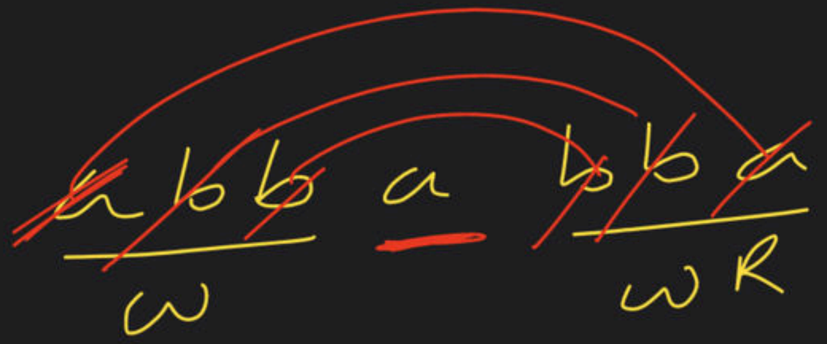
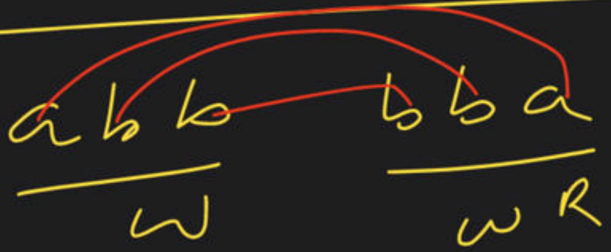
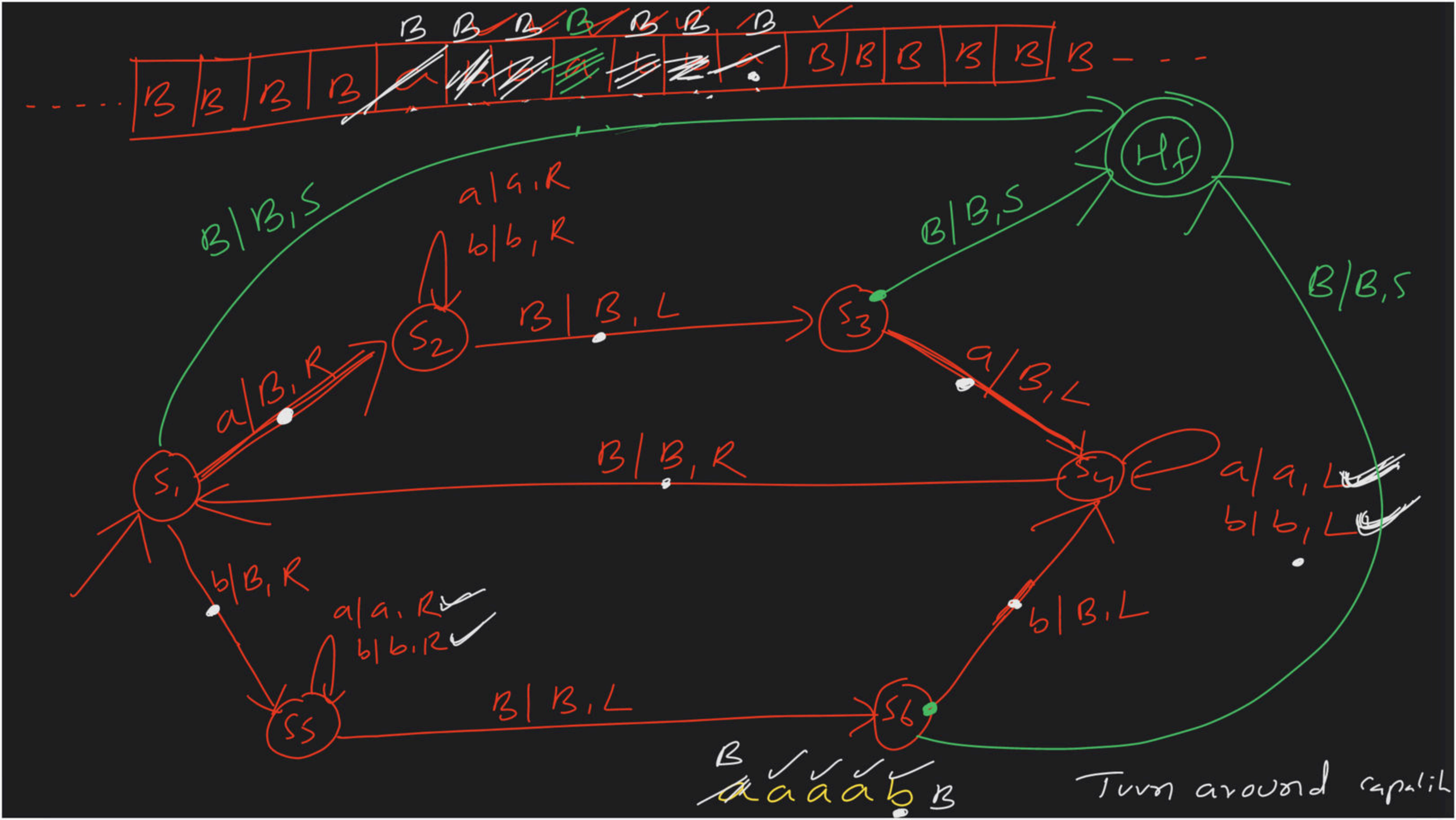
$L_1 = \{ w w^R \mid w \in (a+b)^* \} \Rightarrow$ even

