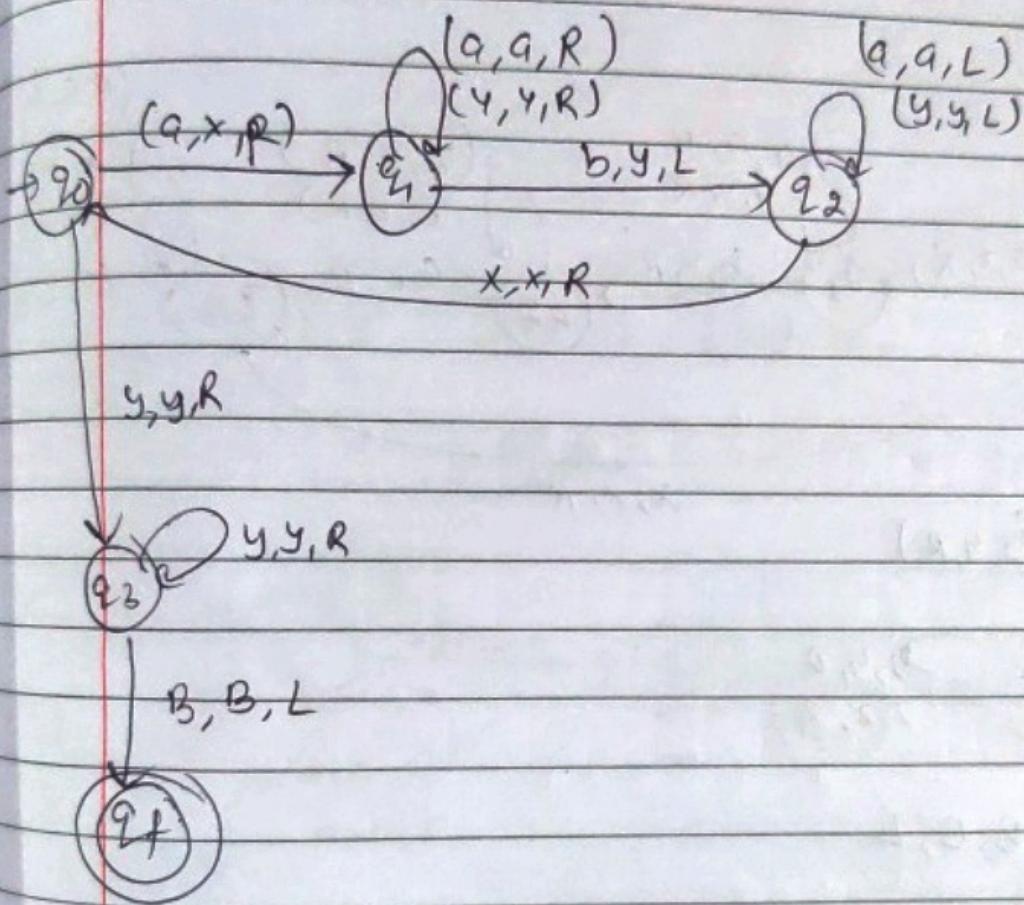
$B|B|B|x|0|x|1|1|0|1|1|1|$

$B|B|B|B|0|1|1|1|0|1|1|1|1|1|$

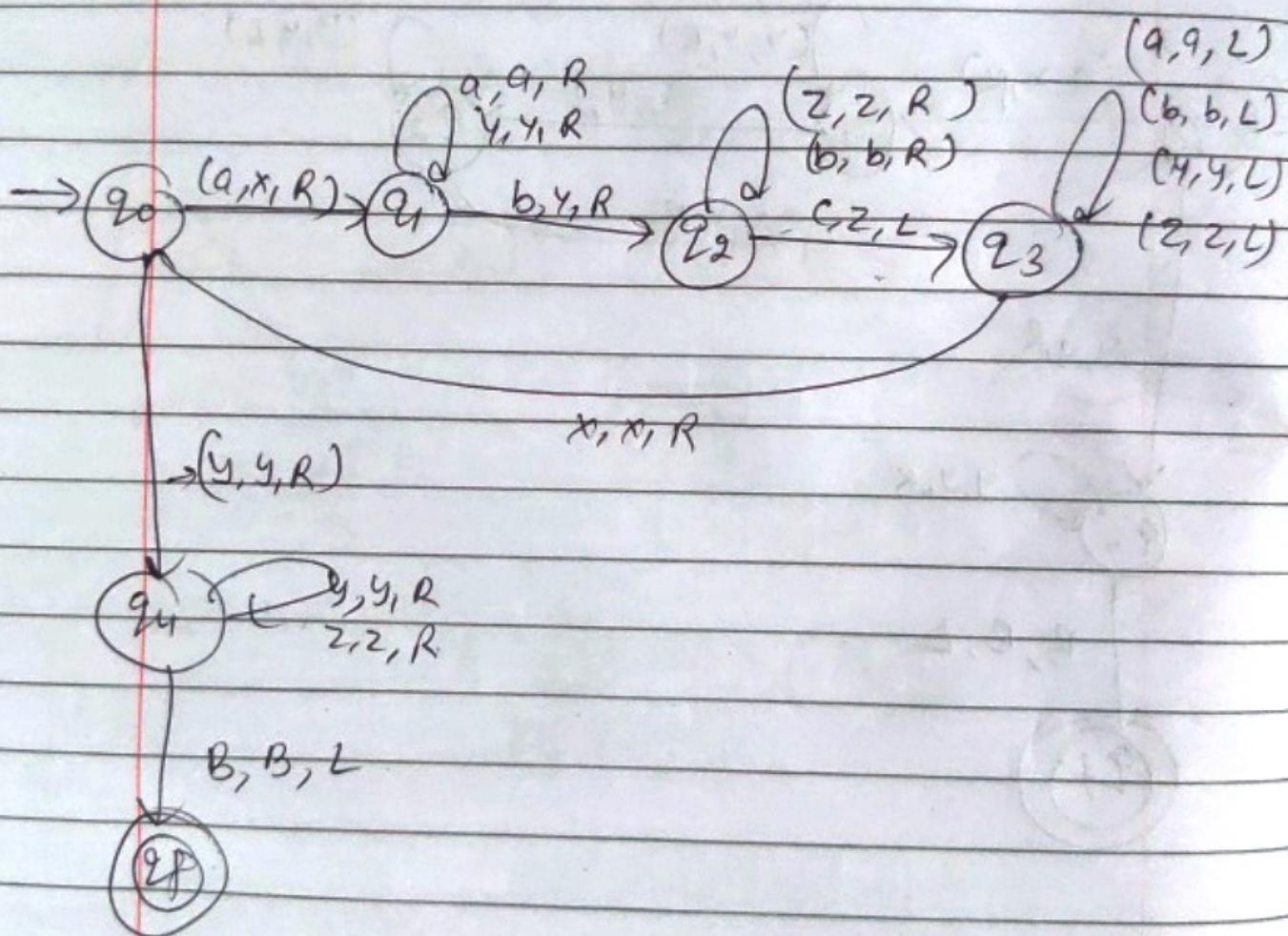
