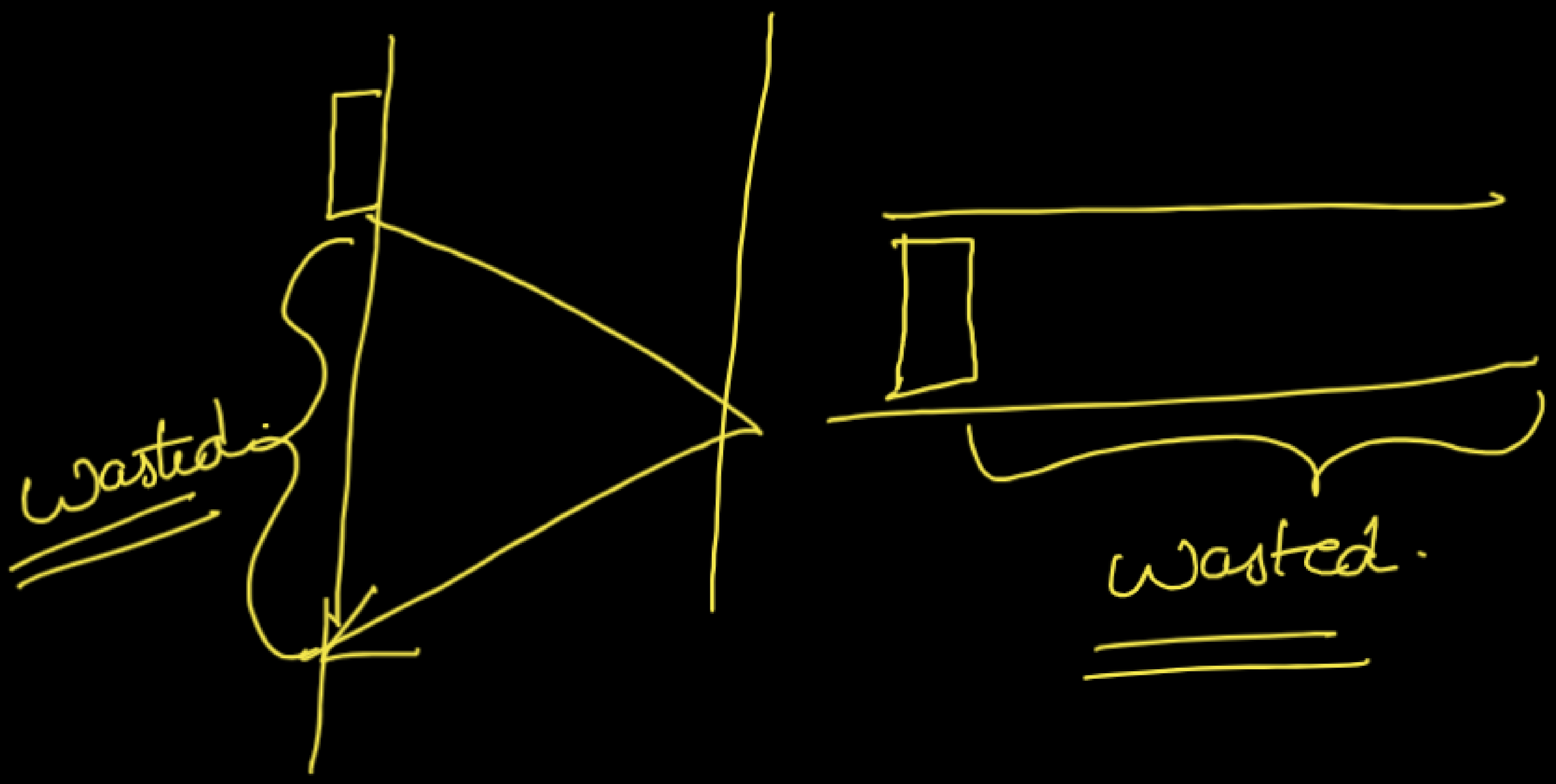
S

Sliding window protocol.

Finish → late

flow

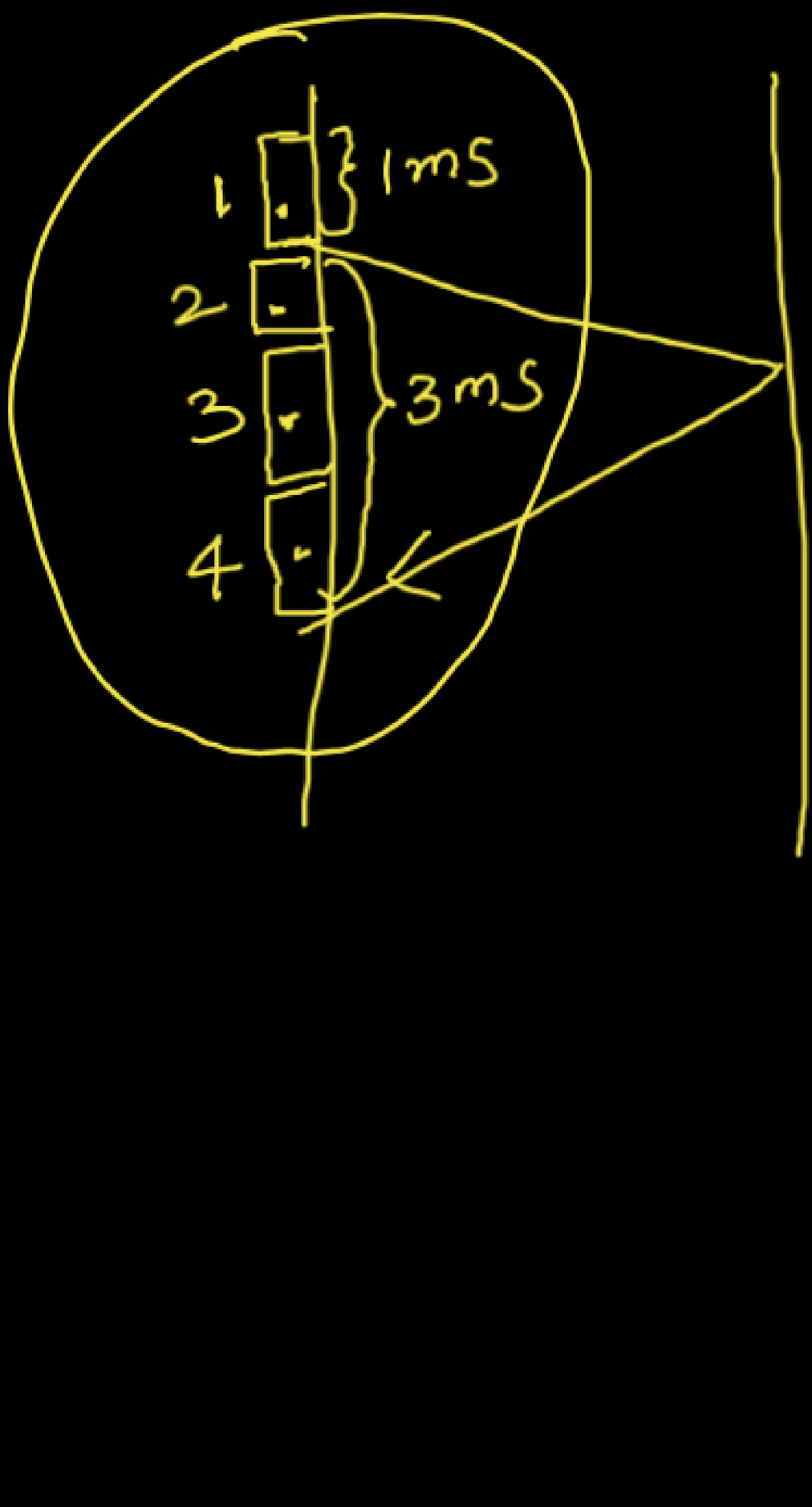
Sand wait



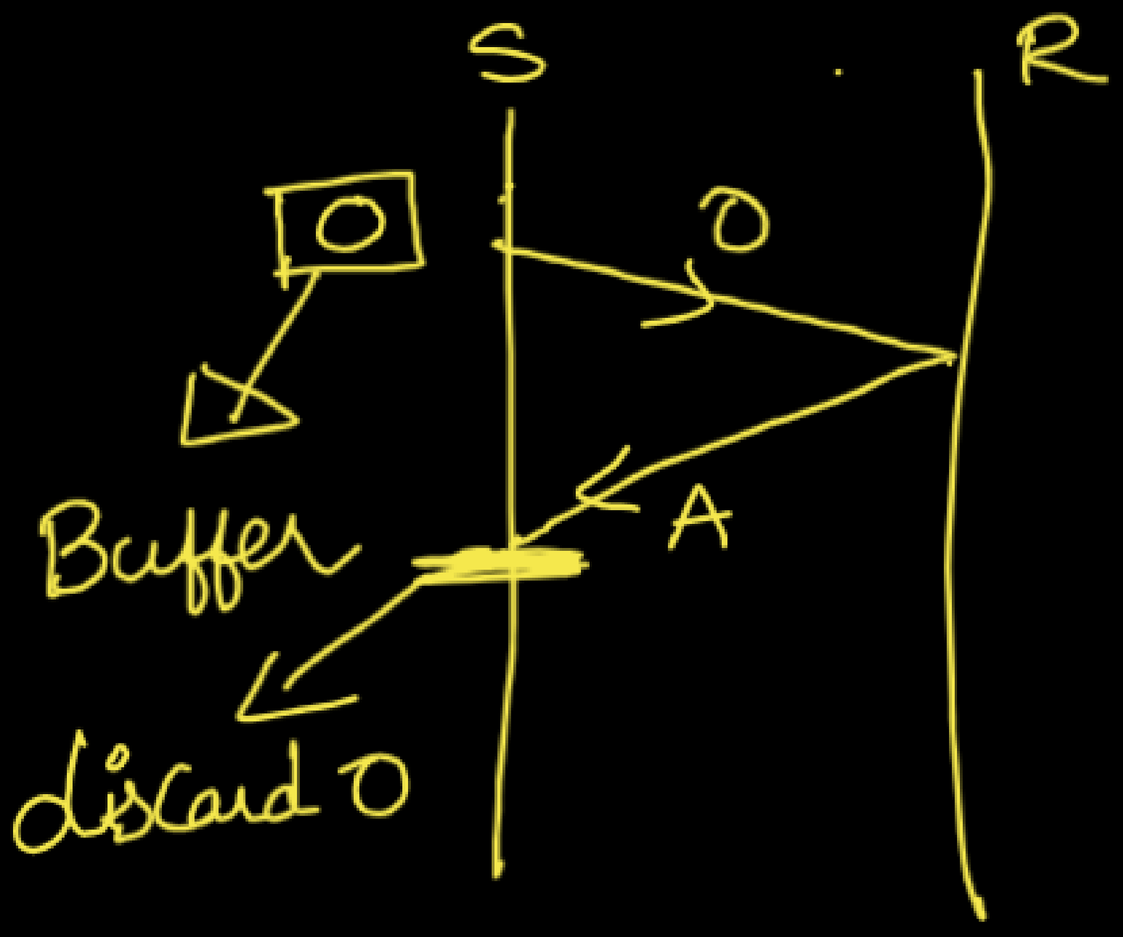
Pipe.

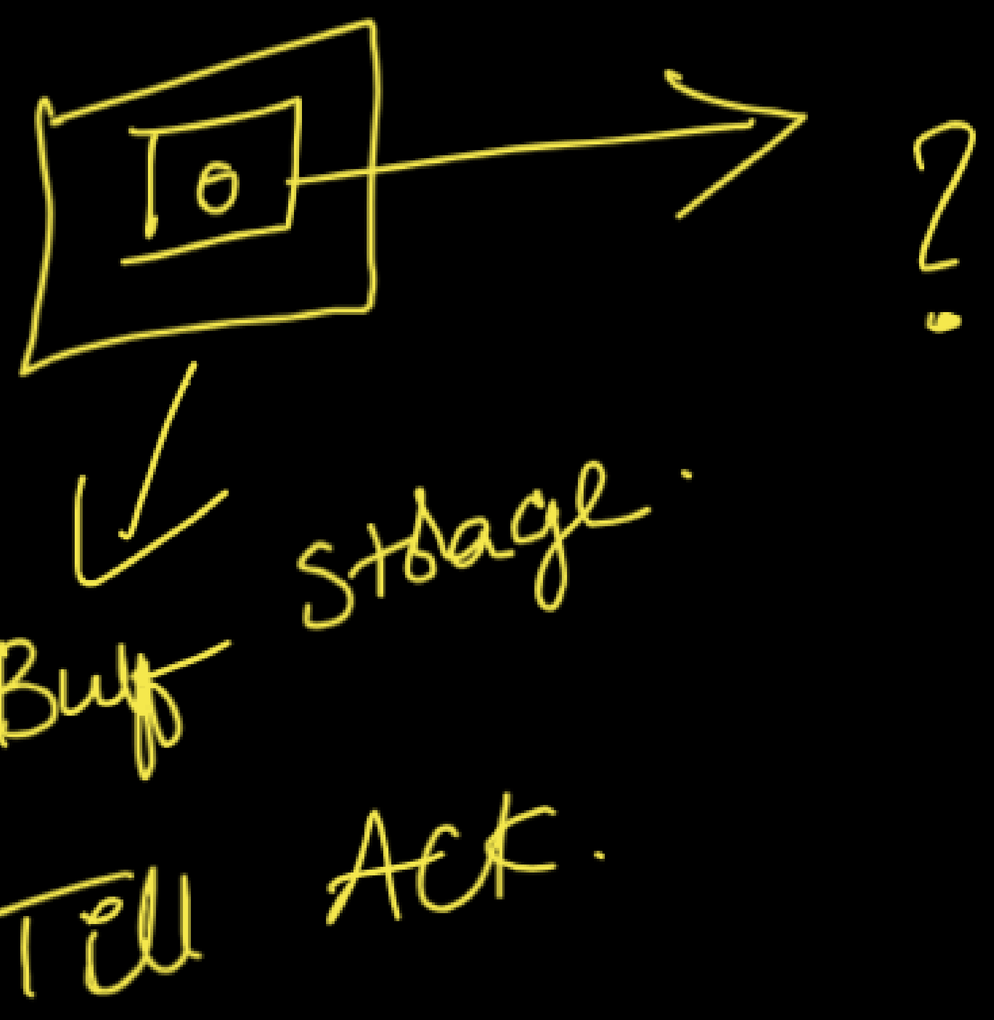
Swap :

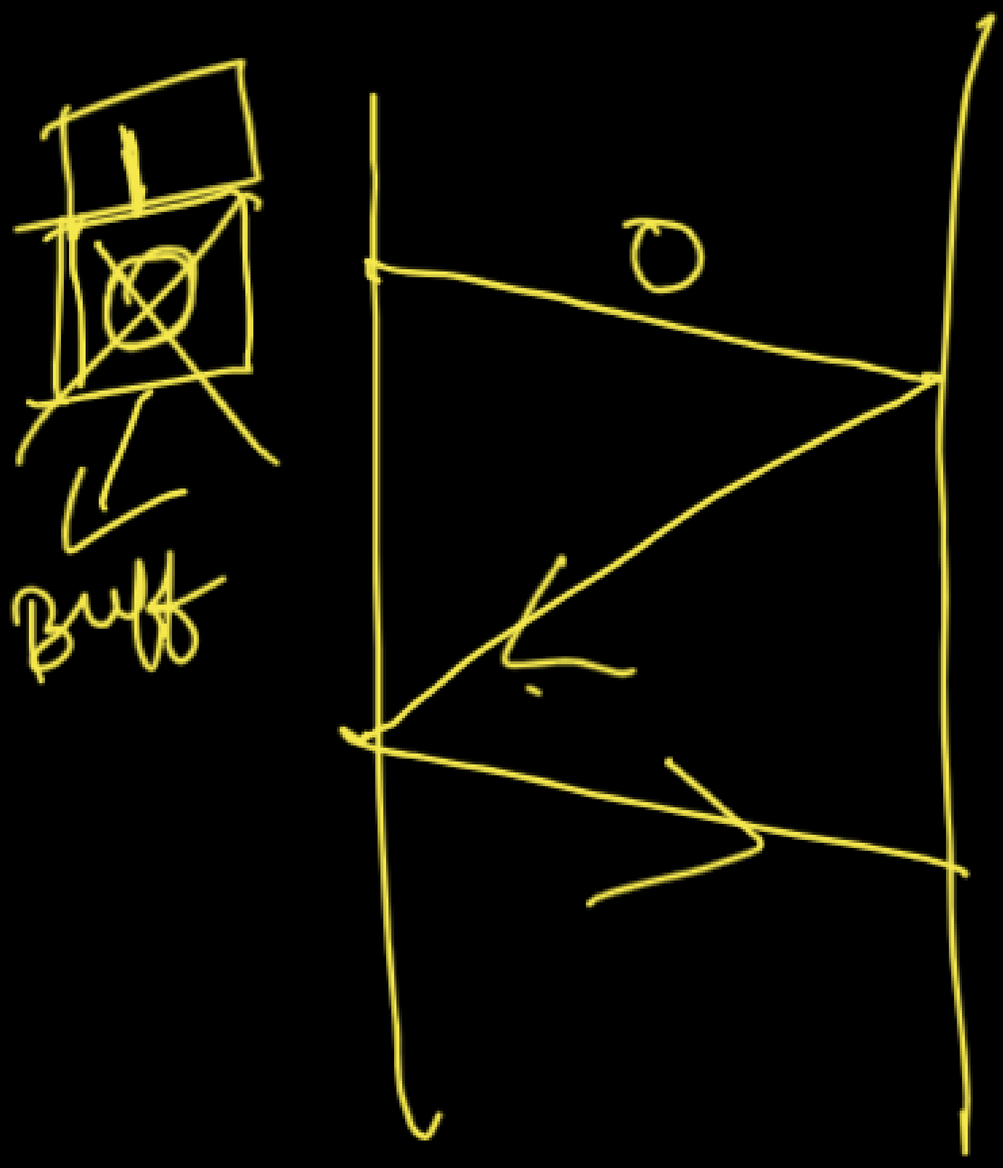
$T_t = 1ms$ $T_p = 1.5 ms$ $\eta = ?$ 25% (1/4)



Sliding window protocol.

