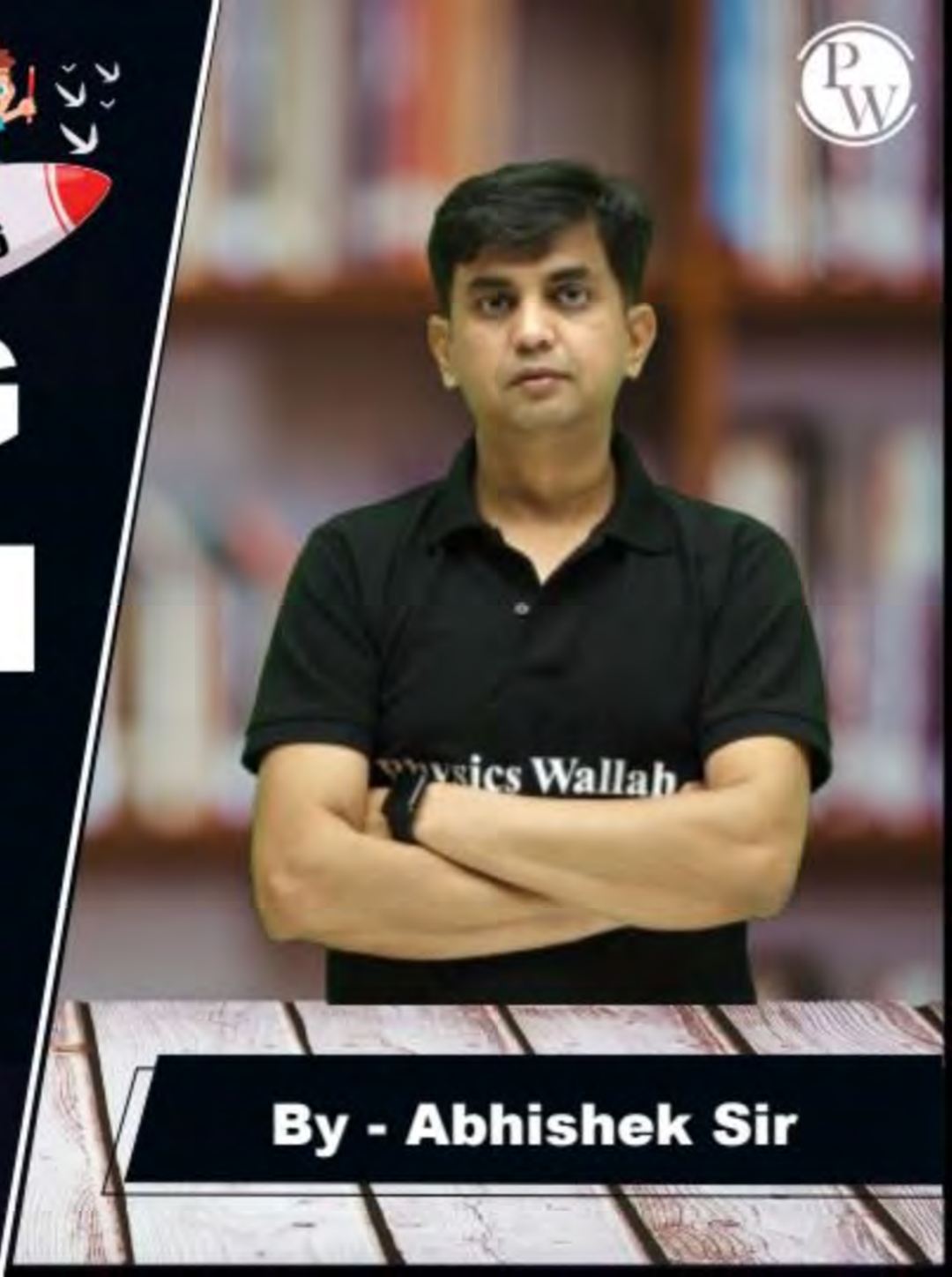
CS & IT ENGINEERING

Computer Network

Flow Control

Lecture No. - 05



By - Abhishek Sir

Recap of Previous Lecture

Topic Go Back N ARQ

↳ Transmitter's protocol

Topics to be Covered

Topic Go Back N ARQ

Topic Selective Repeat ARQ

ABOUT ME

Hello, I'm Abhishek

- GATE CS AIR - 96
- M.Tech (CS) - IIT Kharagpur
- 12 years of GATE CS teaching experience