$L_2 = \{ w x w^R \mid w \in (a+b)^*, \; x \in \{a, b\} \} \Rightarrow$ odd

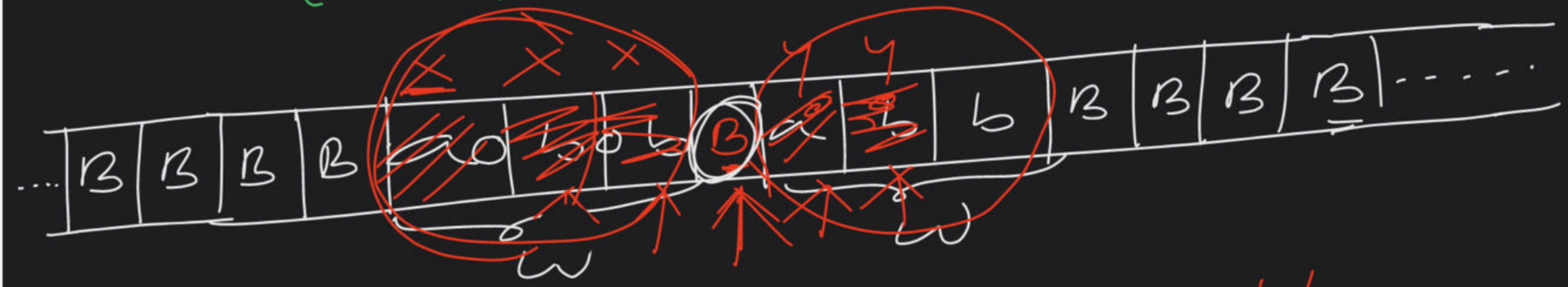
$L = L_1 \cup L_2 \Rightarrow$ all palindromes over $\{a, b\}$