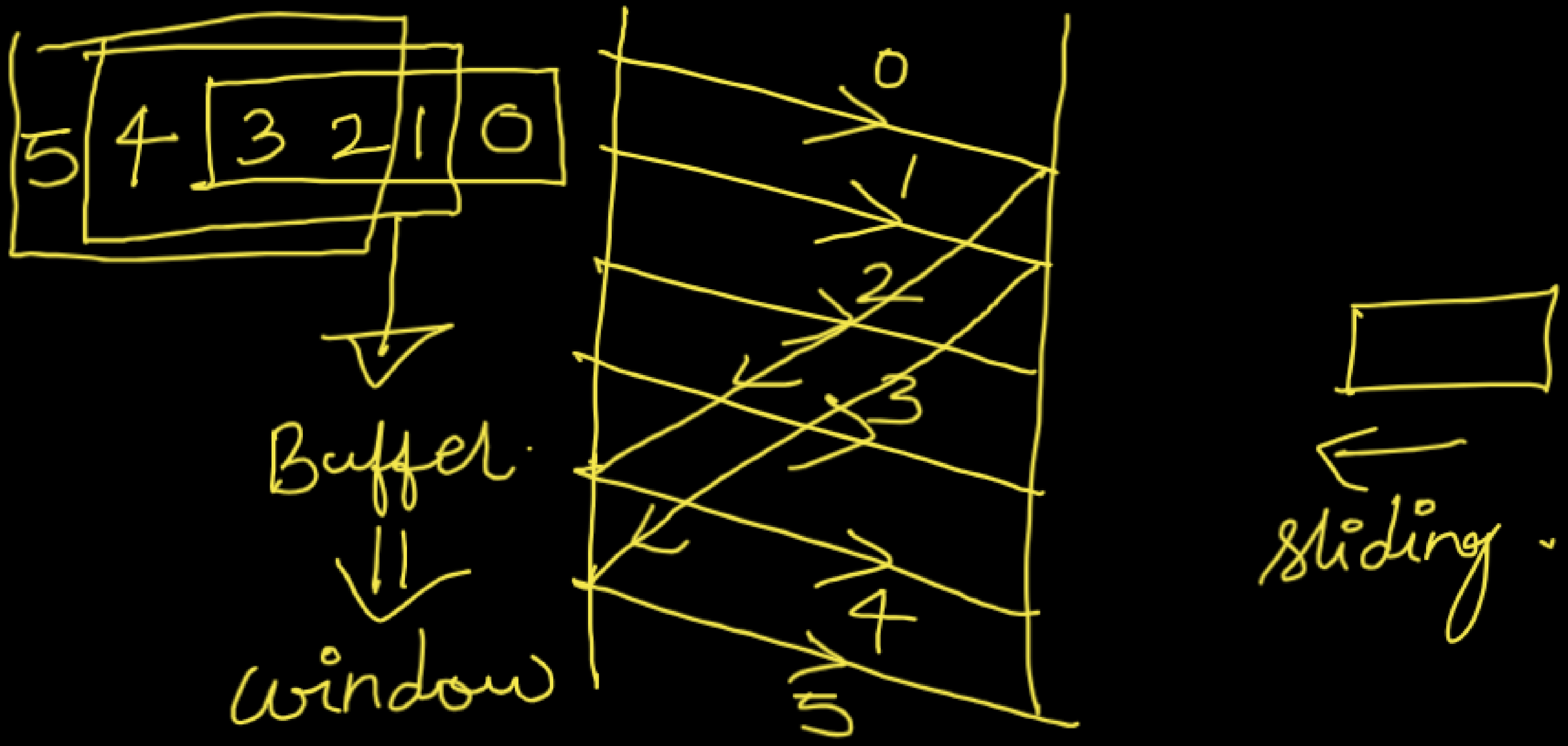

S
R
0
0
A
Buffer
discard 0

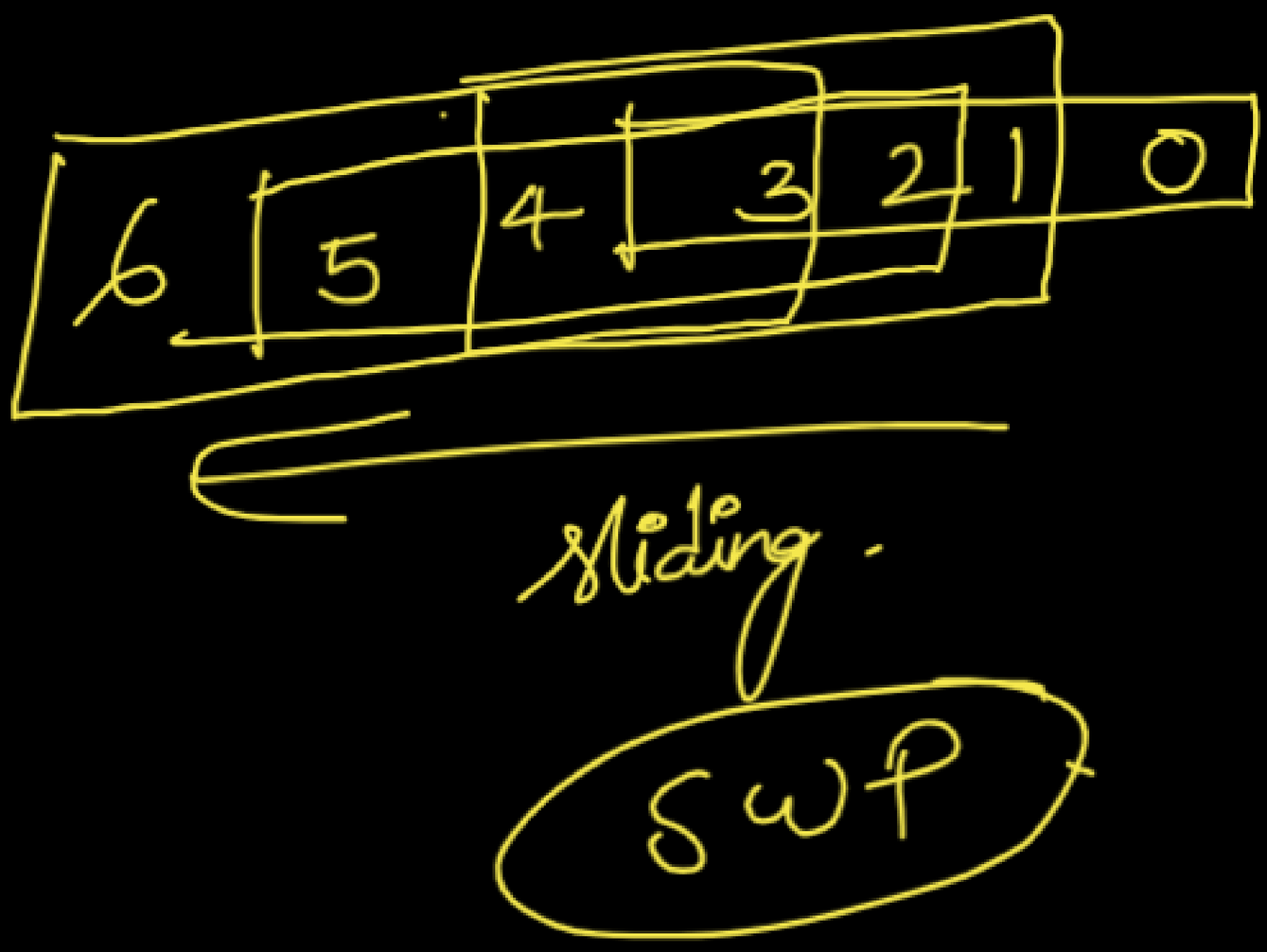

0
?
storage
Buff
Tell ACK.

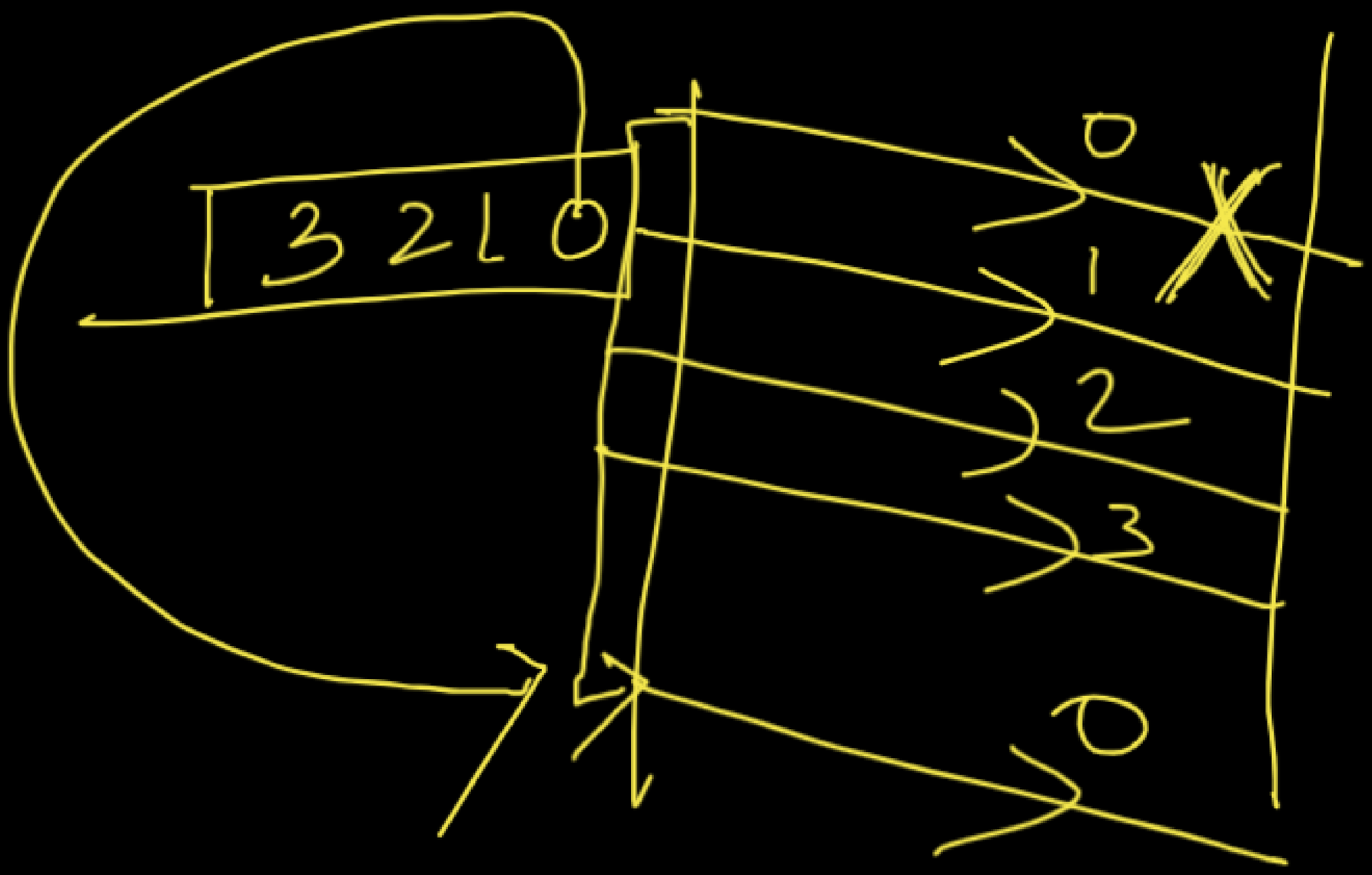


How long should you save a packet?

Till ack is rec


5
4
3
2
1
0
Buffer
window
0
1
2
3
4
5
sliding


6
5
4
3
2
1
0
sliding
swp


3 2 1 0
0
1
X
2
3
0

5) $T_t = 1ms$ $T_p = 1.5ms$.

window size = ?

For 100% effici

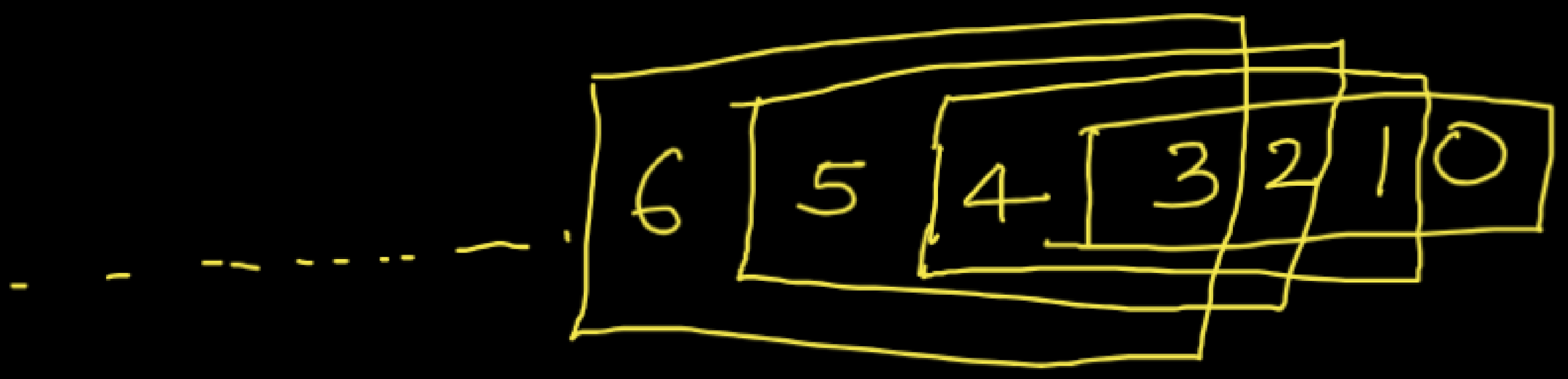
T_t time → 1 packet

$T_t + 2*T_p$ → ?

$$\frac{T_t + 2*T_p}{T_t}$$

$$= \boxed{1 + 2a}$$

$$F_{d\ max\ eff}\ (\omega_s) = (1 + 2a)$$

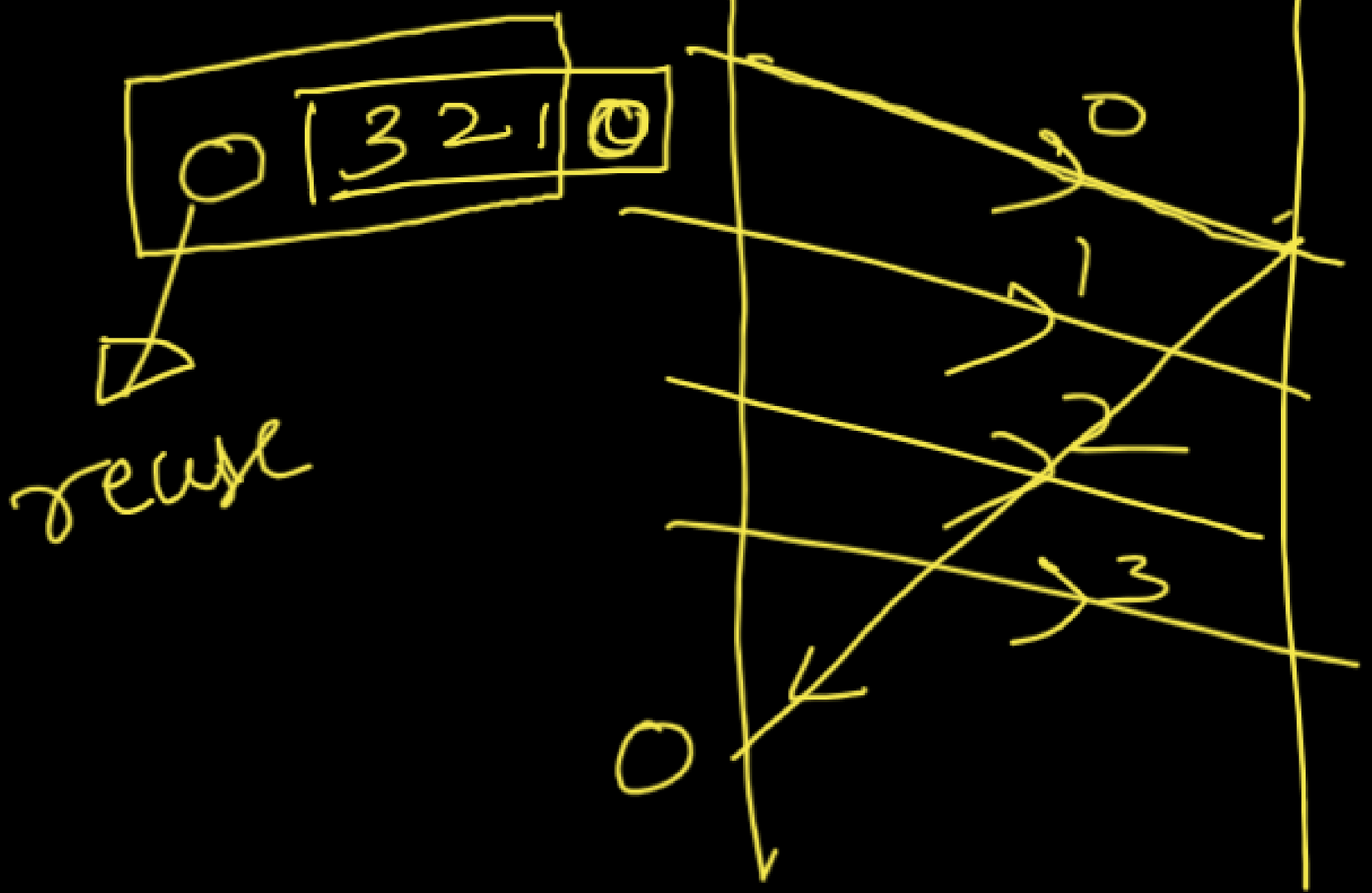


how many numbers ?

"∞" min

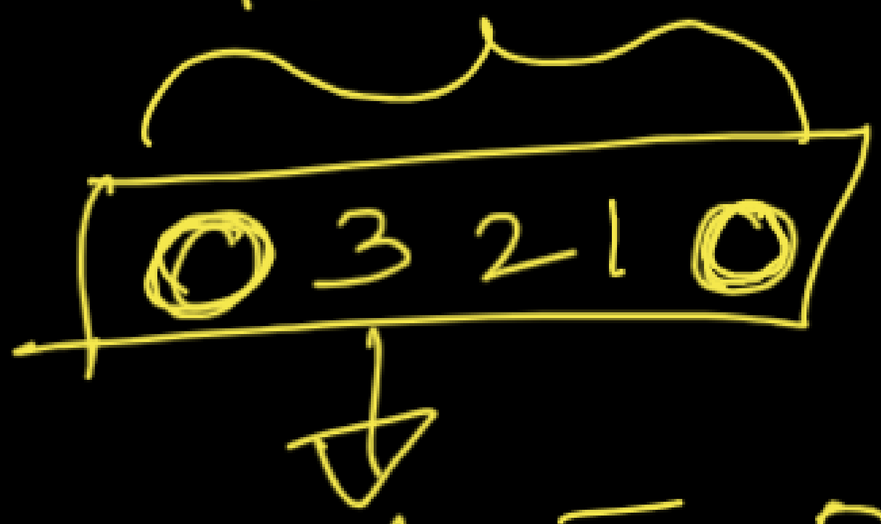
sequence number

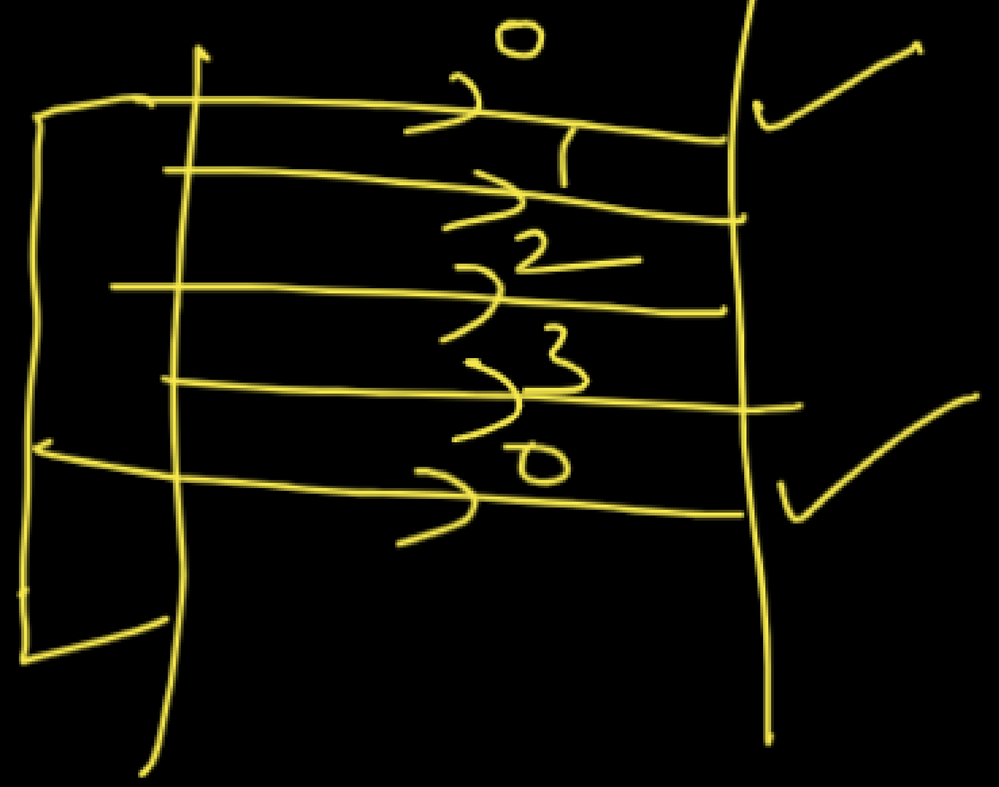
data packet


0 1 3 2 1 0
reuse
0
1
2
3
0
0 is not in the w/w

min Seq numbers = size of the window

no overlapping





[ws] = 5

Seq. = 4

min seq no = size of window

Ex: 4 → seq → ? bits

2 bits

16 → seq → ? bits

4 bits

10 → seq → ? bits (4 bits)

4 bits → Seq num ?