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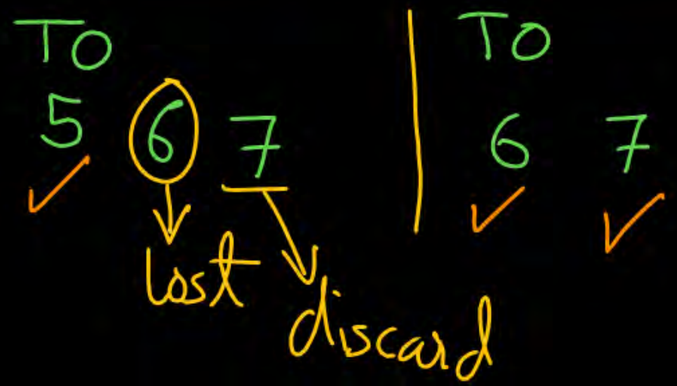
Example 9 :- [H.W.]

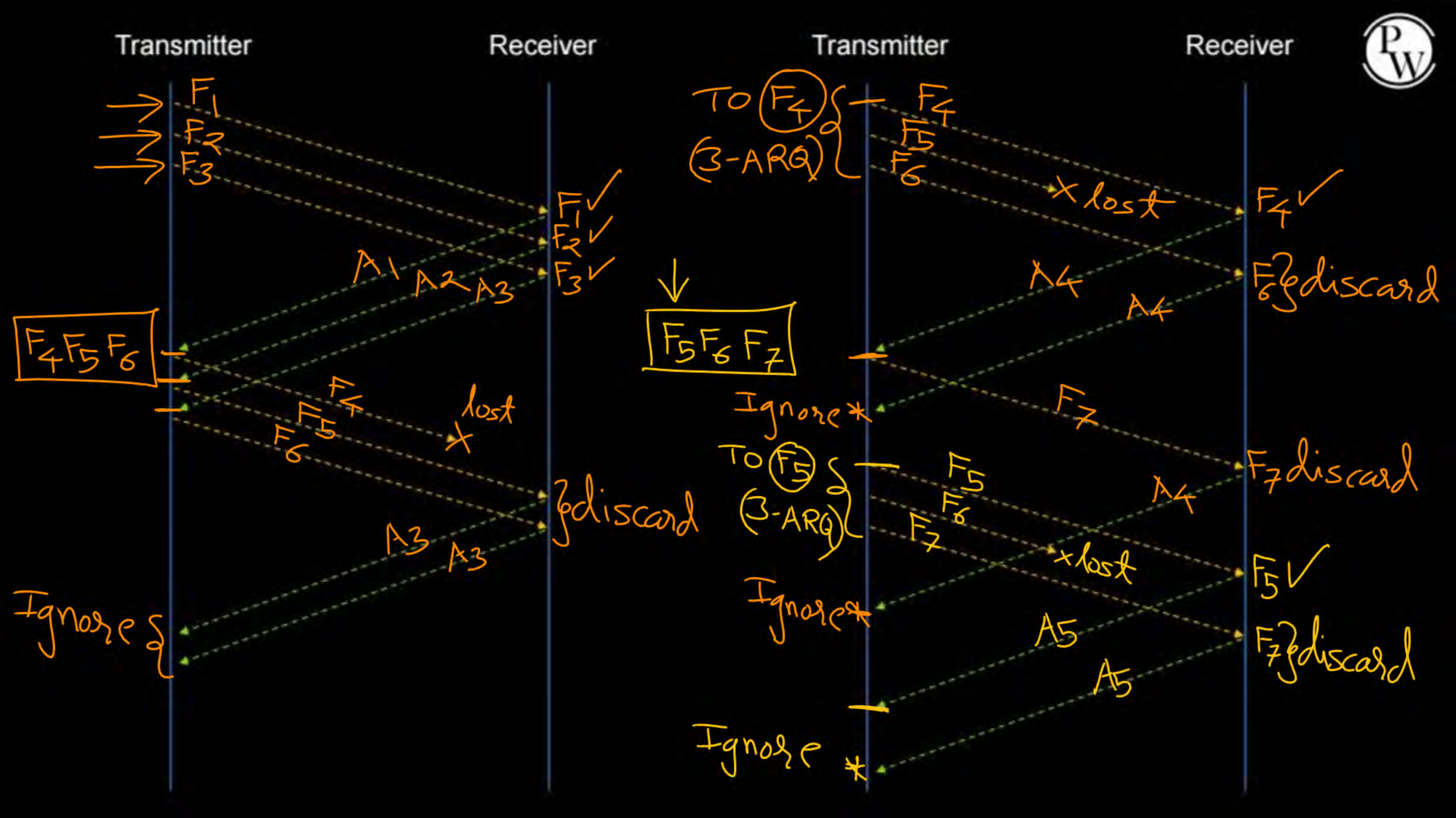
#Q. Consider host A wants to send a file to ~~Station~~ Host B using go-back-N (window size 3) flow control strategy. The file is divided into 7 packets. If every 4th packet that A transmits gets lost (but no ACKs from B ever get lost), then what is the number of packets that A will transmit for sending the file to B ?