$B|B|B|B|B|B|B|B|B|1|1|1|1|1|1|$



Design a TM for $a^n b^n | n \geq 1$

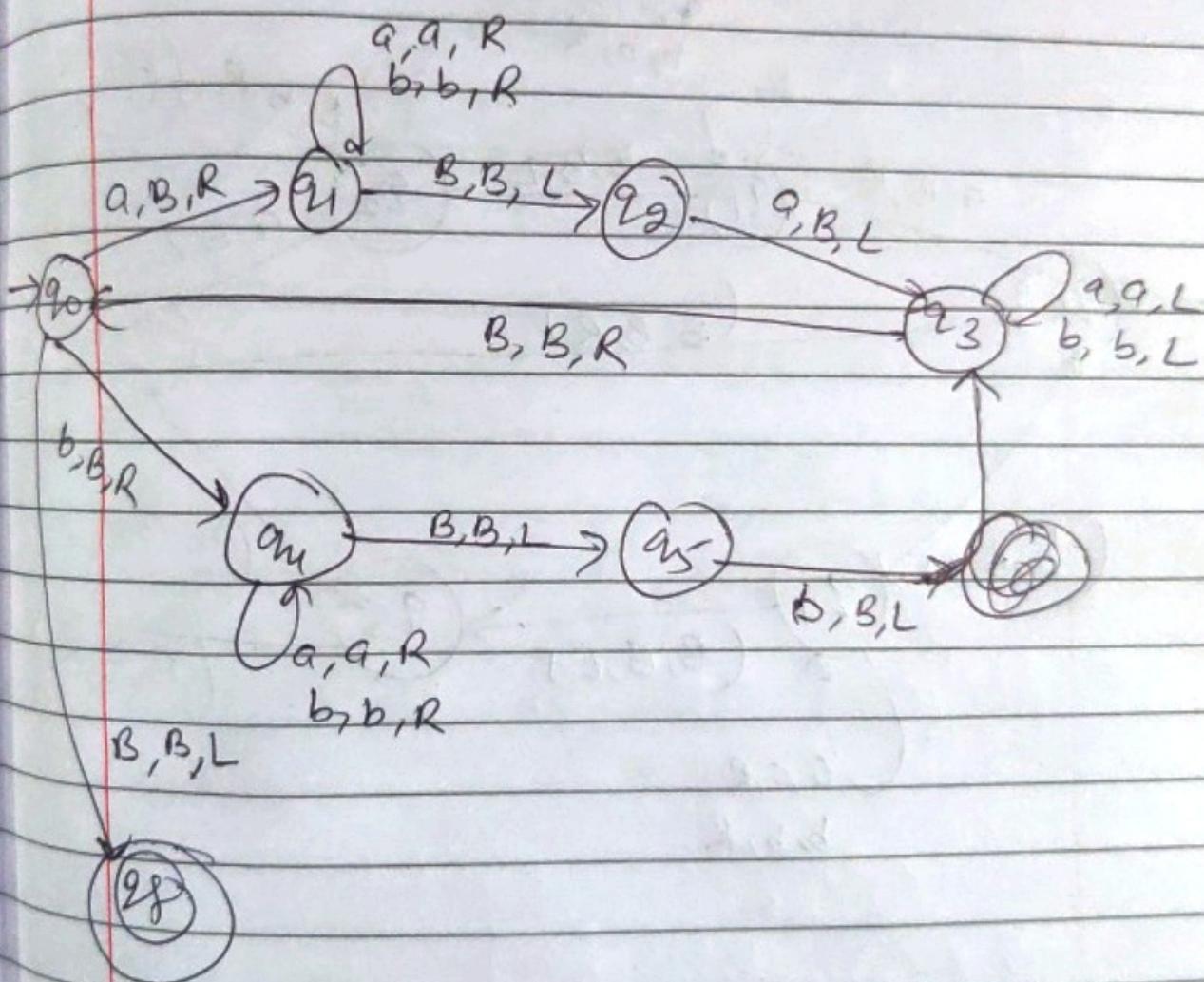


Design a TM for $a^n b^n c^n \mid n \geq 1$