16

10 no problems.

Seq num > |ws|

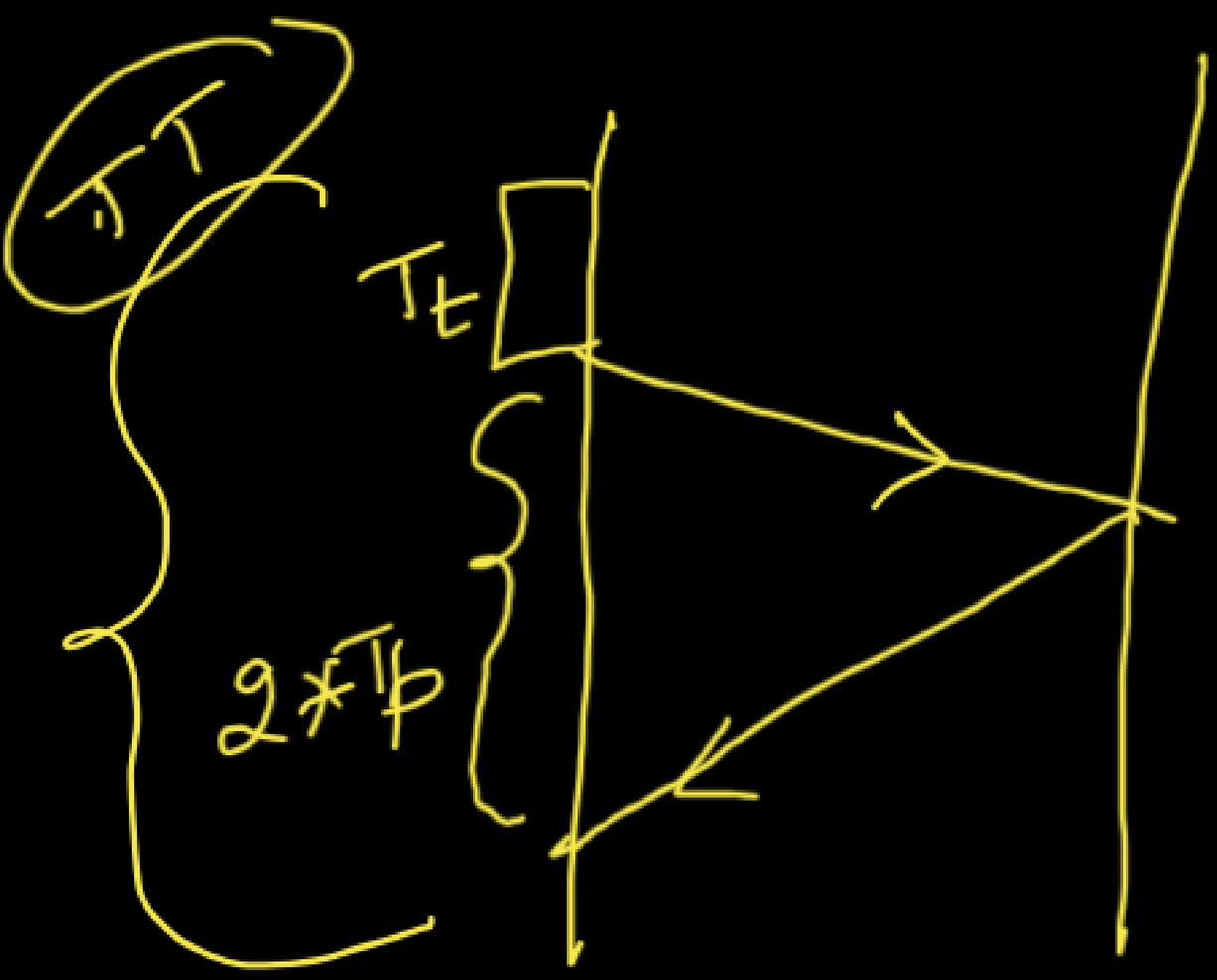
Seq numbers $\geq \omega_s$

Seq numbs $\geq (1+2\alpha) \rightarrow 100\%$ efficiency

bits in seq number field.

$\log 10 = \lceil 3.3 \rceil$

$\lceil \log_2(1+2\alpha) \rceil \rightarrow$ ceil. 100% effic



Total time = $T_t + 2*T_p$

Trans → 1 pact → T_t sec.

T_t → 1 packet

1 sec → $\frac{1}{T_t}$ packets.

$T_t + 2*T_p$ ⇒ $\frac{T_t + 2*T_p}{T_t}$ pack

$a = \frac{T_p}{T_t}$ = $\boxed{1 + 2a}$

For 100% efficiency → $(1+2a)$.

$\therefore \boxed{|\omega_s| = (1+2a)}$

3 2 1 0 $(\omega_s = 4)$ ⇒ 4 seq numbers.

Seq = $(1+2a)$ = ω_s → 100% efficiency.

bits → $\lceil \log_2 (1+2a) \rceil$ ✓

$T_t = 1ms \quad T_p = 49.5ms$

$|\omega_s| \rightarrow 100\%$ effi

$|\omega_s| = 1 + 2\alpha = 100$

Seq numbers = 0 to at least 100

$\lceil \log_2 100 \rceil = 7$ bits

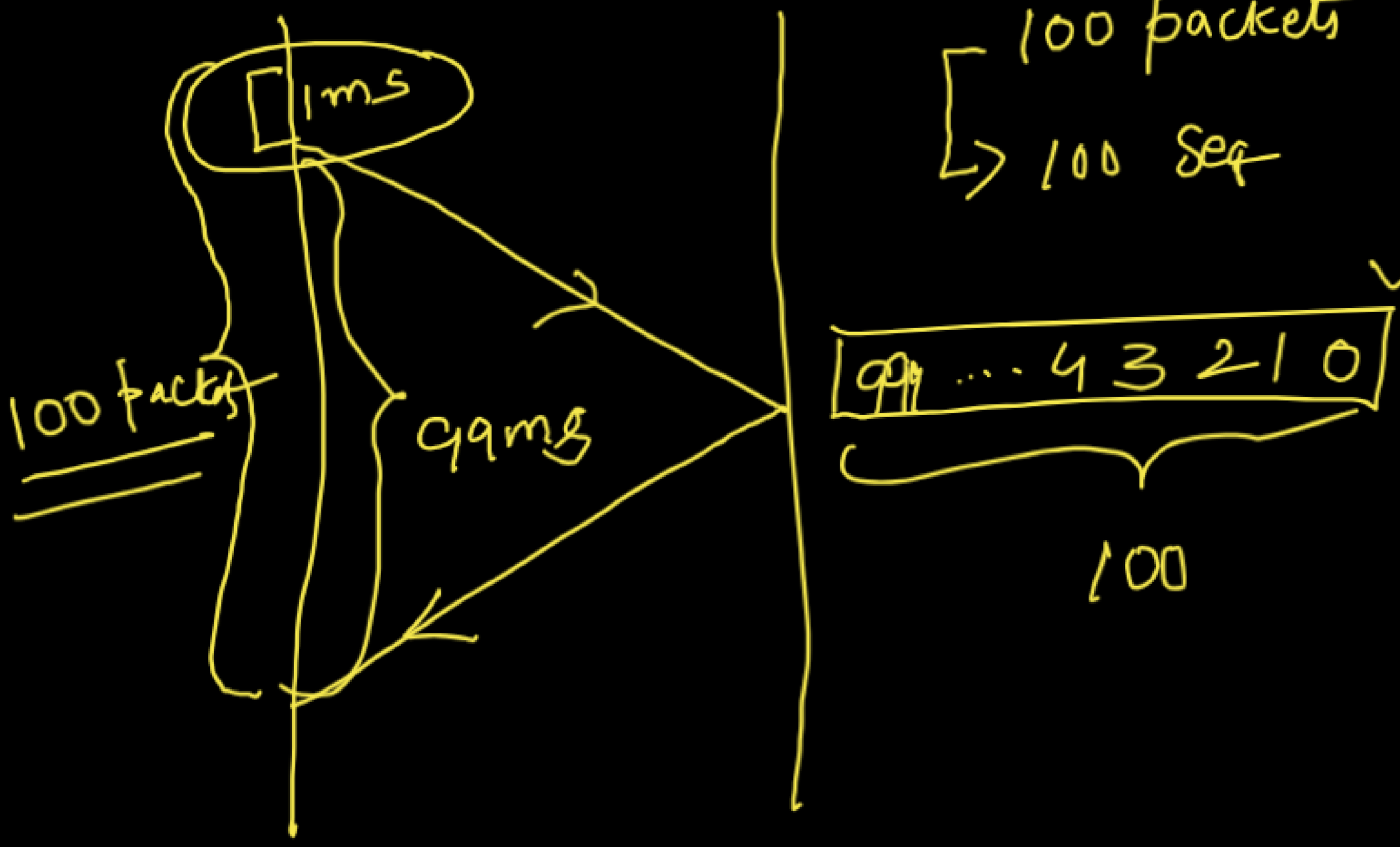
bits

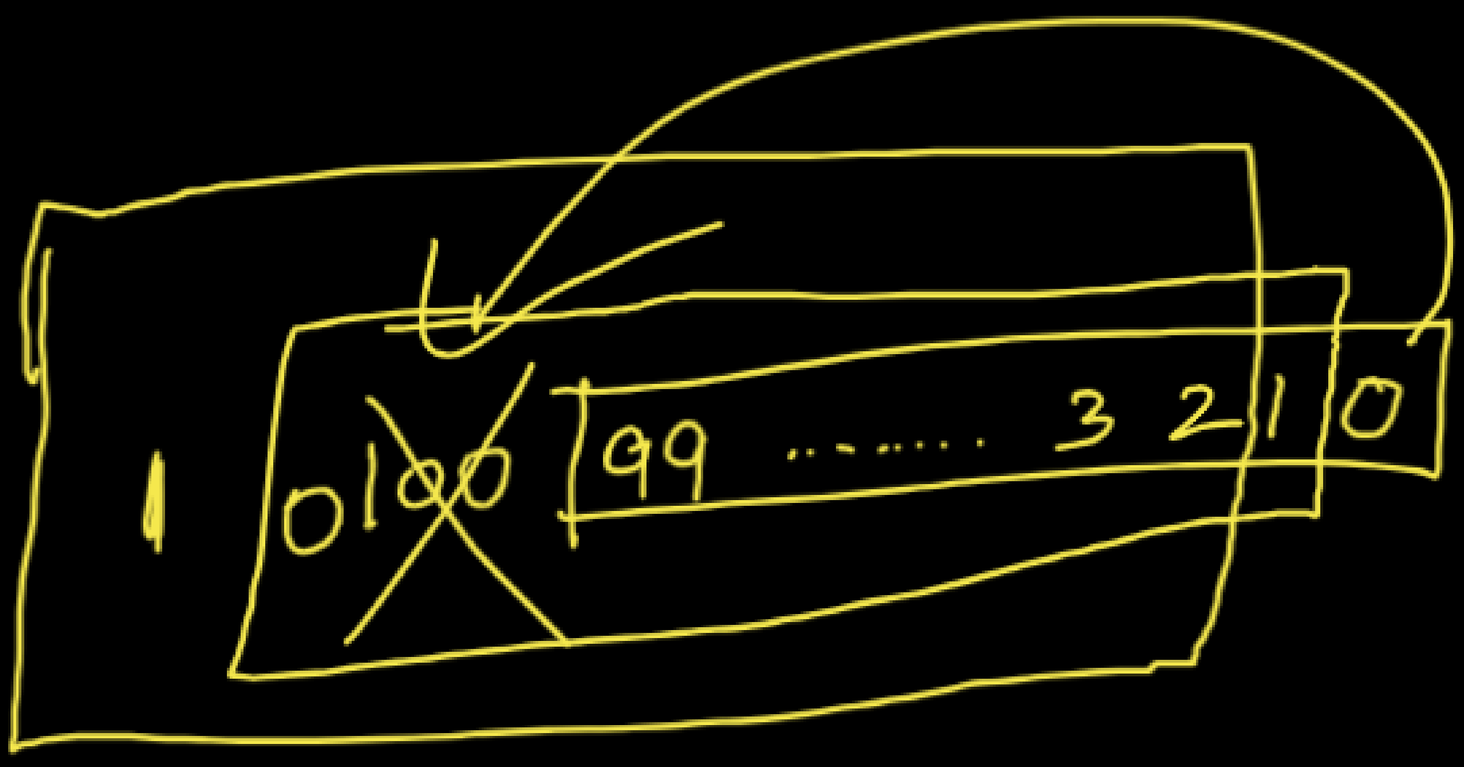
$\downarrow$

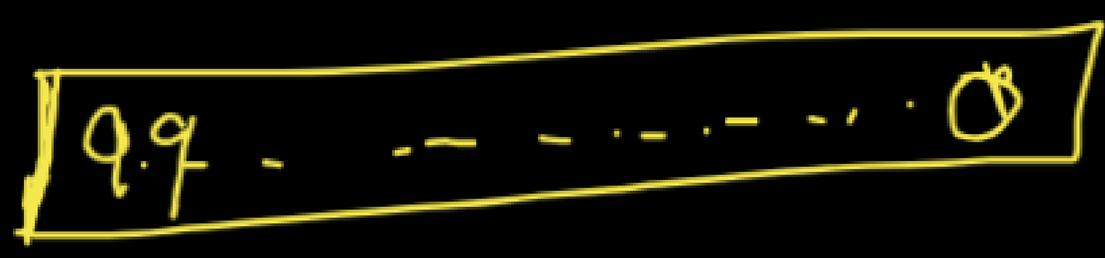
128

≥ 100

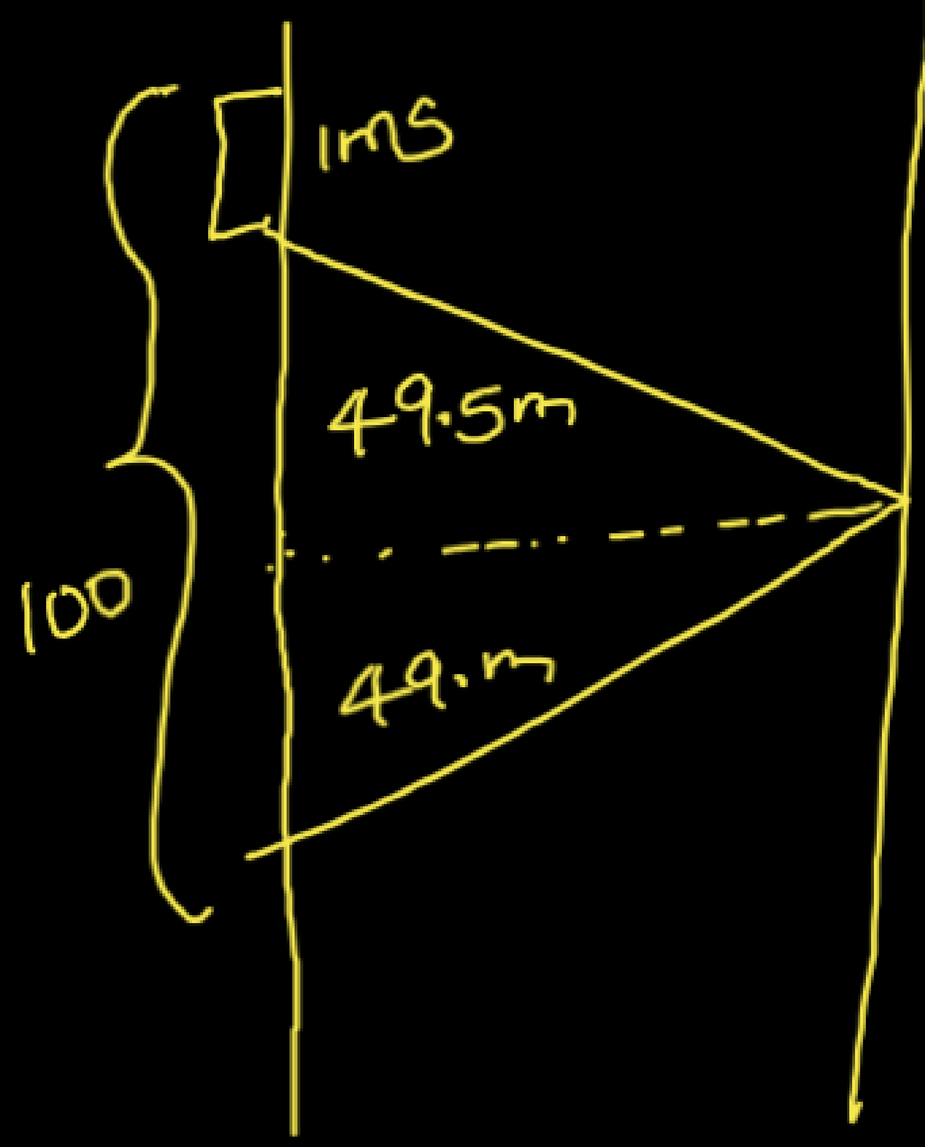
$T_t = 1ms \quad T_p = 49.5ms$







100



Bits = 7 bits → 100%

But I have 6 bits only

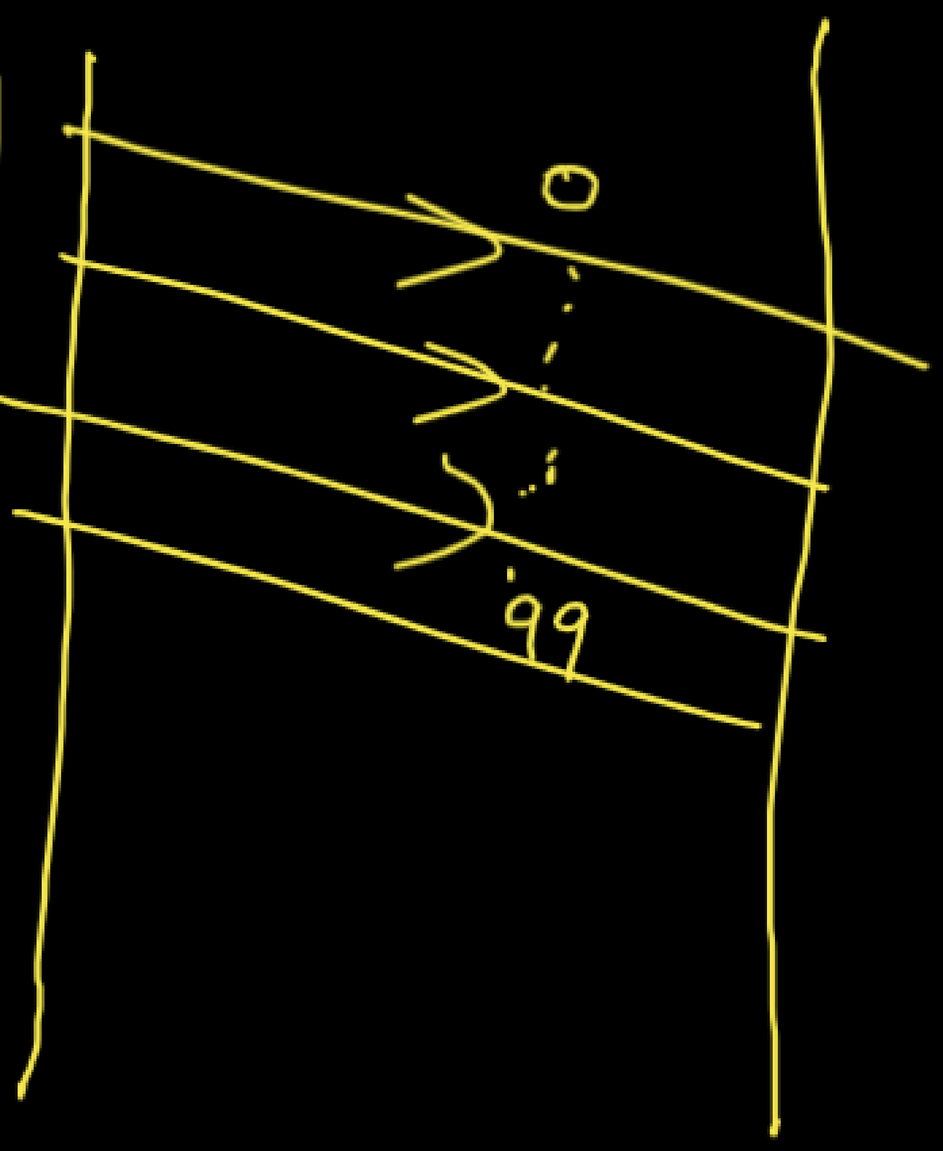
→ η = ?