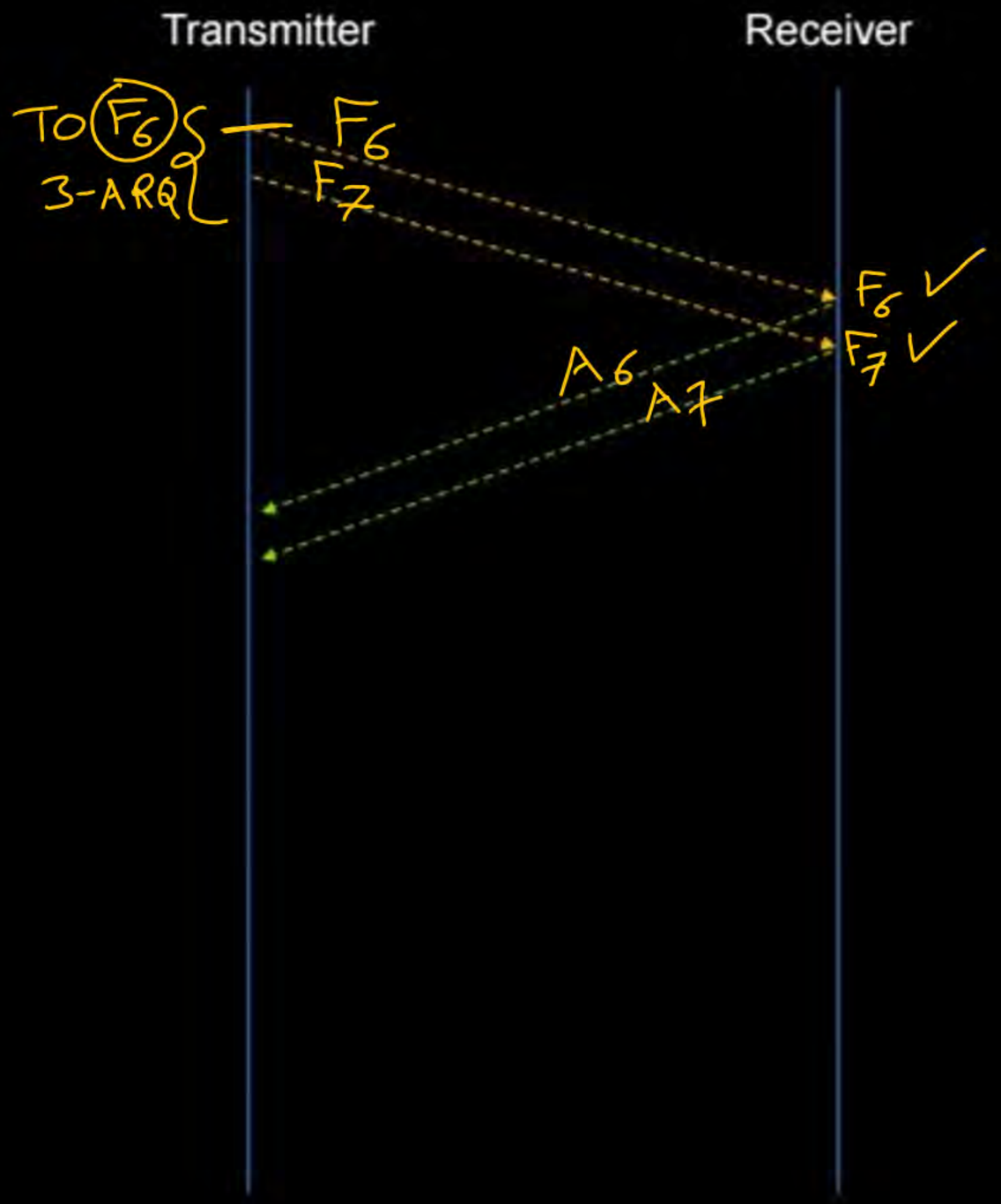
[Including Retransmission]