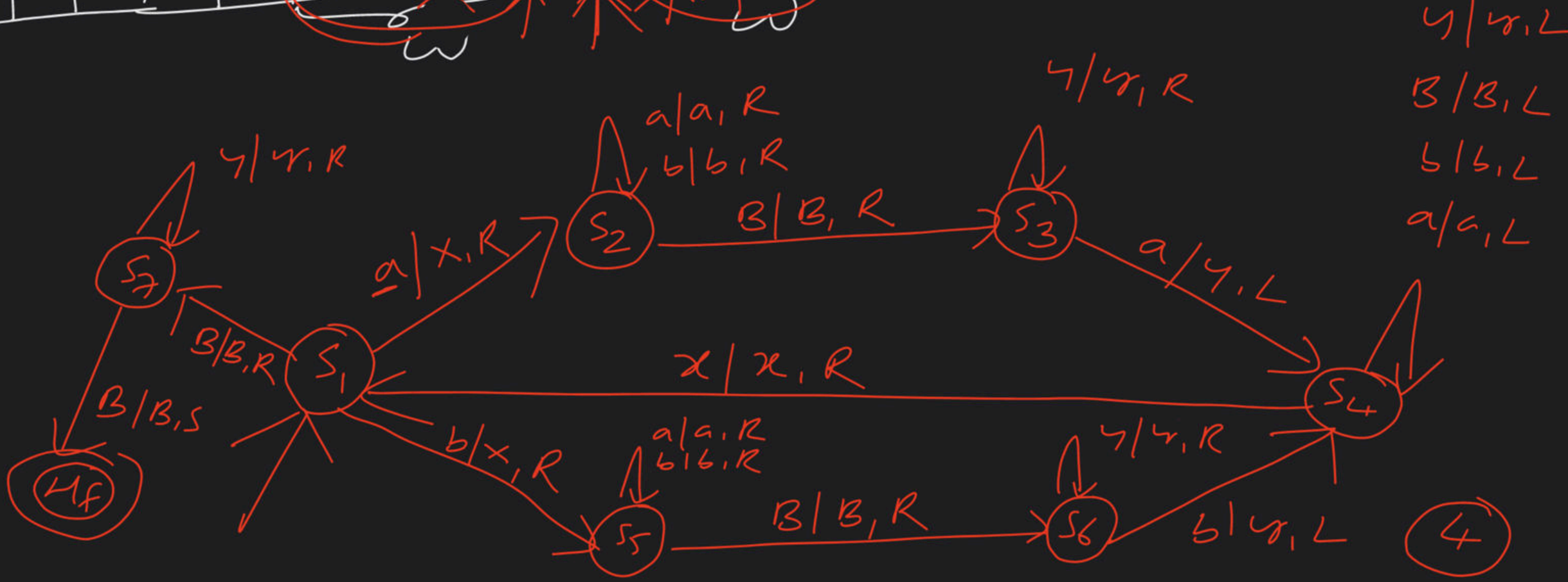




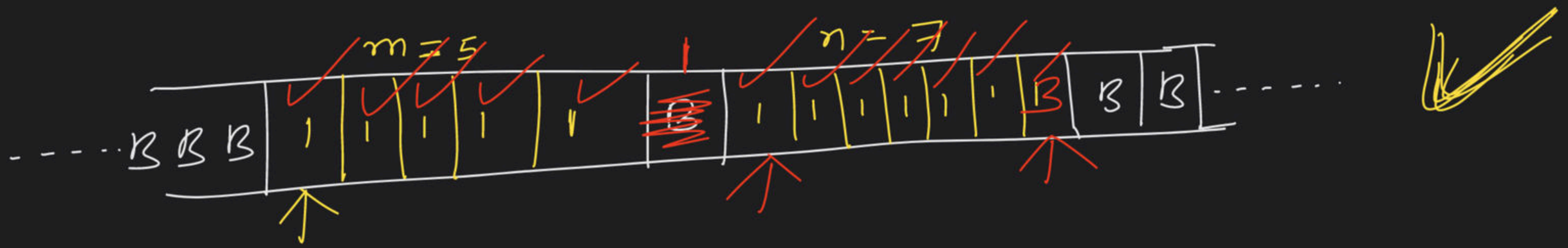

B B B B B B B
B B B B B B B

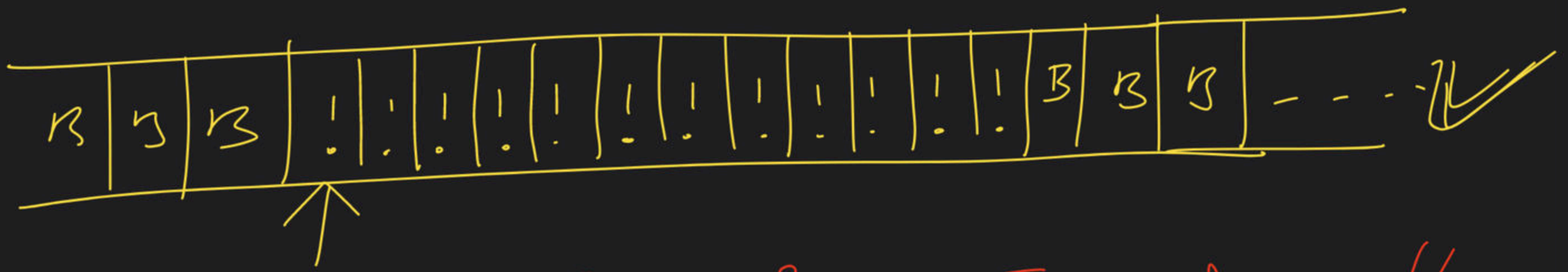