100 fd max

ws

99	...	4	3	2	1	0

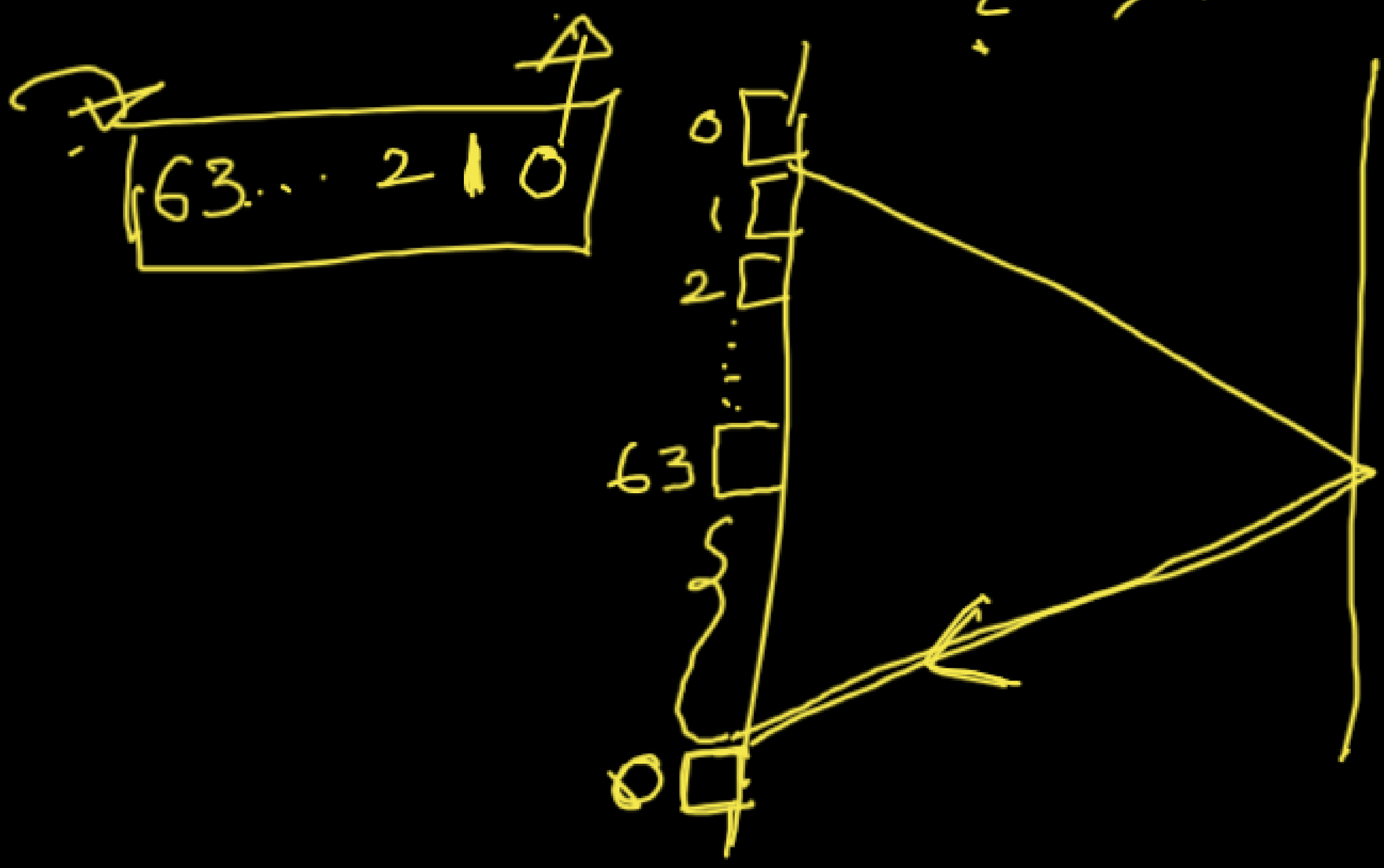
if I have
100 seq
number.



But we have only 6 bits

6 bits ⇒ 64 seq numbers only.

? → 100

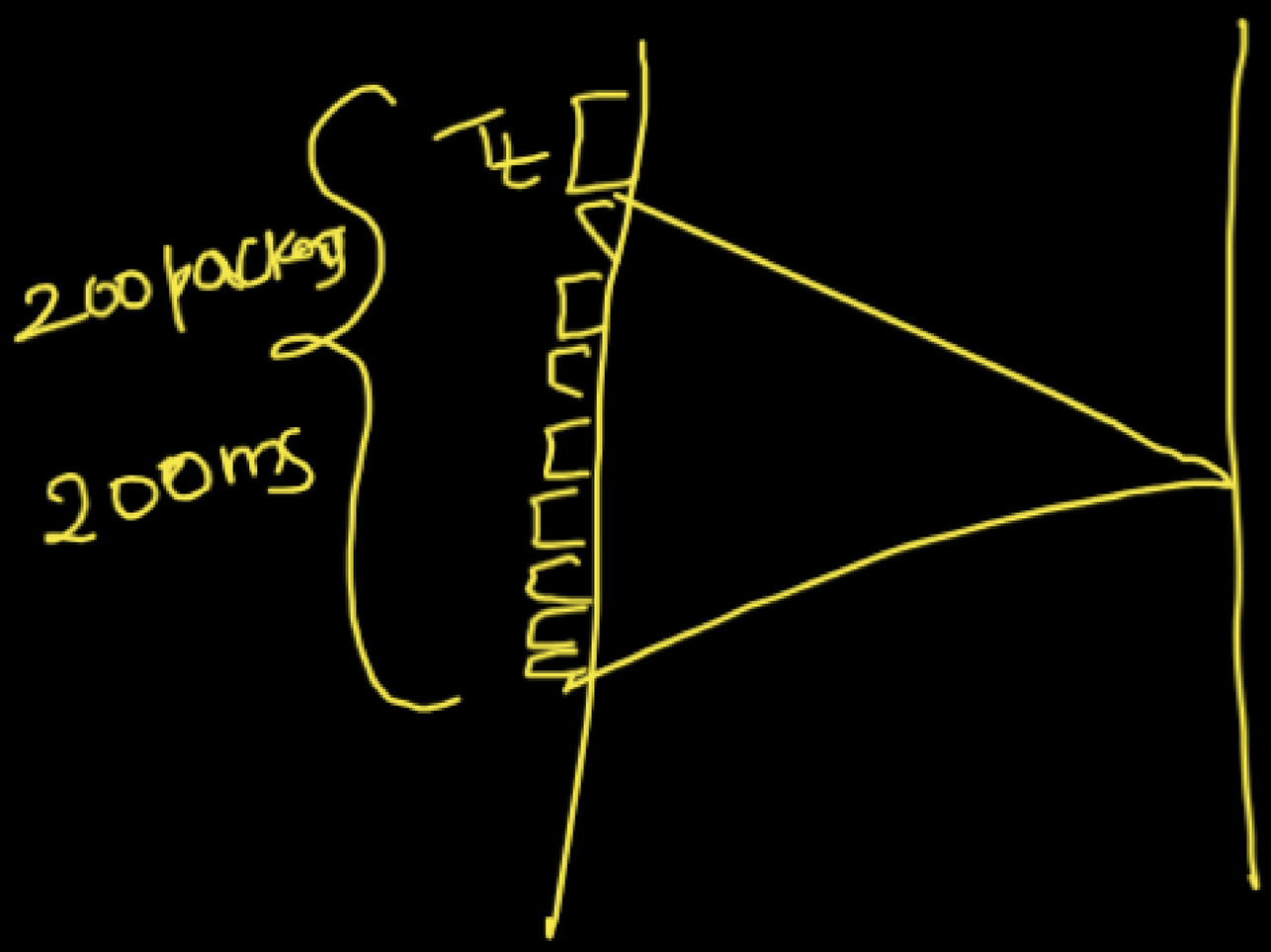


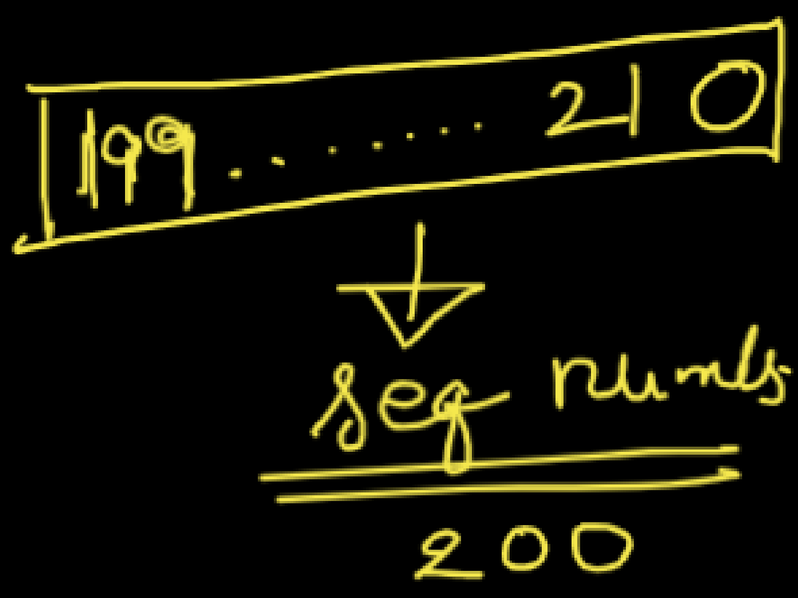
η = 64%

$T_t = 1ms$, $T_p = 99.5ms$ $|\omega_s| \Rightarrow 100\%$

$|\omega_s| = 1 + 2a = 200$ packets

Seq $\rightarrow$? ≥ 200 ; bits $\rightarrow$ 8 bits





K = 8 bits 8 bits → 100 % eff

7 bits → ? ☹

|ws| → 200 packets.