Ans > 7

Ans = 15


Transmitter
Receiver
Transmitter
Receiver
F1
F2
F3
F1 ✓
F2 ✓
F3 ✓
A1
A2
A3
F4 F5 F6
F4
F5
F6
lost
discard
A3
A3
Ignore
To (F4) (3-ARQ)
F4
F5
F6
lost
F4 ✓
A4
A4
F6 discard
F5 F6 F7
Ignore
F7
F7 discard
To (F5) (3-ARQ)
F5
F6
F7
A4
lost
F5 ✓
Ignore
A5
A5
F7 discard
Ignore


Transmitter
Receiver
To F6
3-ARQ
F6
F7
F6 ✓
F7 ✓
A6
A7

#Q. Station A needs to send a message consisting of 9 packets to Station B using a sliding window (window size 3) and go-back-n flow control strategy. All packets are ready and immediately available for transmission. If every 5^{th} packet that A transmits gets lost (but no ACKs from B ever get lost), then what is the number of packets that A will transmit for sending the message to B?

[GATE 2006]

IIT-KGP, H.W.

A 12

B 14

C 16

D 18

#Q. Consider a network connecting two systems located 8000 kilometers apart. The bandwidth of the network is 500×10^6 bits per second. The propagation speed of the media is 4×10^6 meters per second. It is needed to design a Go-Back-N sliding window protocol for this network. The average packet size is 10^7 bits. The network is to be used to its full capacity. Assume that processing delays at nodes are negligible. Then, the minimum size in bits of the sequence number field has to be _____.

[GATE 2015, Set-3, 2-Mark]

IIT-K, H.W.

Topic : Selective Repeat ARQ

→ Transmitter's transmitting window size = N (N > 1)

→ Receiver's receiving window size = N

* Altenet sequence set

Topic : Selective Repeat ARQ

→ Total number of sequences = 2N [0 to (2N-1)]

0 to (N-1)

N to (2N-1)

Total number of sequences =
Transmitter's transmitting window size
+ Receiver's receiving window size

Sequence number ← (Frame number) mod (2N)