$$L = \{ ww \mid w \in (a+b)^* \}$$



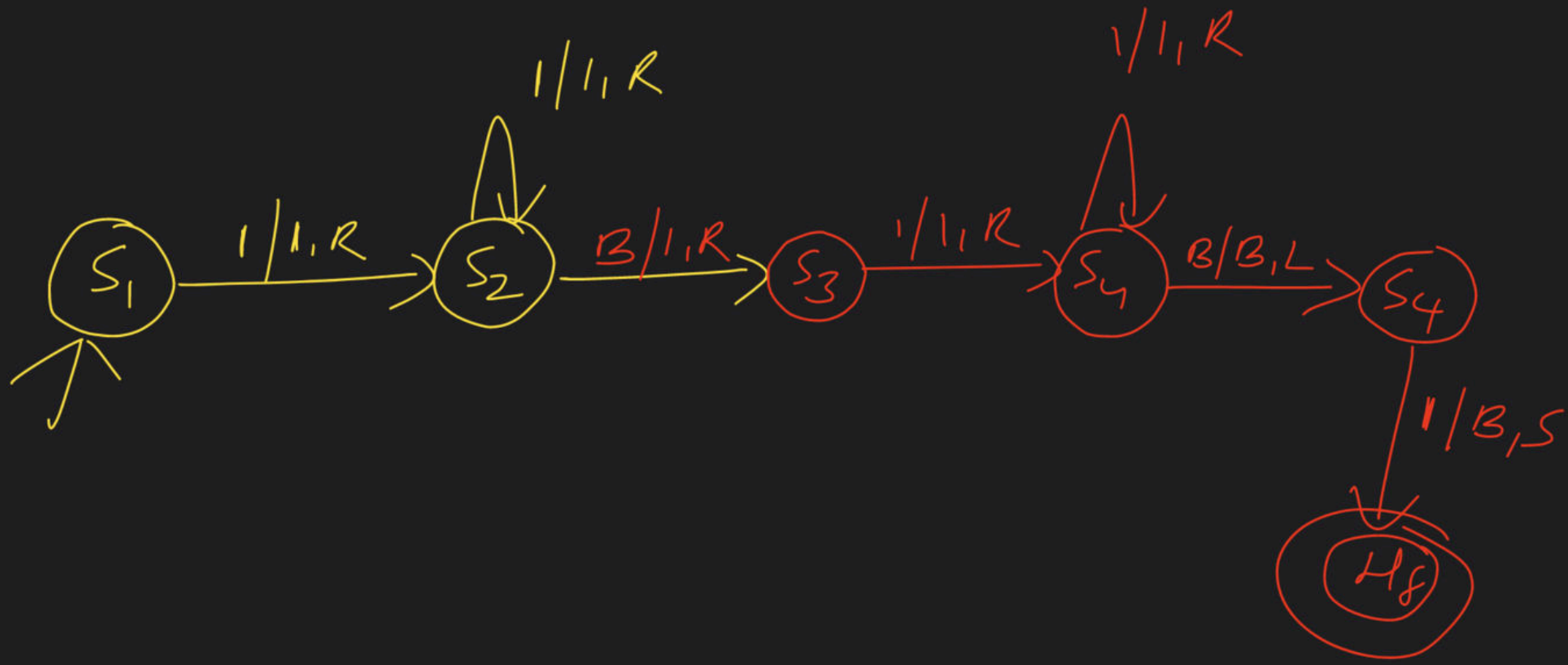


Construct TM to perform addition of two integers $m \geq 1$, $n \geq 1$.