But → 2^7 → 128 pack

$$\frac{128}{200} = 64\%$$

$T_t = 1mS \quad T_p = 149.5\,ms$

$(1+2a) = 300$ pkts

$|W_S| \rightarrow 100\%$ eff

bits $\rightarrow$ Seq num $\rightarrow$ 9 bit

8 bits $\rightarrow$?n

$8 \rightarrow 256.$

$\eta = \frac{256}{300} = 85.33\%$

$w_s = (1+2a)$ → enough seq numbers

if 'n' → no of bits in seq no field

↓ seq

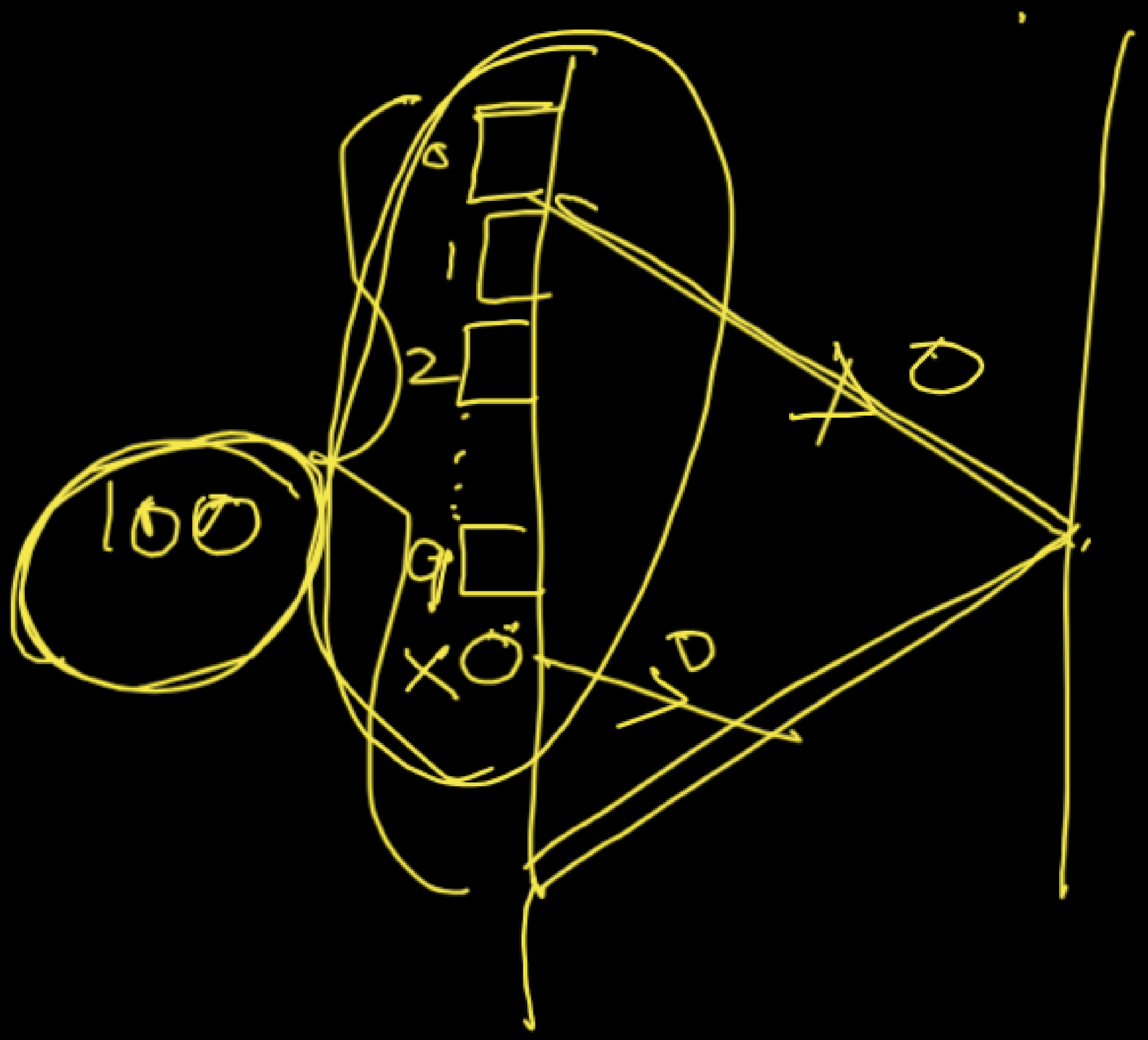
2^n

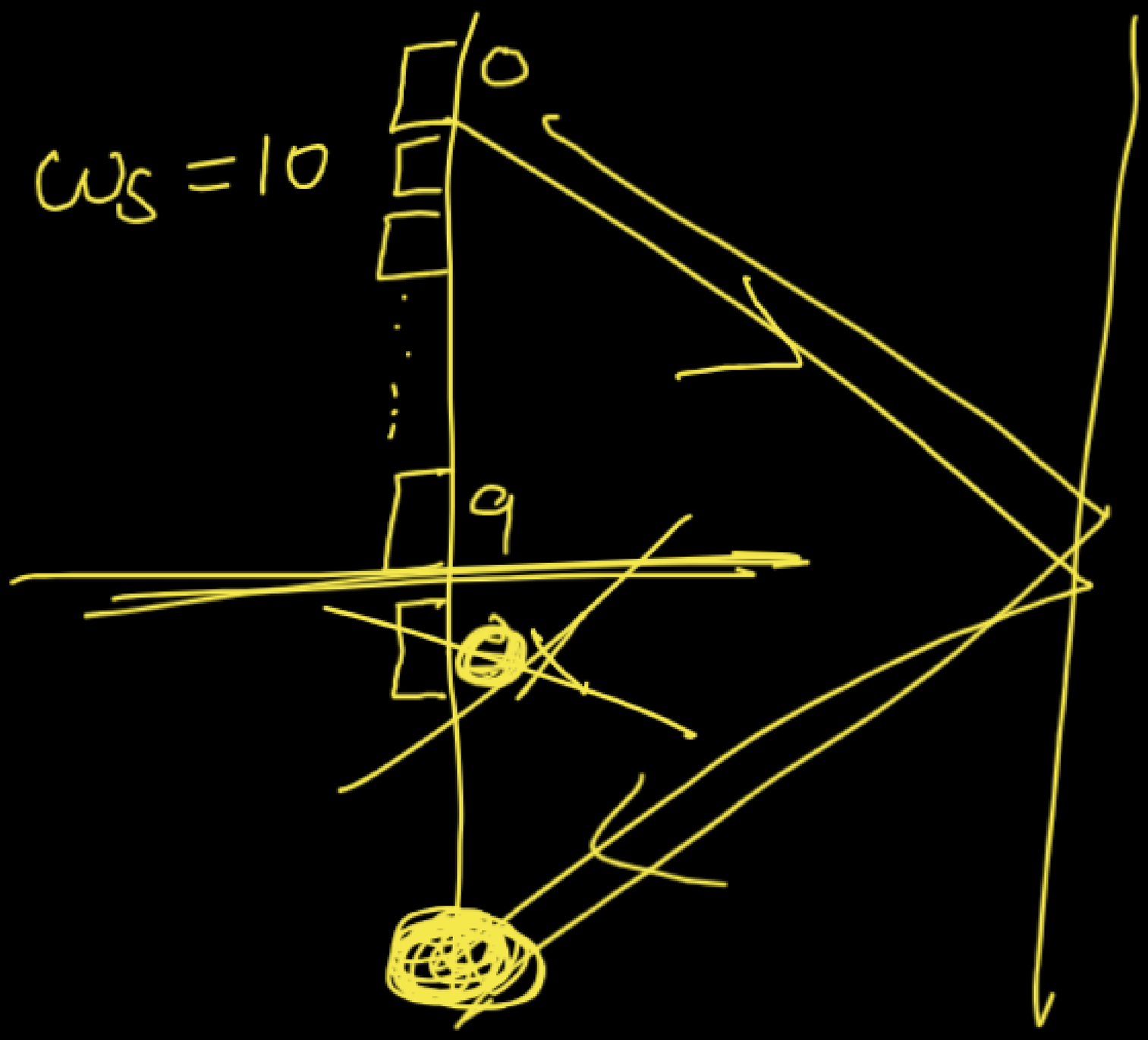
$1+2a$

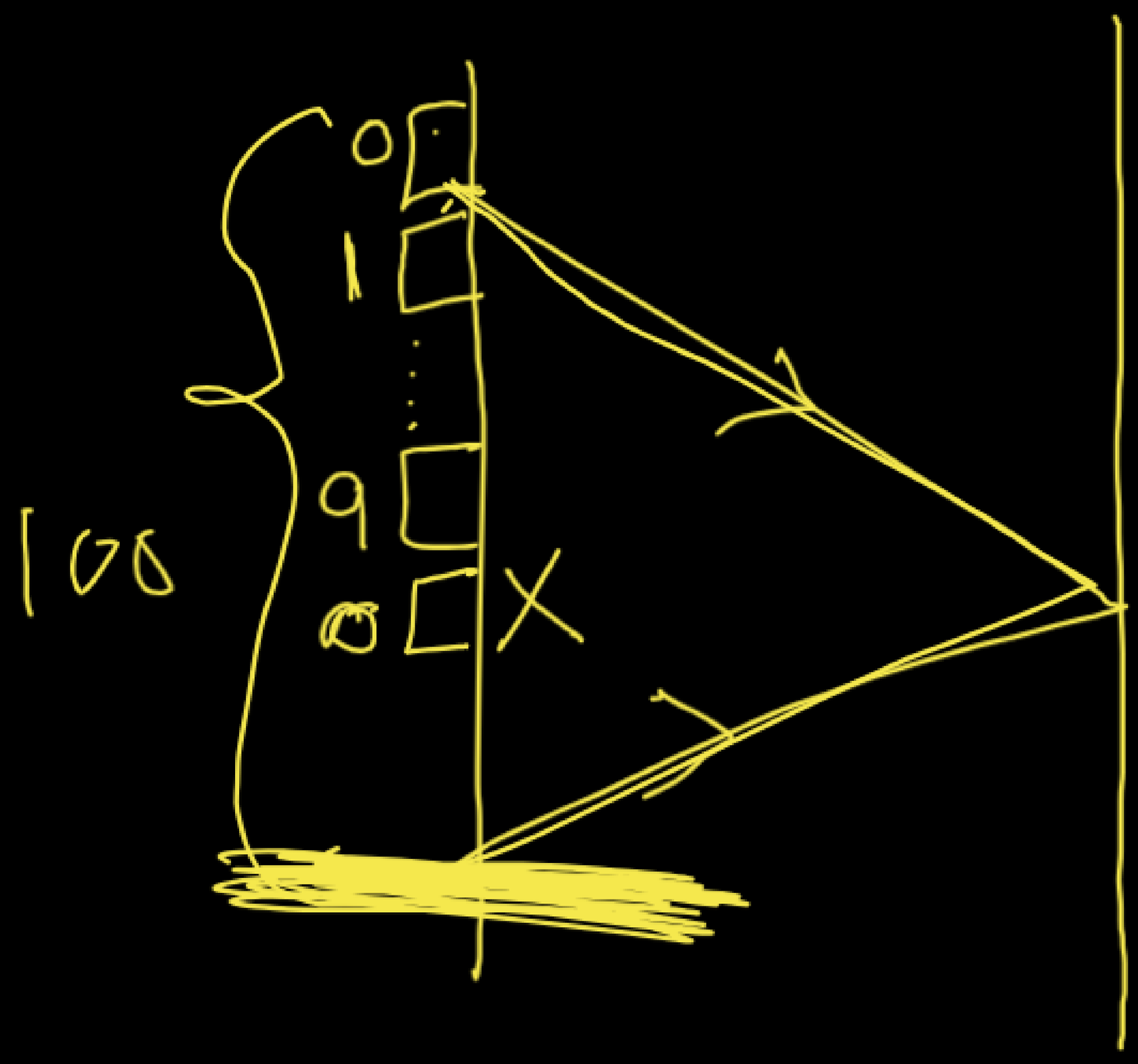
$w_s = \min(1+2a, 2^n)$

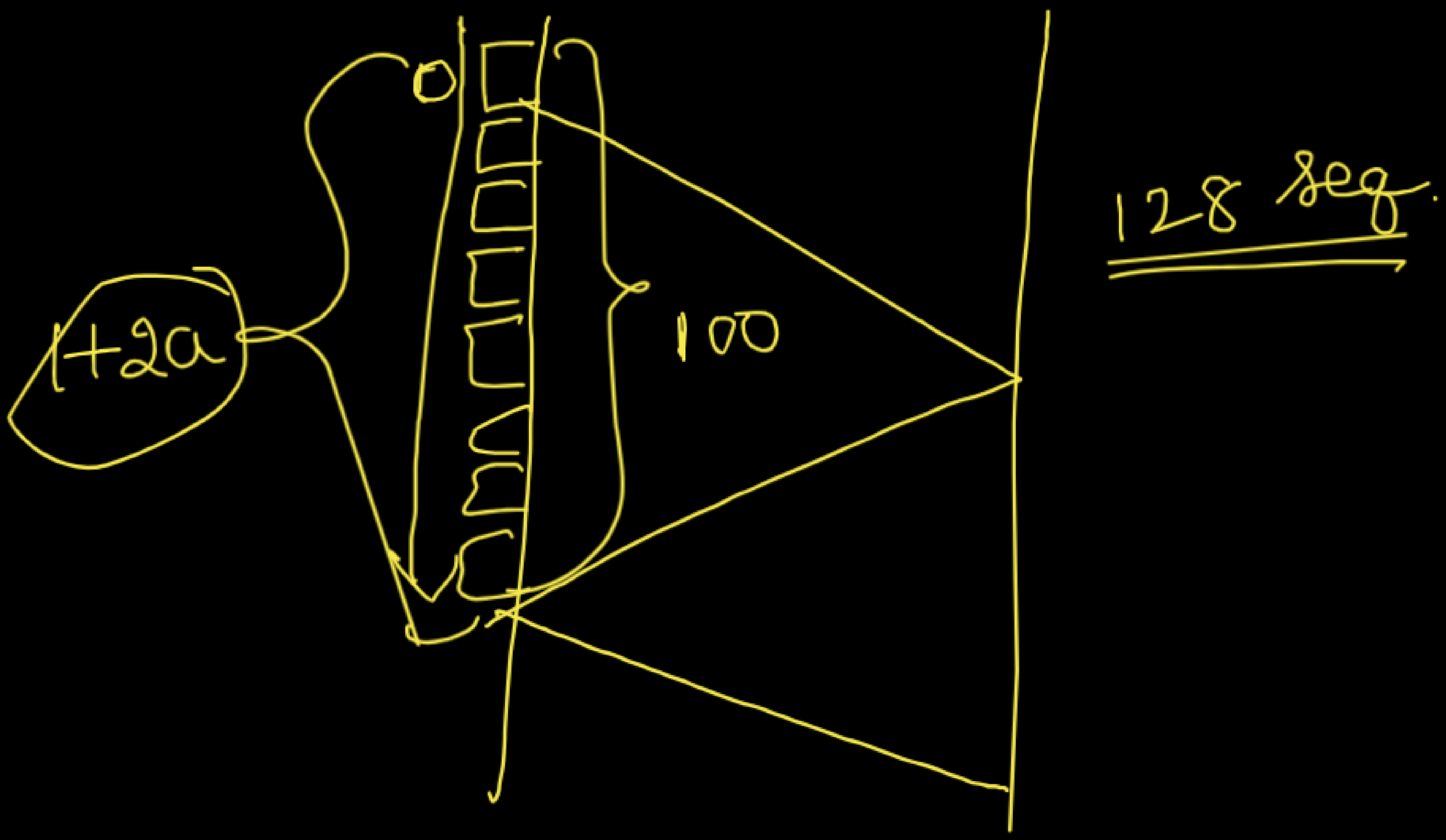
100 10 → 10

100 128 → 100


0
1
2
9
100
≠0
XO
D


$\omega_s = 10$
O
9


0
1
9
8
X
100


0
+2a
100
128 seg.

$(1+2a)$

8:08

Finish → swp

Data →

Basics ← SWP → theory

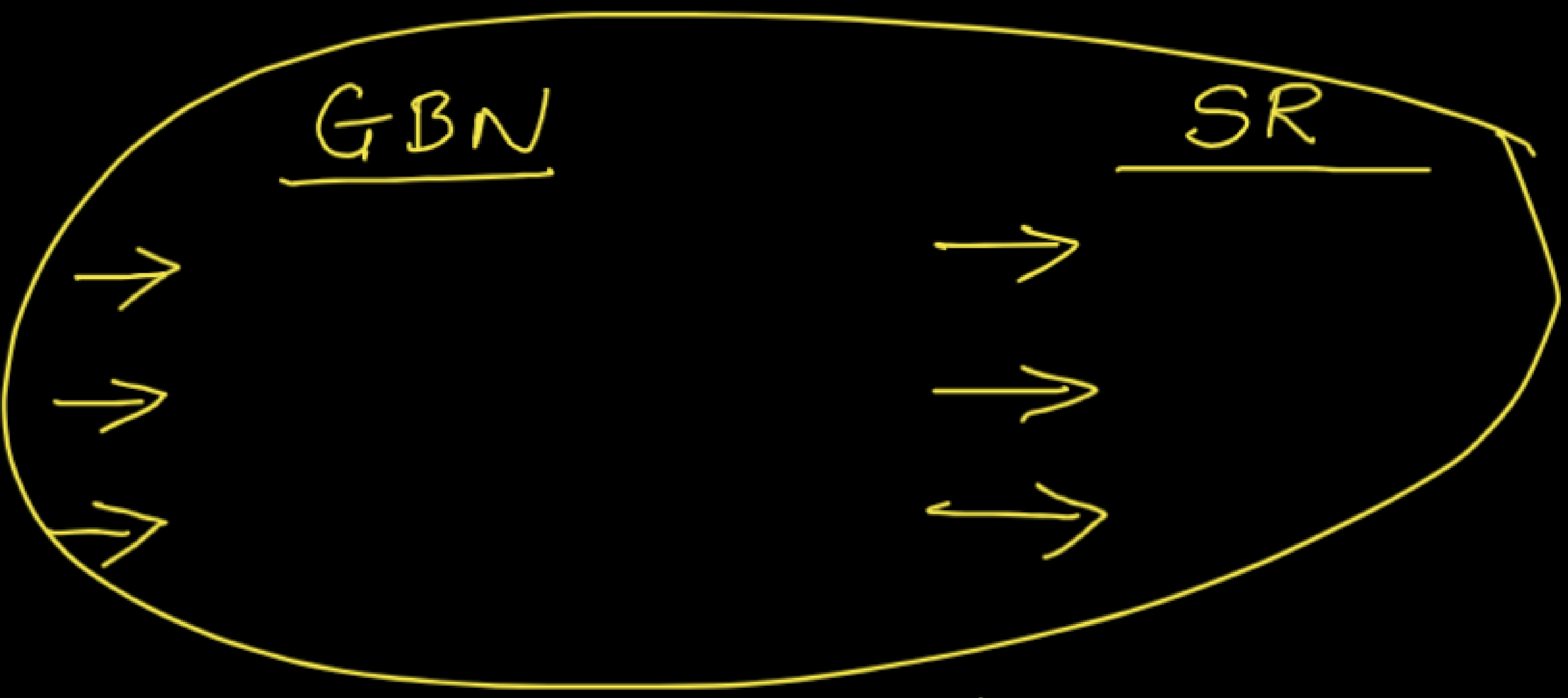
SWP

GBN

SR

Practice.

Real world.



3 points

No text book has simple explanation

Dont Read

GBN → Go back N

(i) Sender window size in 'N'

GB10 → $|W_S| = 10$

~~GB100~~ → $|W_S| = 100$

$|N| \geq 2$! $|N| = 1$ →

↓

Stop and wait

$T_t = 1\ ms \quad T_p = 49.5\ ms \rightarrow \eta$ for GBN

$100\% \rightarrow \underline{\underline{W_s}} = 1 + 2a$

$= 1 + 2 * 49.5$

$= \underline{\underline{100}}$ packs

GBN → $W_s = 10$ packets

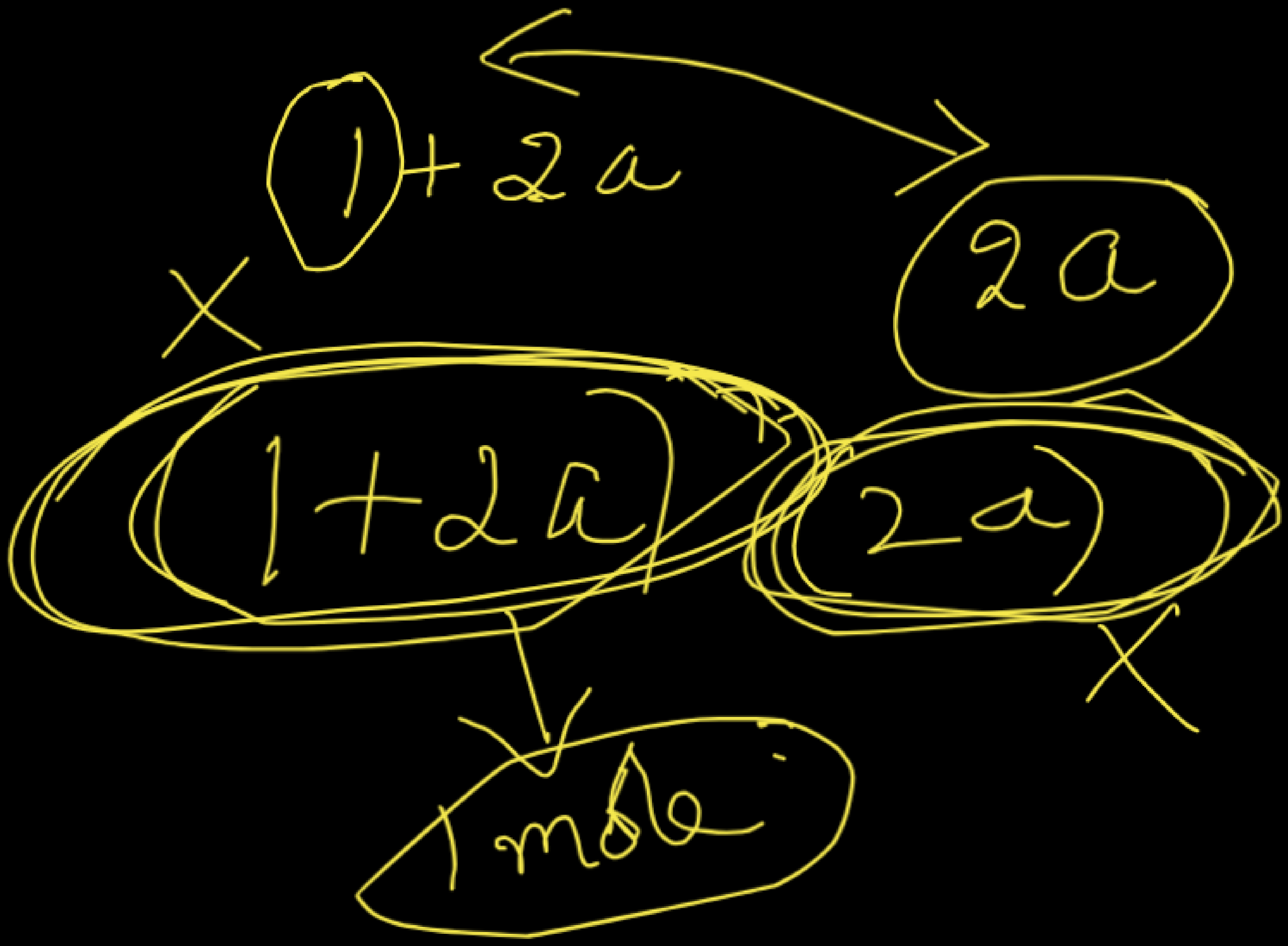
$\eta = \frac{10}{100}$

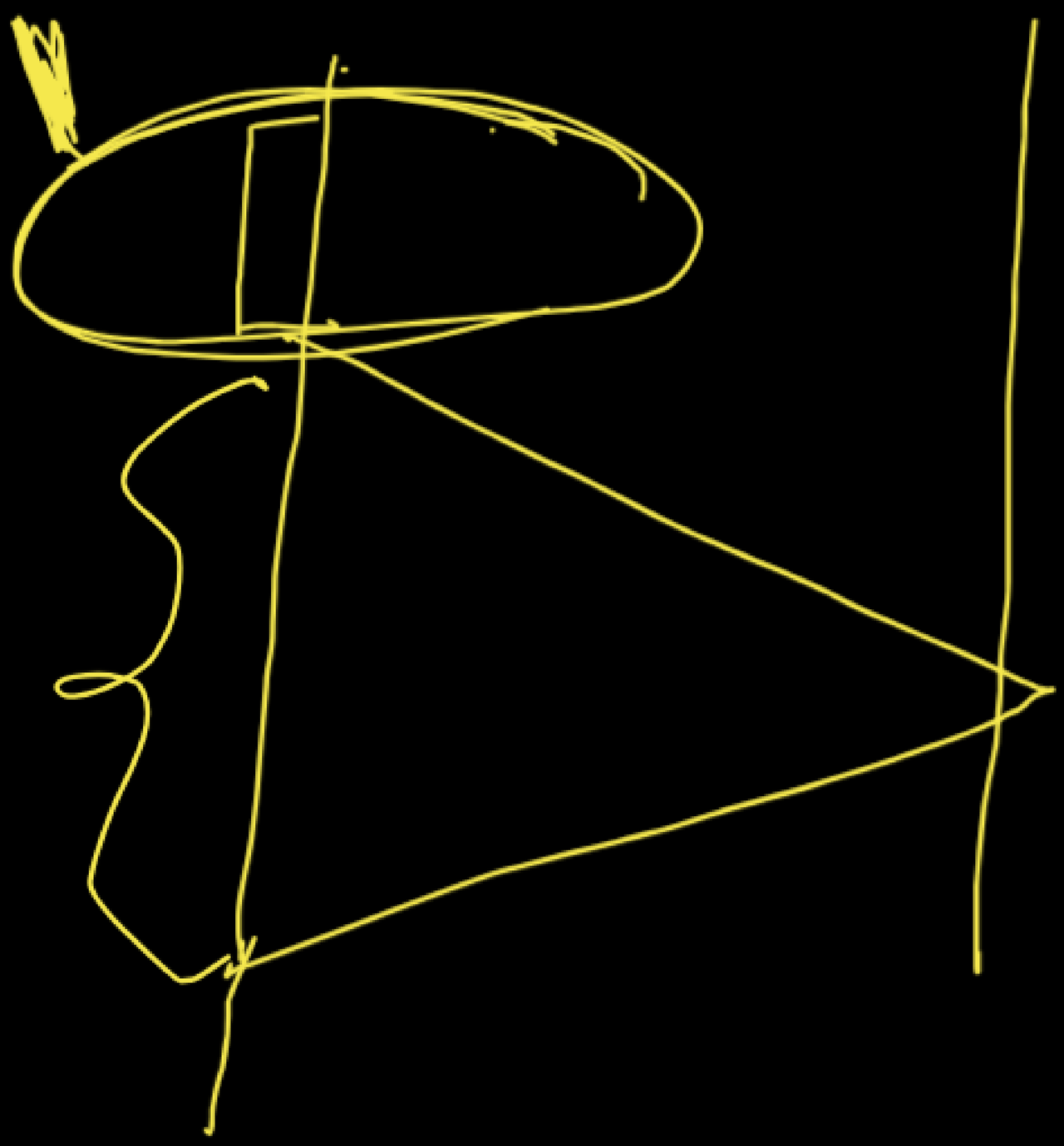
$T_t = 1ms$, $T_p = 99.5ms \Rightarrow \eta$ GB100