Topic : Selective Repeat ARQ

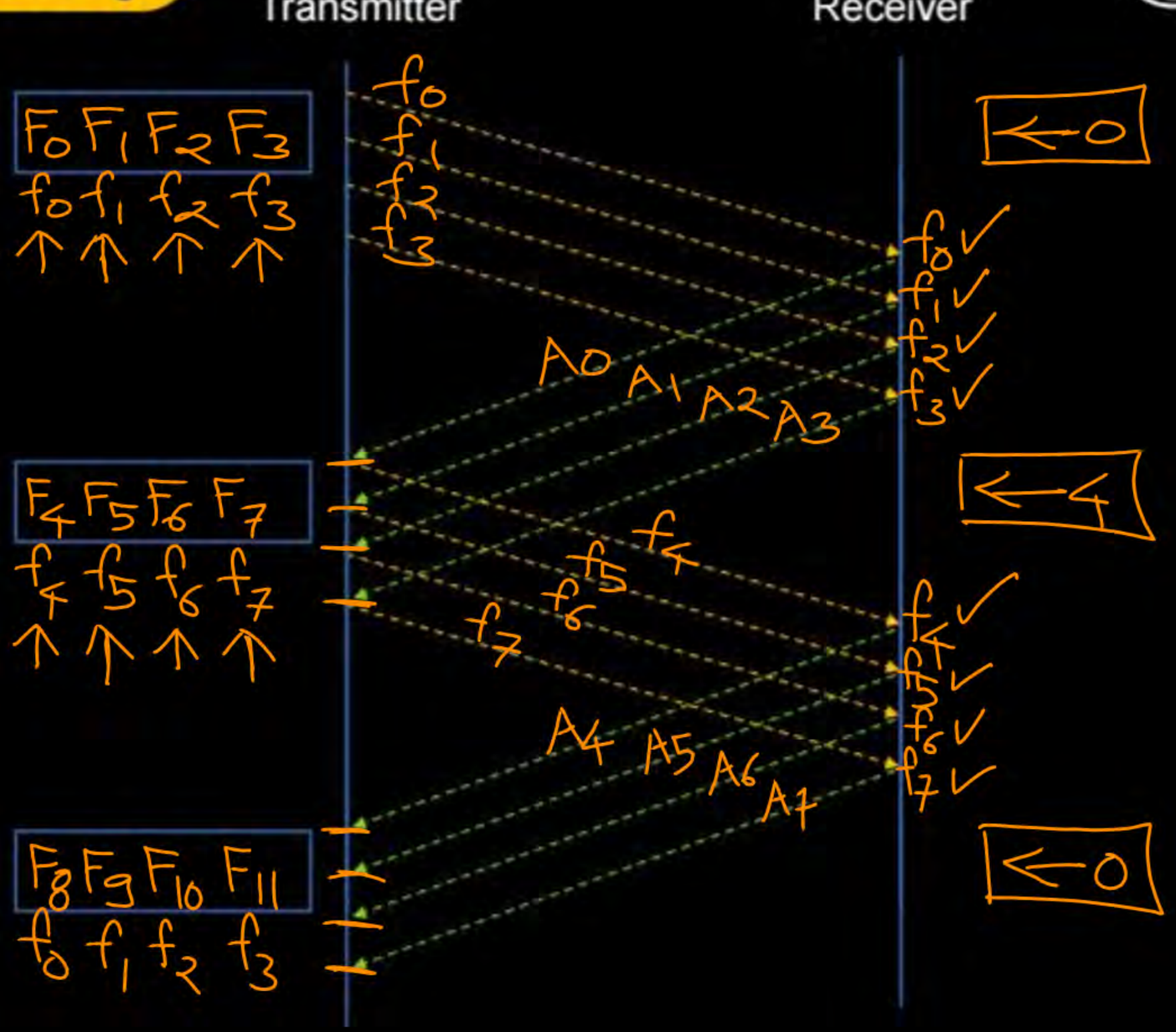
CASE I :

Suppose N = 4

Sequence Number = 0 to 7

⇒ Mod(8)

→ Expected seq. no.