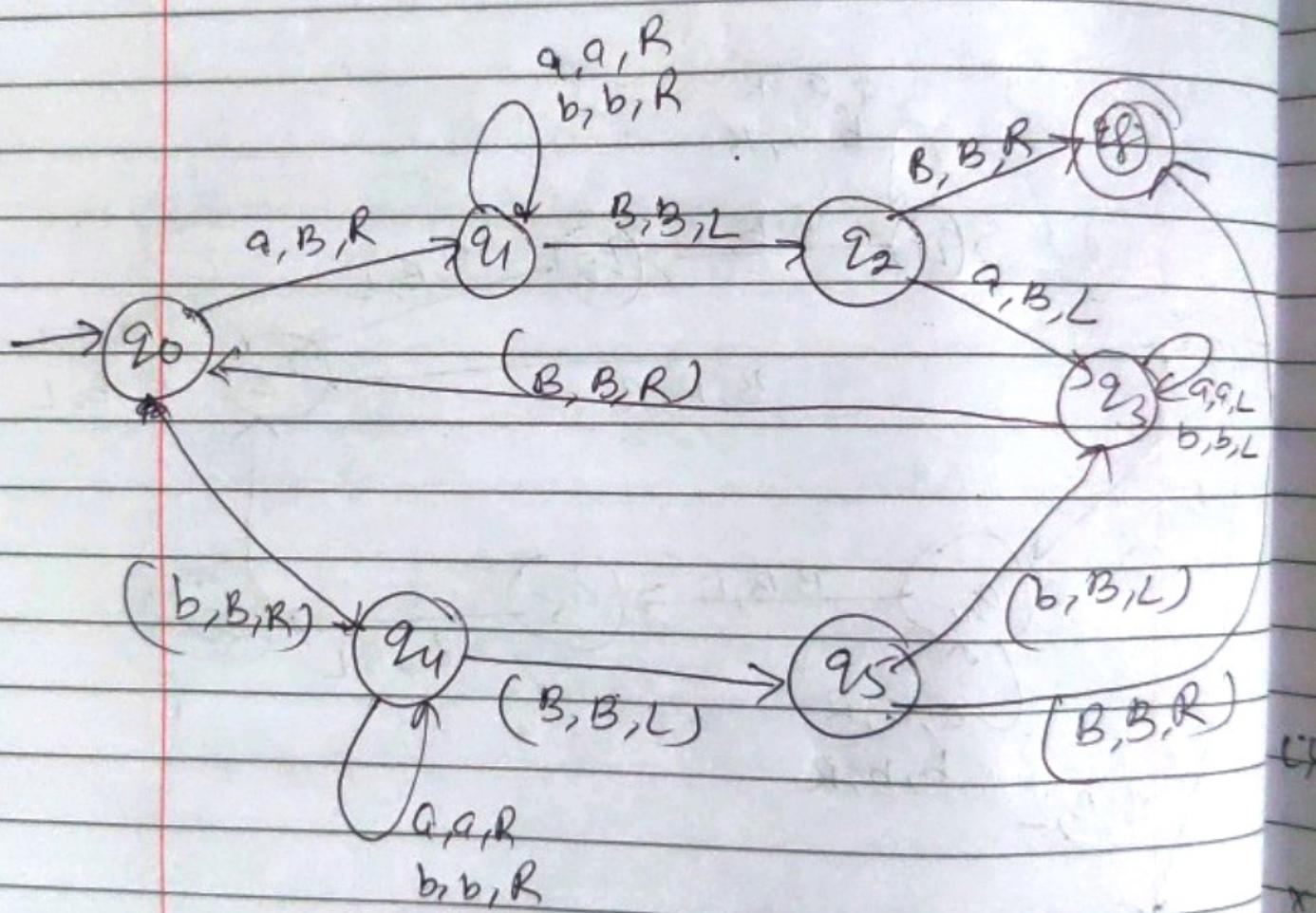
Design a TM for ww^{σ}

Design a TM for Even Palindrome

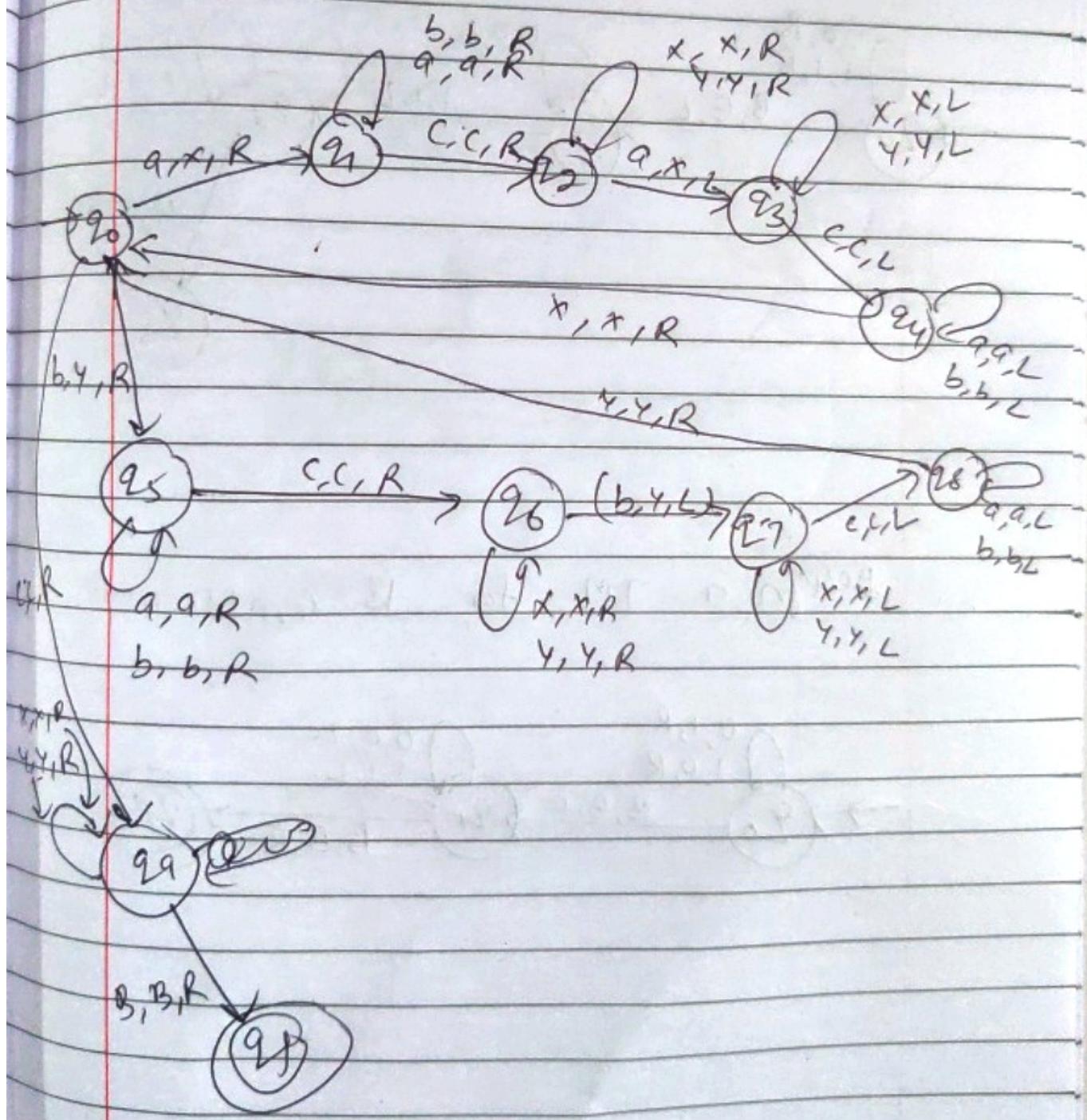


Design a TM for Odd Palindrome