$100\% \rightarrow (1+20) \rightarrow 20$ packs

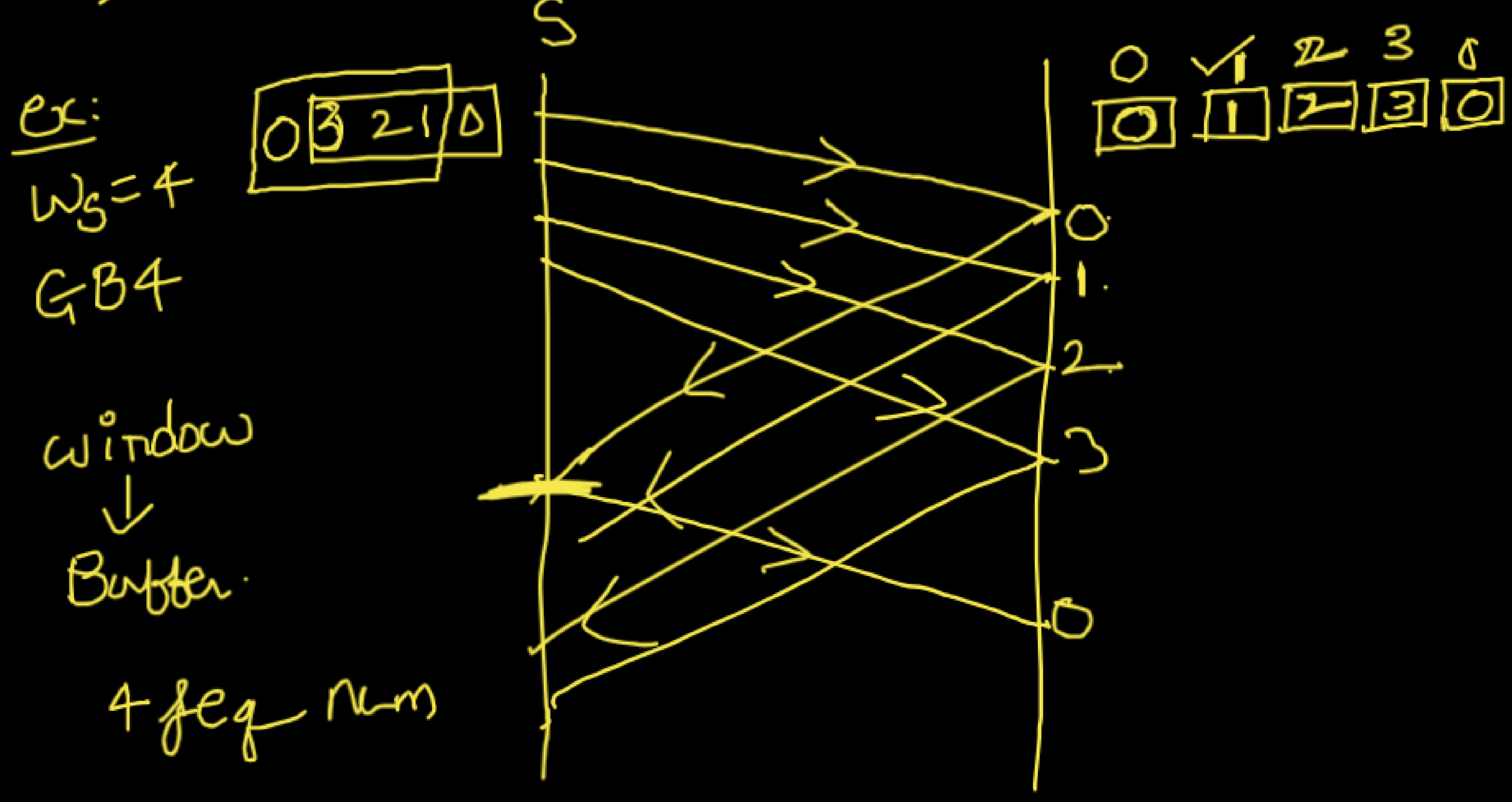
$|\omega_s| = 100$ $\eta = \frac{100}{200}$

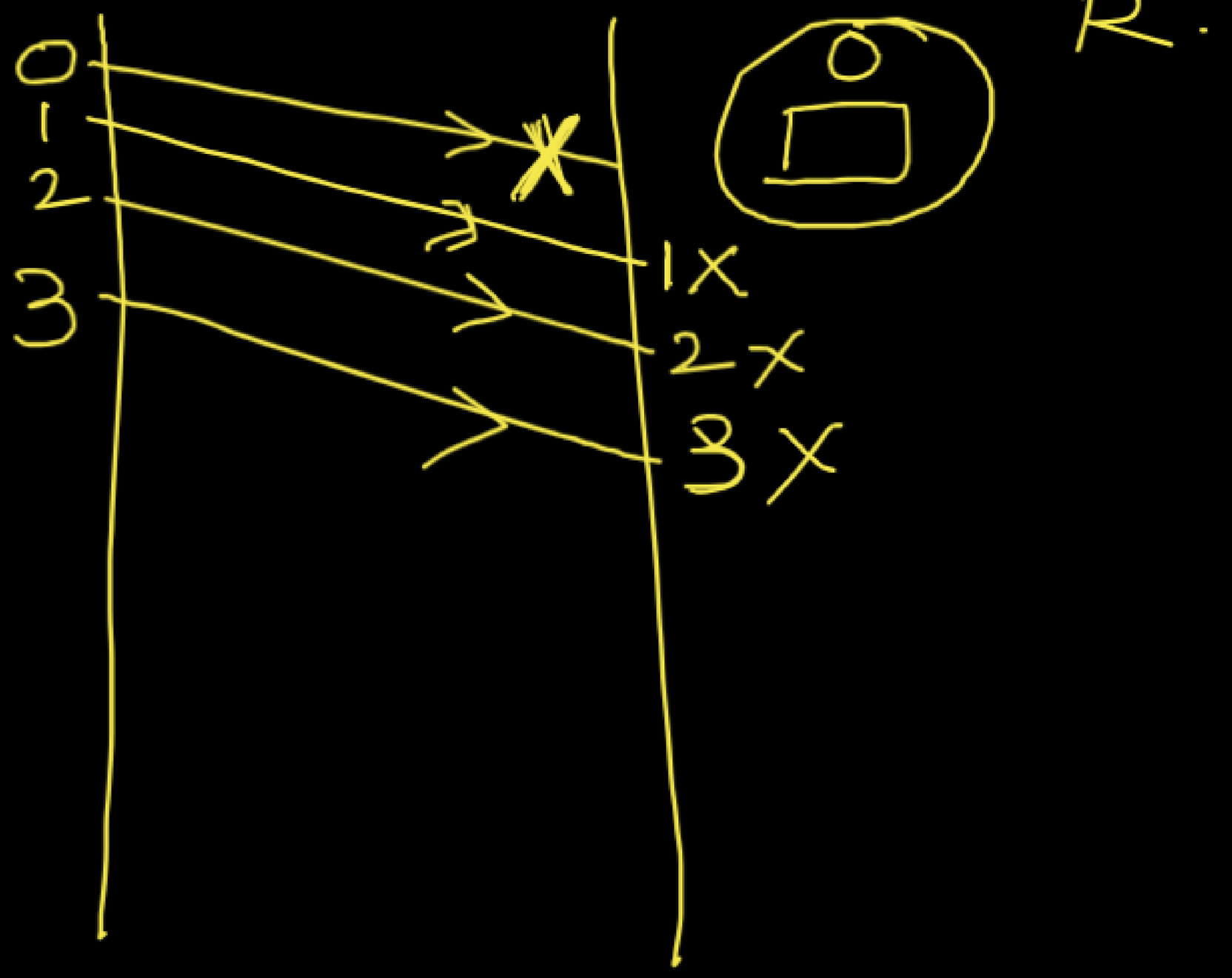
50%


1+2a
2a
1+2a
2a
1 mole

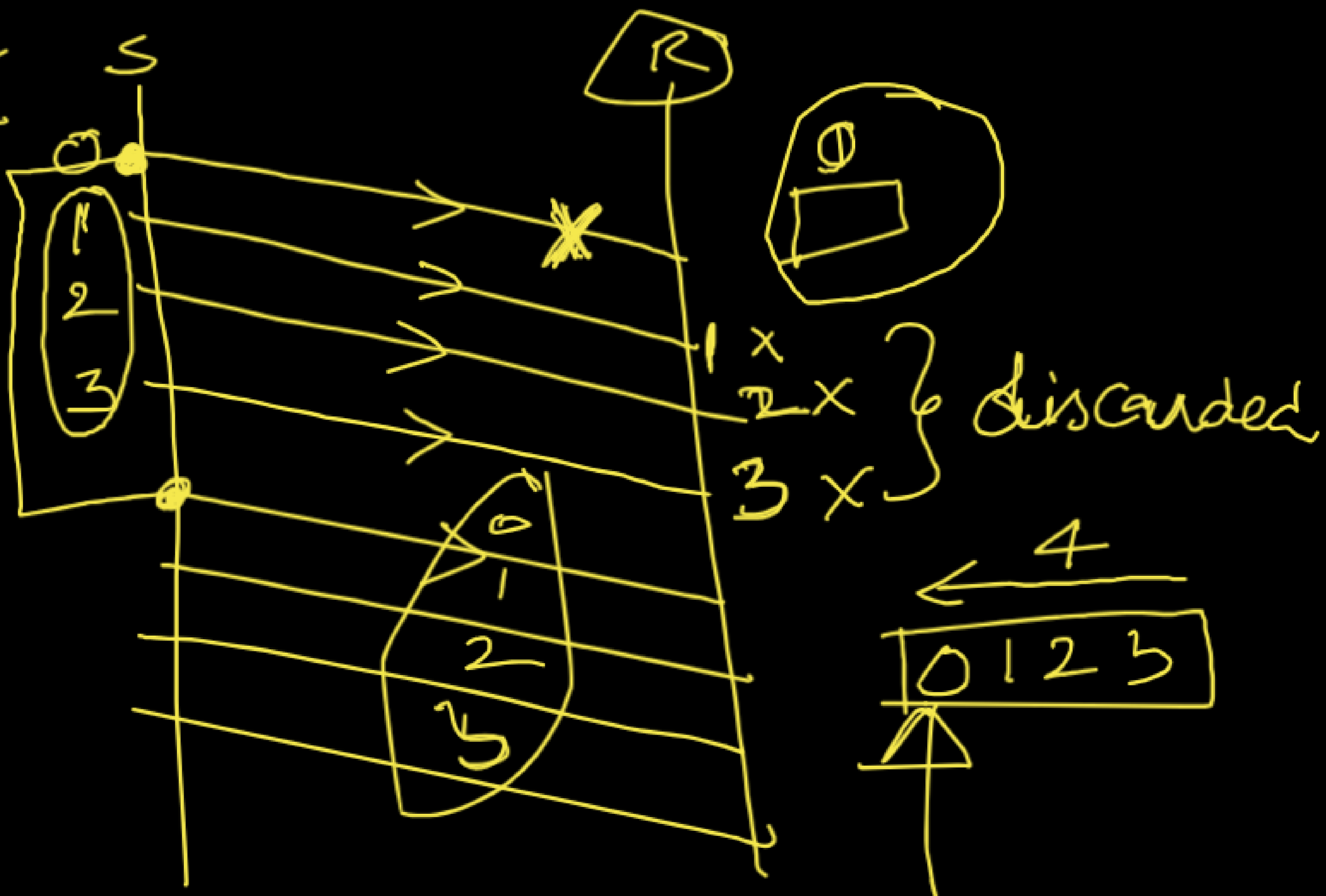


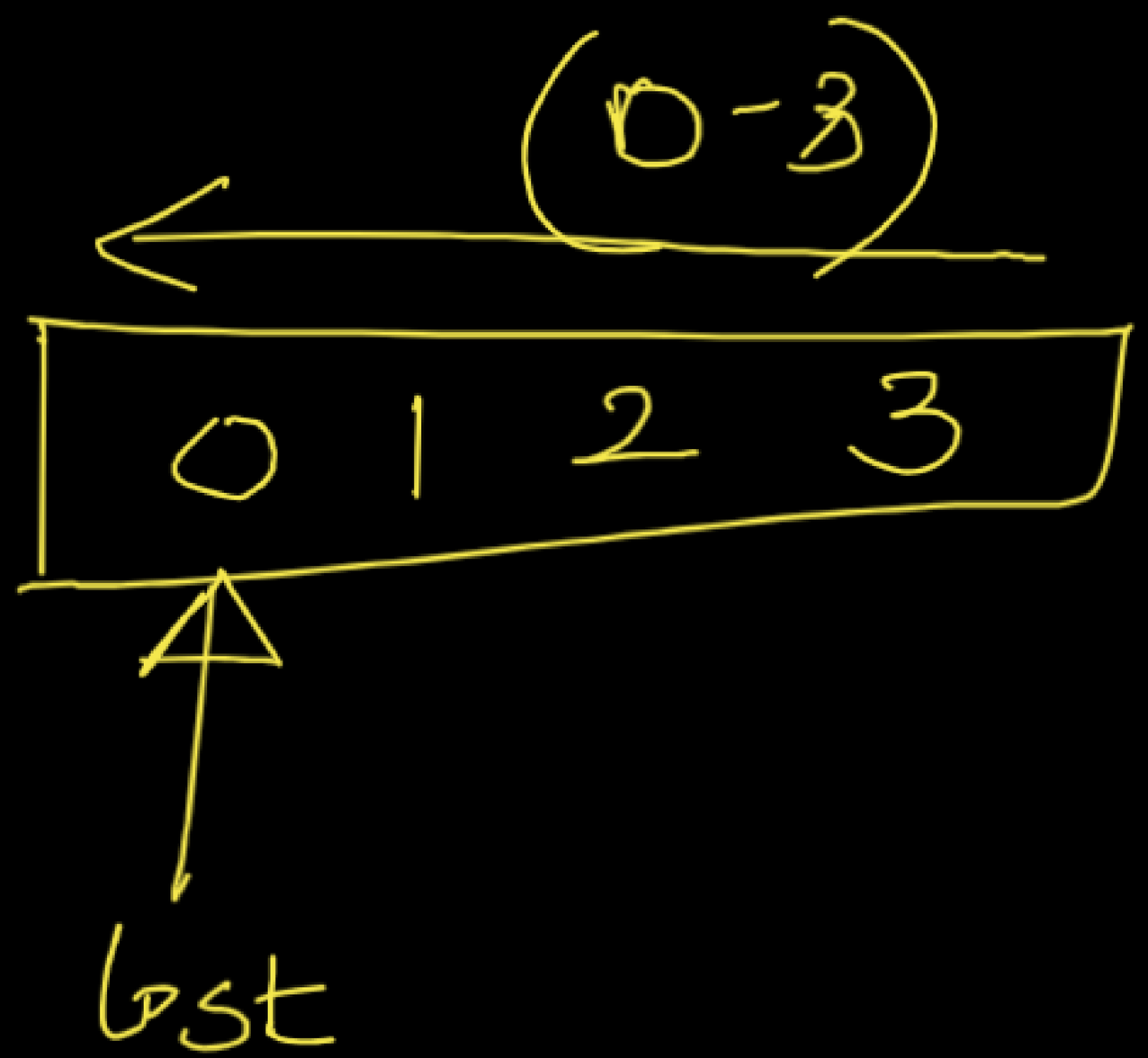
2) Receiver window size is 1

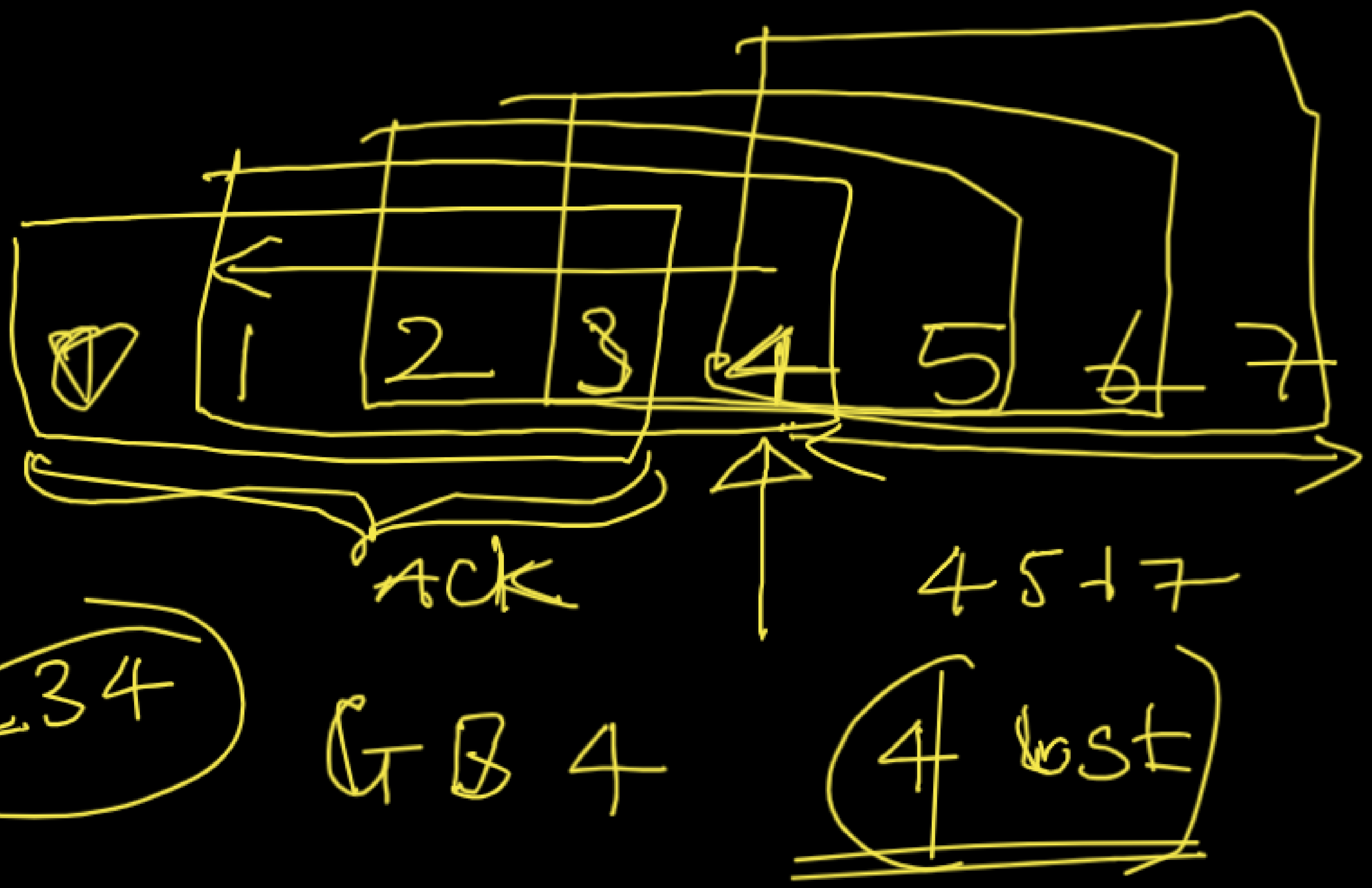


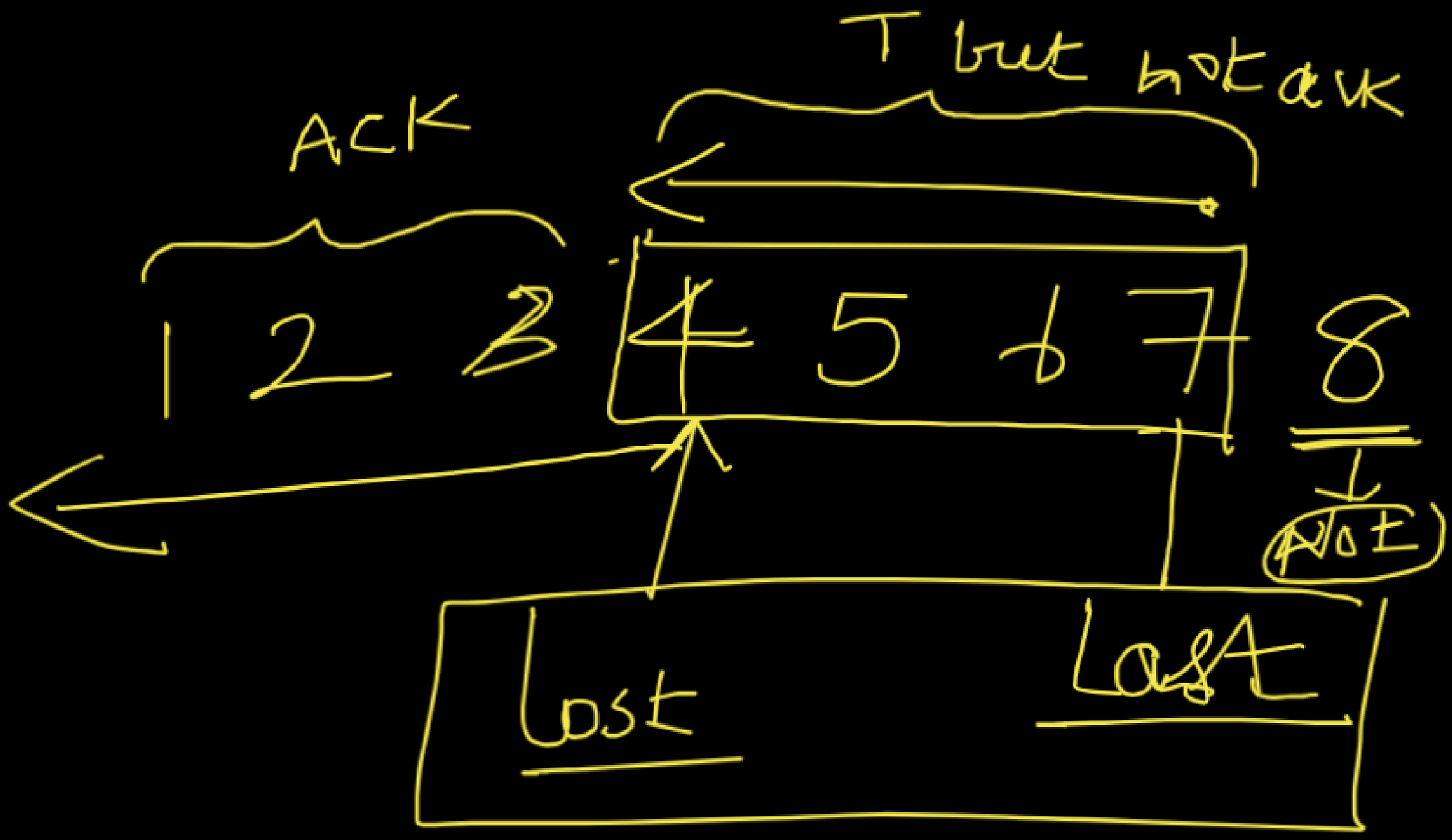

0
1
2
3
1x
2x
3x
R.