TM as a Transducer //

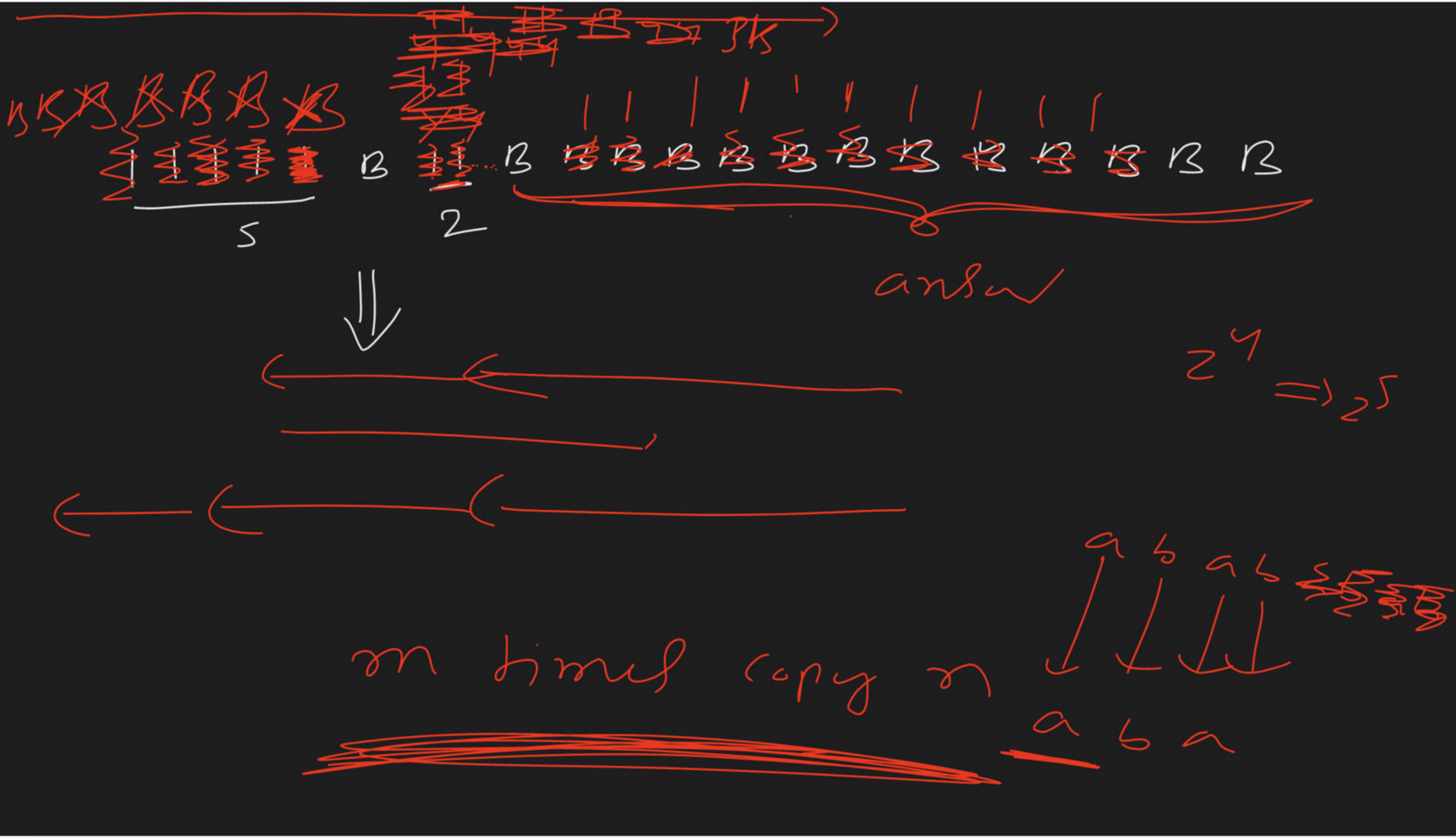

1/1, R
1/1, R
1/1, R
B/1, R
1/1, R
B/B, L
1/B, S
S1
S2
S3
S4
S4
Hf

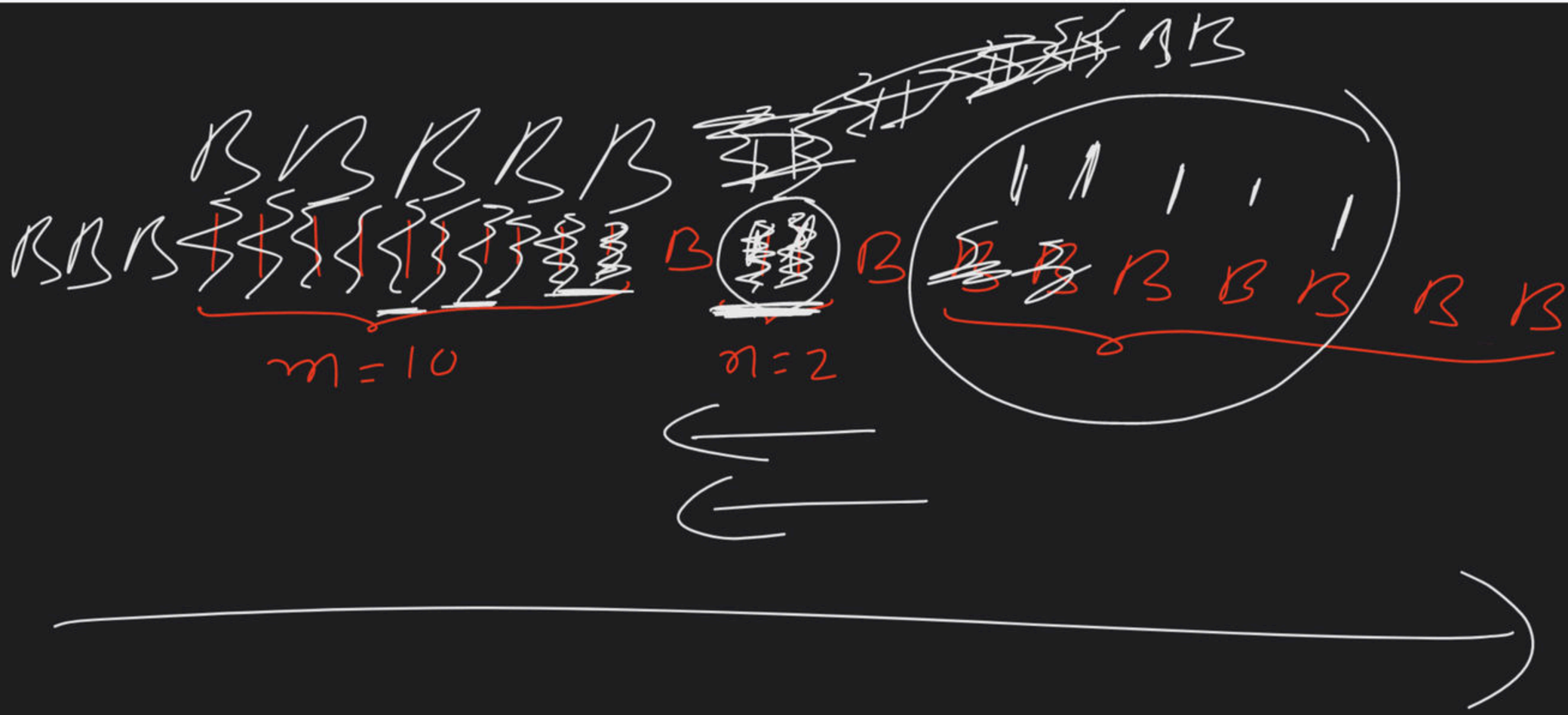
HM

Subtraction of two numbers $m, n \geq 1$ $(m > n)$

Multiplication " " " $(m > n)$

Division


B B B B B
5
2
answer
$2^4 \Rightarrow 2^5$
a b a b
a b a
m times copy n



$10 - 2 = 8 \Rightarrow$

$8 - 2 = 6 \Rightarrow$

$6 - 2 = 4 \Rightarrow$

$4 - 2 = 2 \Rightarrow$

$2 - 2 = 0 \Rightarrow$