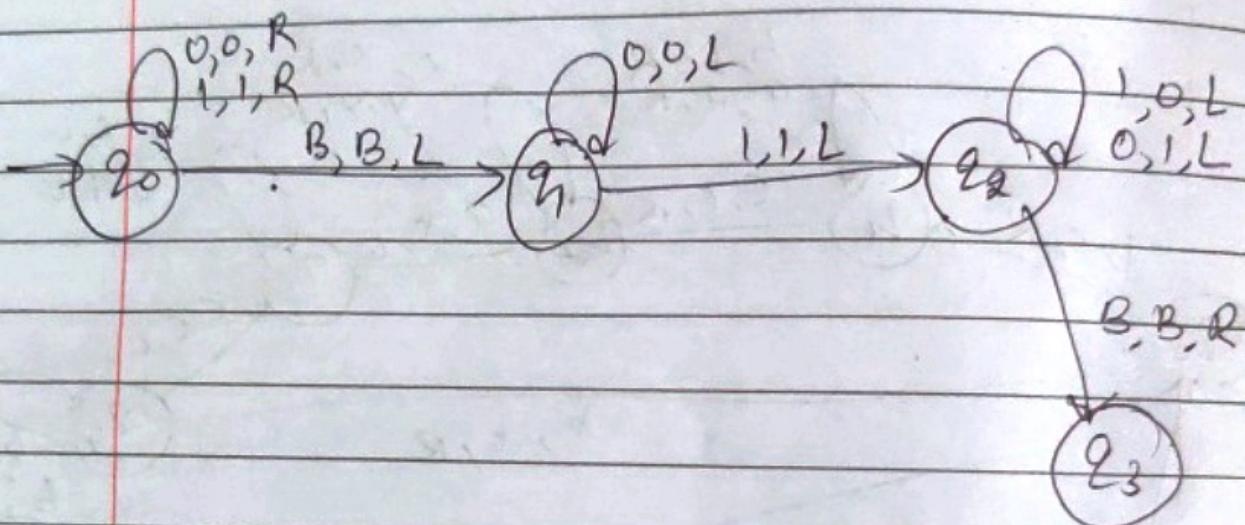
~~waw~~ | waw^R | wbw^R
wb(a,b)*



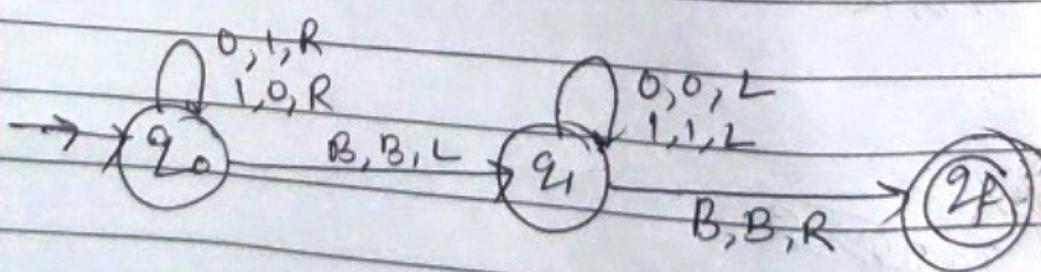
Design a TM for
w $\in \{a, b\}^*$ such that
 $w \in C(a, b)^*$



Design a TM for 2's complement



Design a TM for 1's complement



Design a TM for

$wcwr$

$w \in (a, b)^*$