TB4

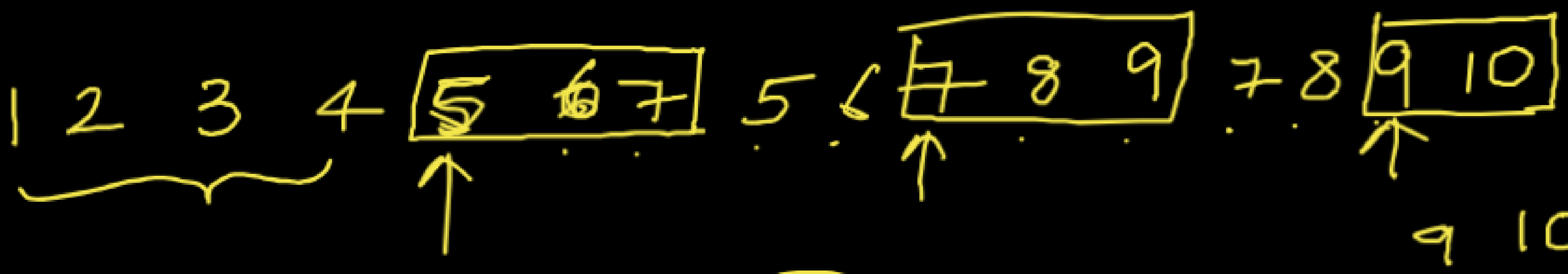



0-3
0 1 2 3
lost

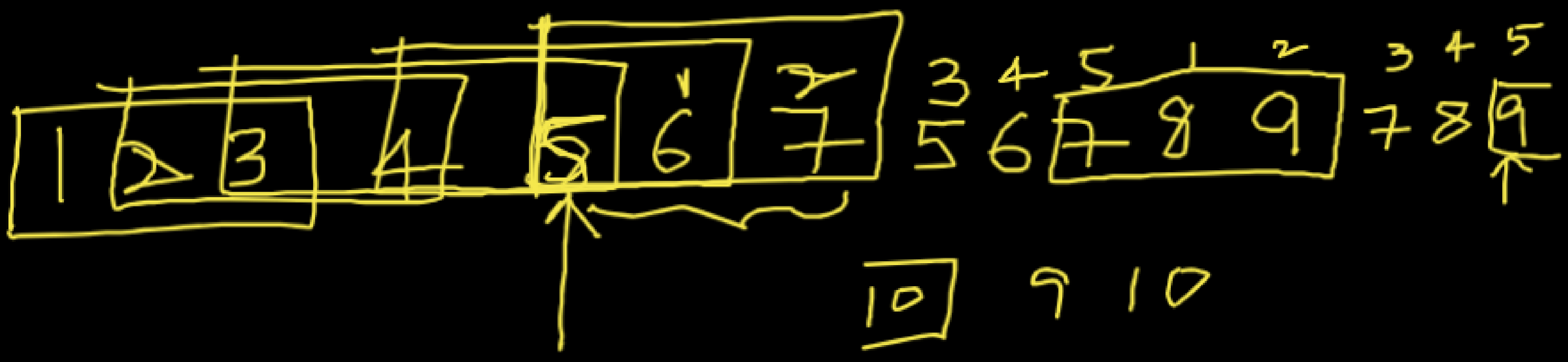

0
1
2
3
4
5
6
7
ACK
4 5 1 7
1 2 3 4
G B 4
4 lost
Retransmitted


Ack
1 2 3 4 5 6 7 8
Lost
Lost

GB-3, if every 5th packet → trav is lost and if we have to send 10 packets, then → transmissions ?



18

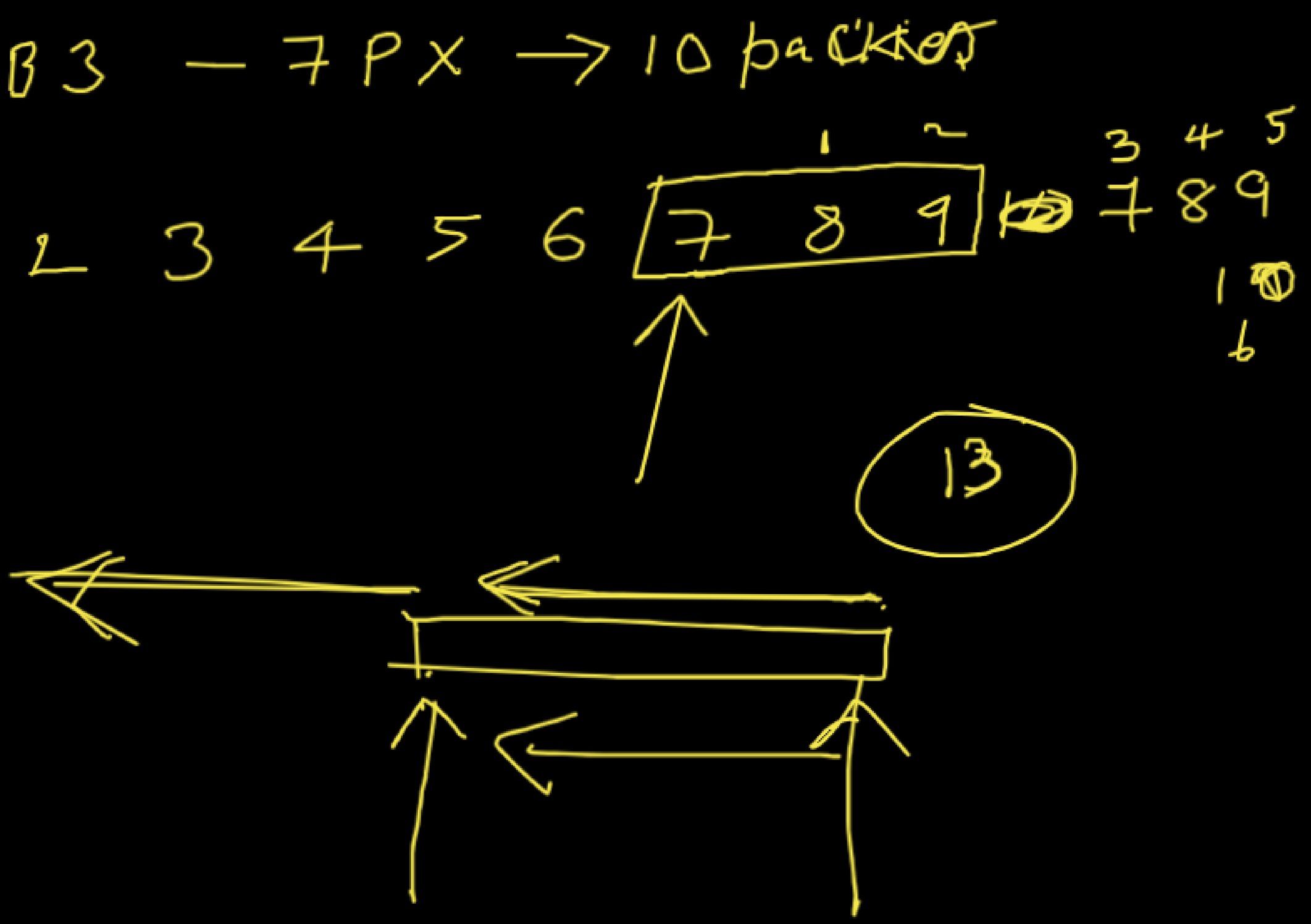

1 2 3 4 5 6 7
3 4 5 6 7 8 9
1 2 3 4 5
7 8 9
10 9 10

GB4 → 6th packet → 10 packet

Transmission

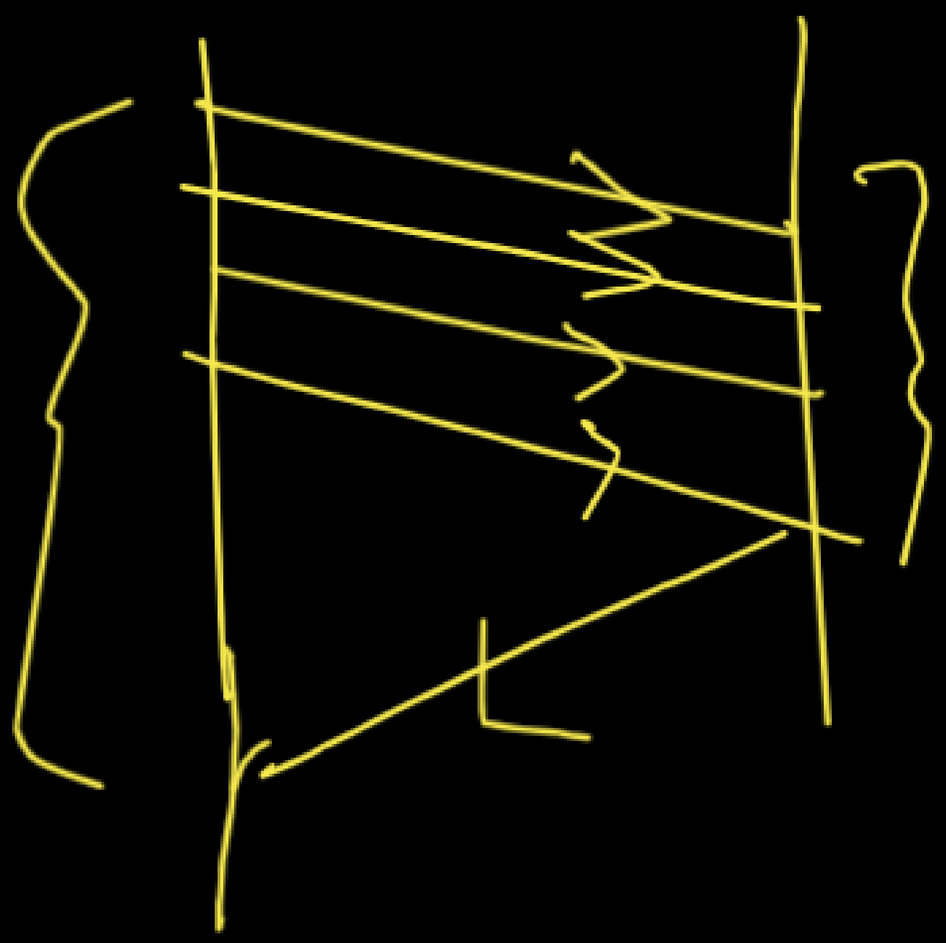
GB3 — 7 PX → 10 packets

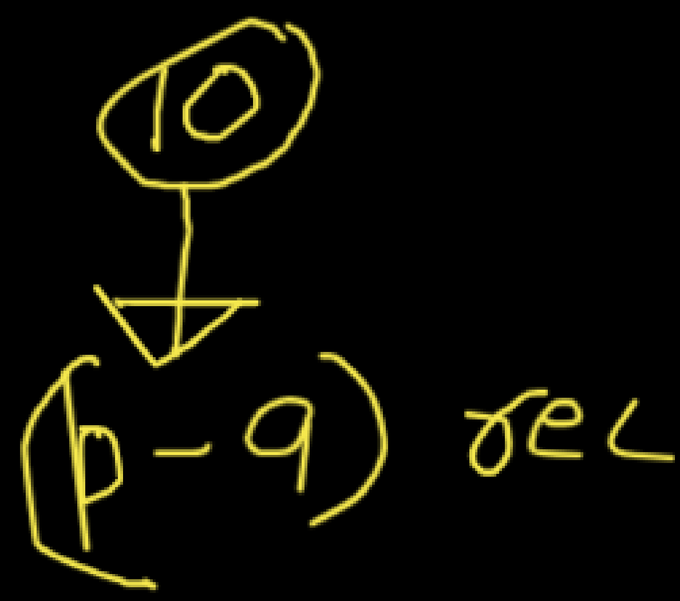
1 2 3 4 5 6 7 8 9

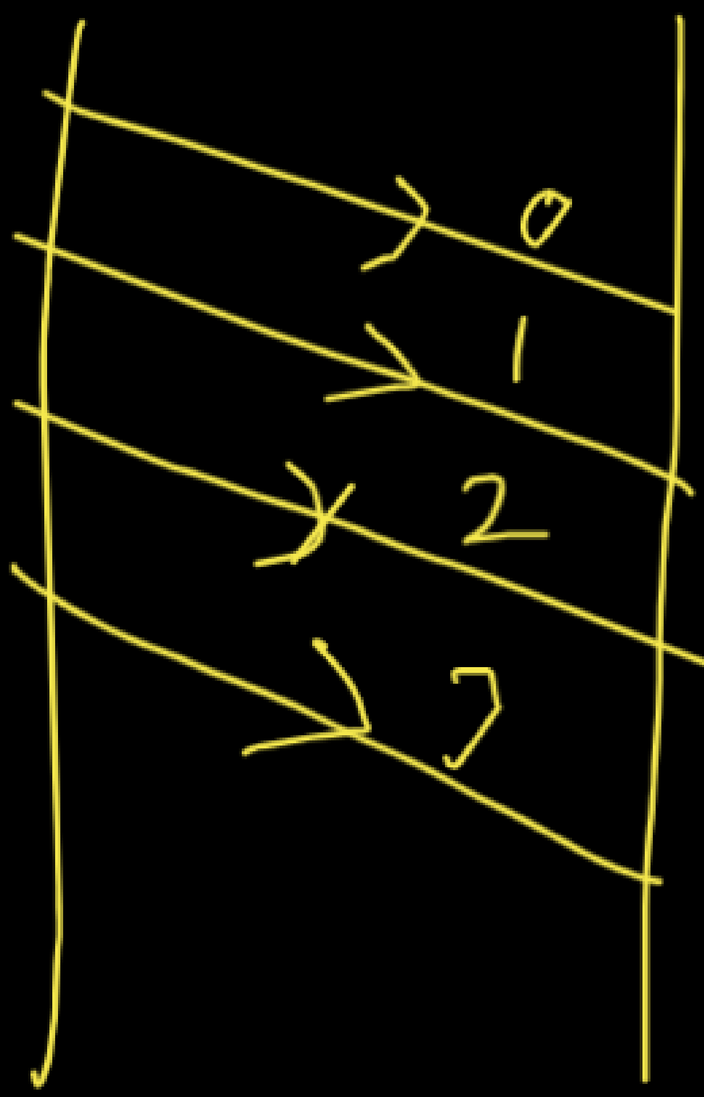


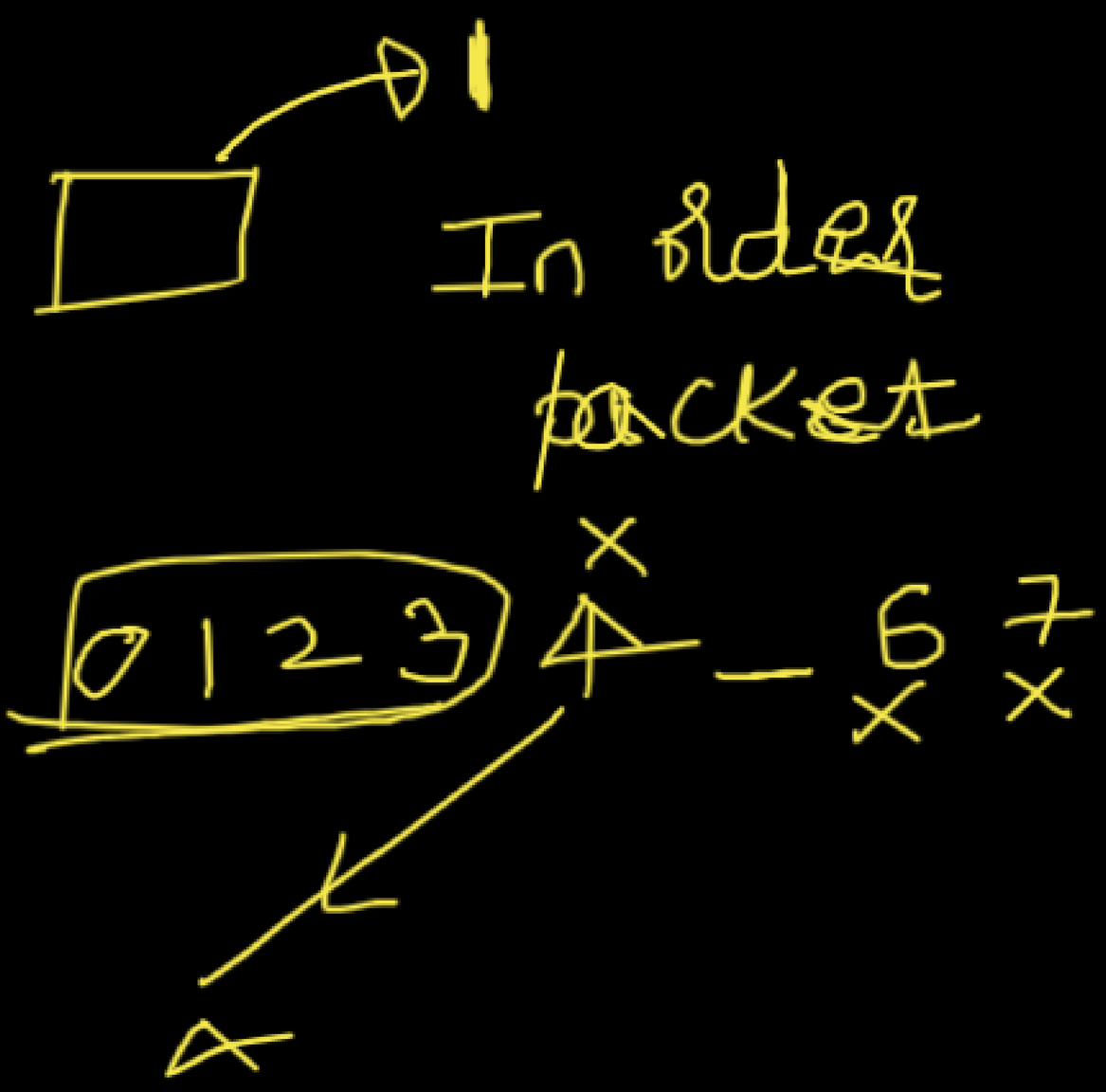
ACK: 3nd | Cumulative

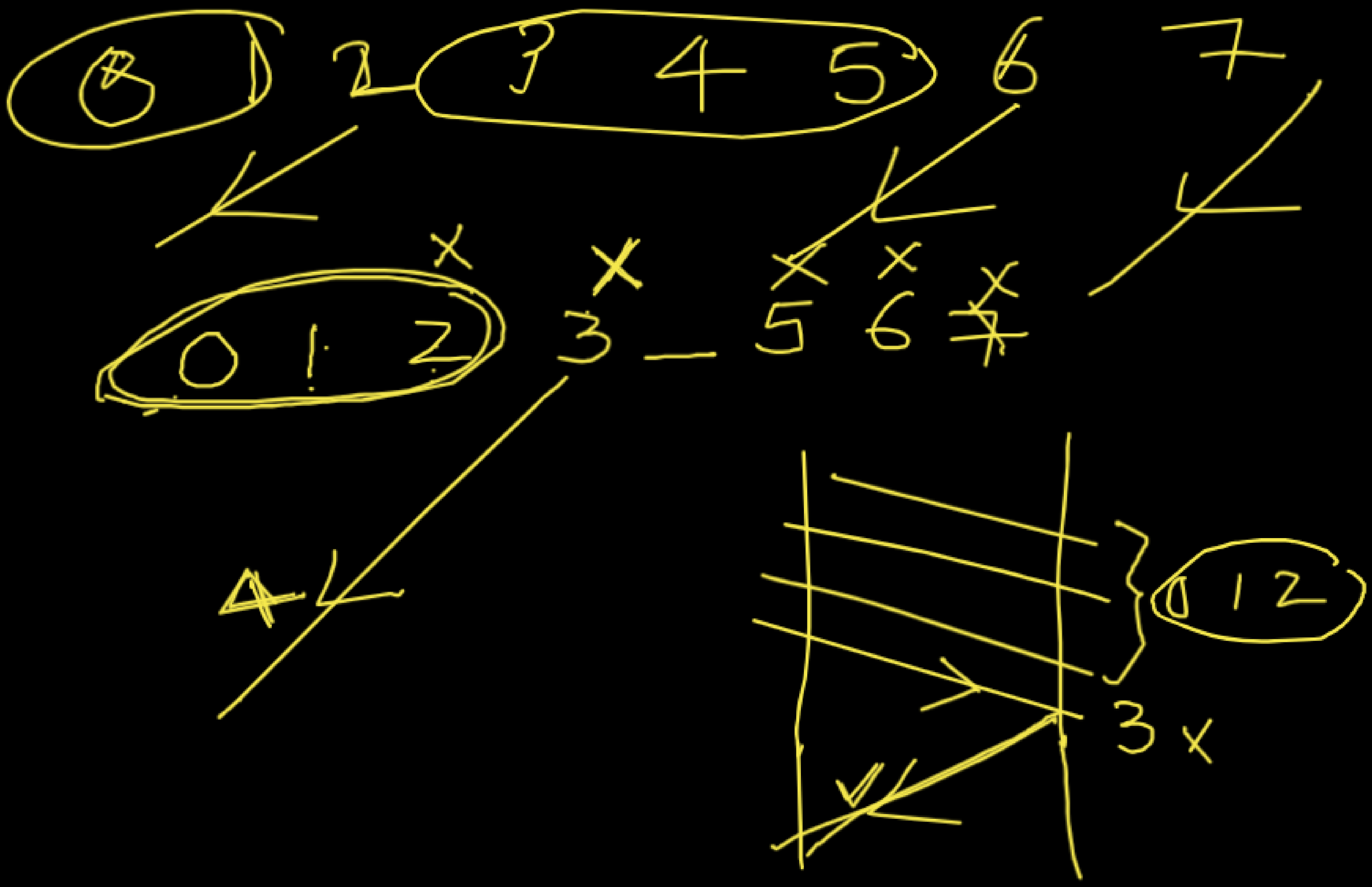
GBN: Cumulative

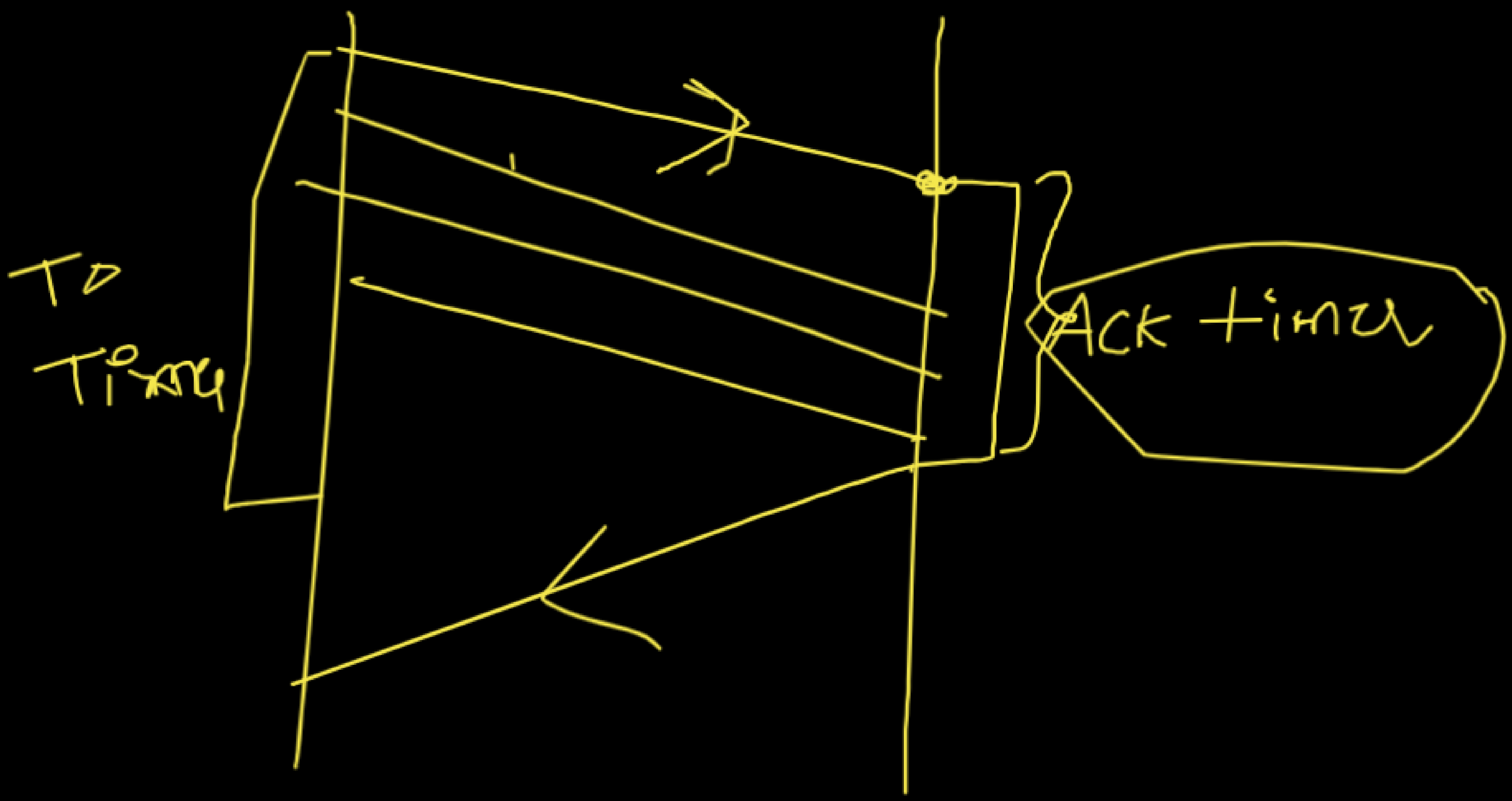


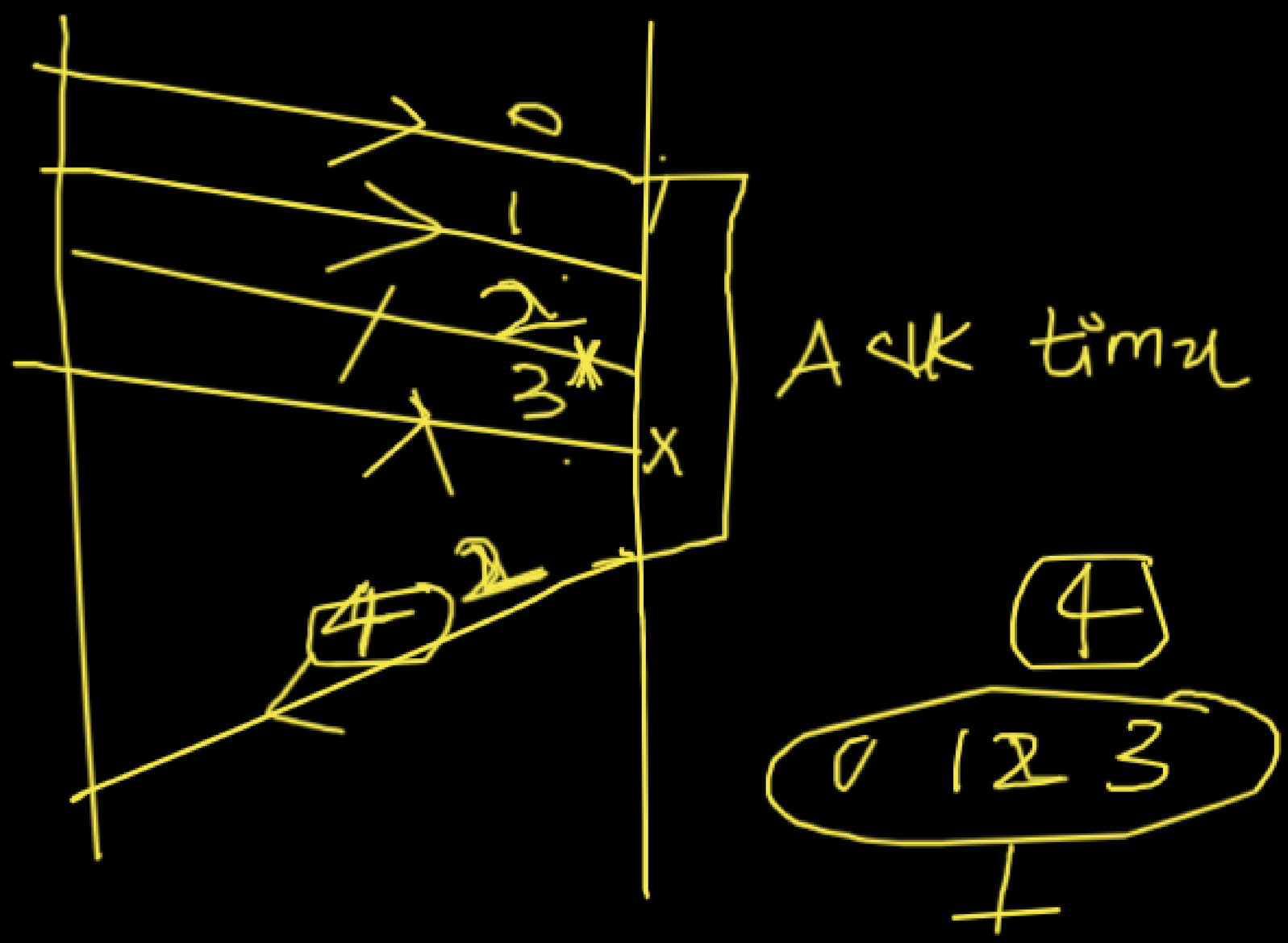


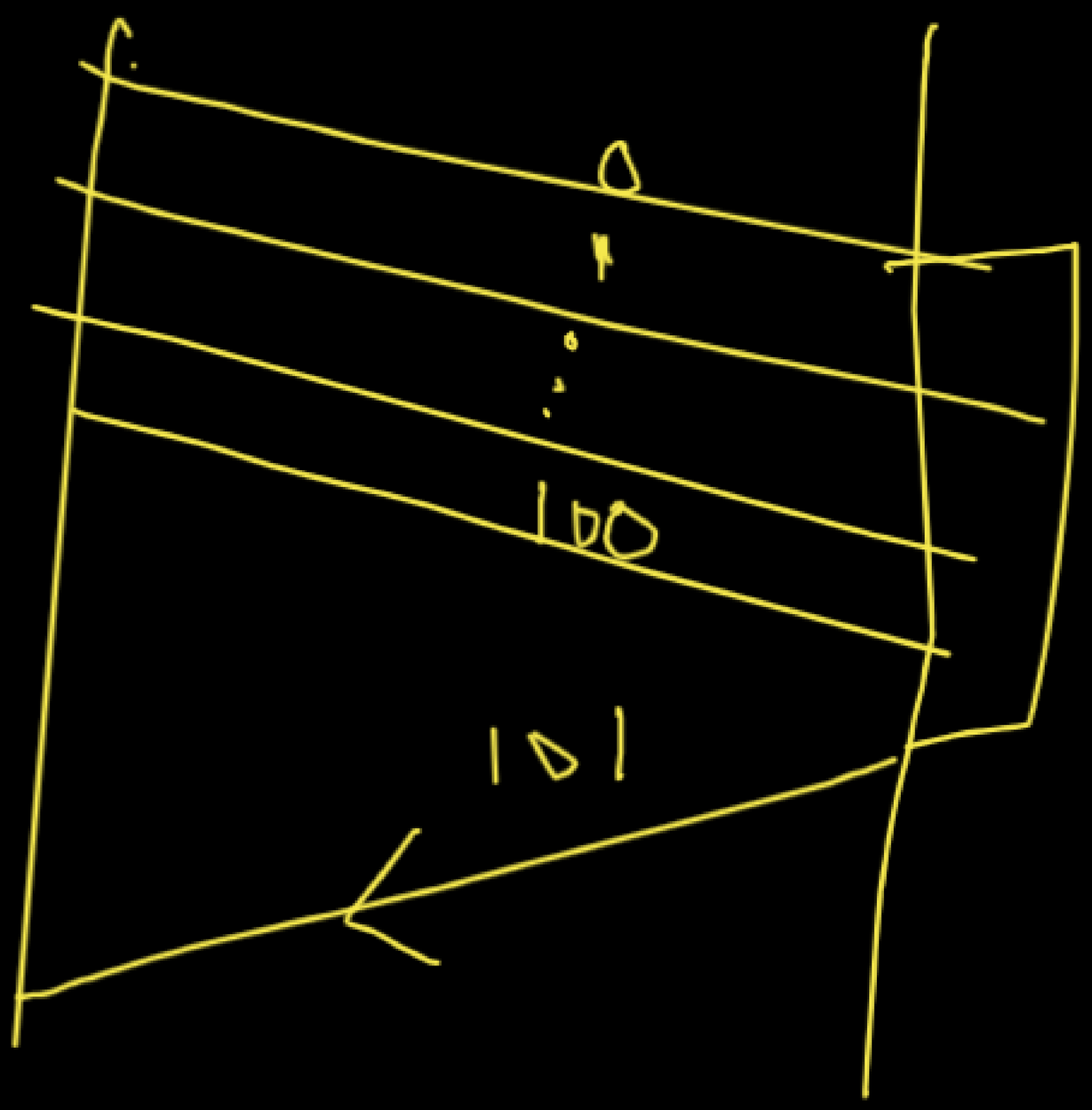

0
1
2
3

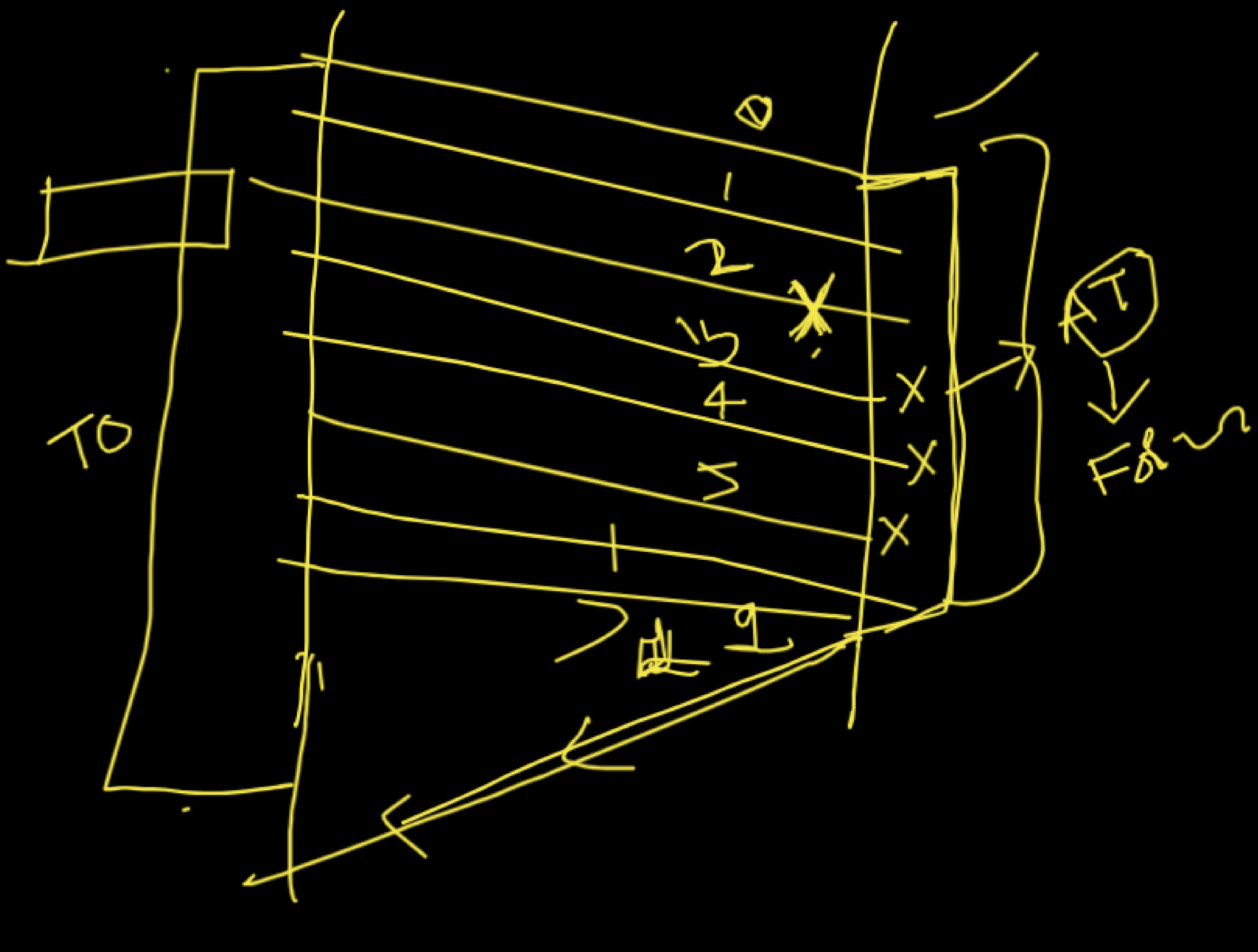

1
In sides
packet
0 1 2 3 4 5 6 7
x x x x
4


0 1 2 3 4 5 6 7
12
3x


TO
TIMER
ACK timer


0
1
2
3
X
4
2
Ack time
4
0 1 2 3


٥
١
١٥٥
١٥١


0
1
2
3
4
TO
X
X
X