Topic : Selective Repeat ARQ

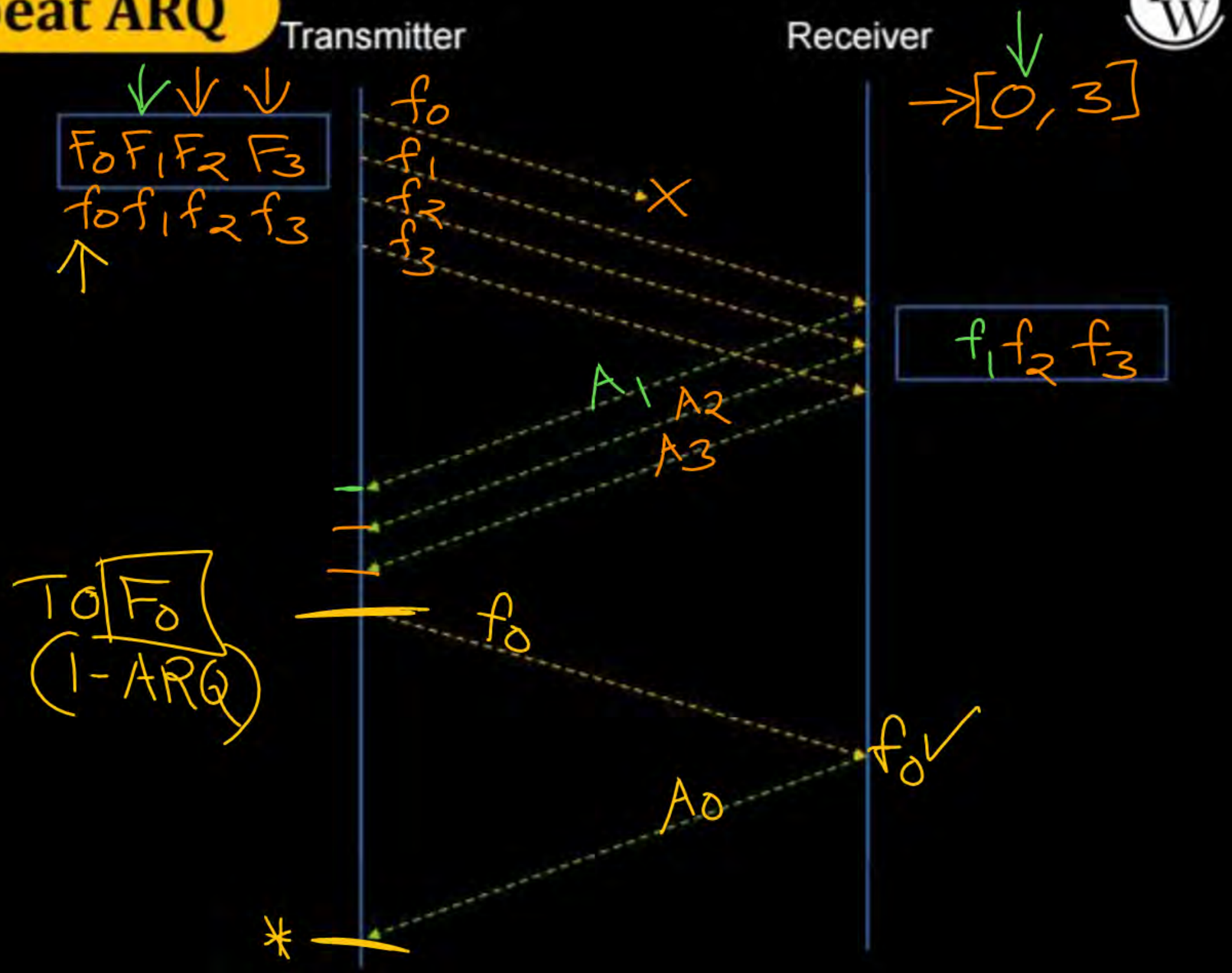
CASE II :

Suppose N = 4

Sequence Number = 0 to 7

Expected seq. no. = i

Expected seq. no. range
= i to (i + N – 1)



Topic : Selective Repeat ARQ

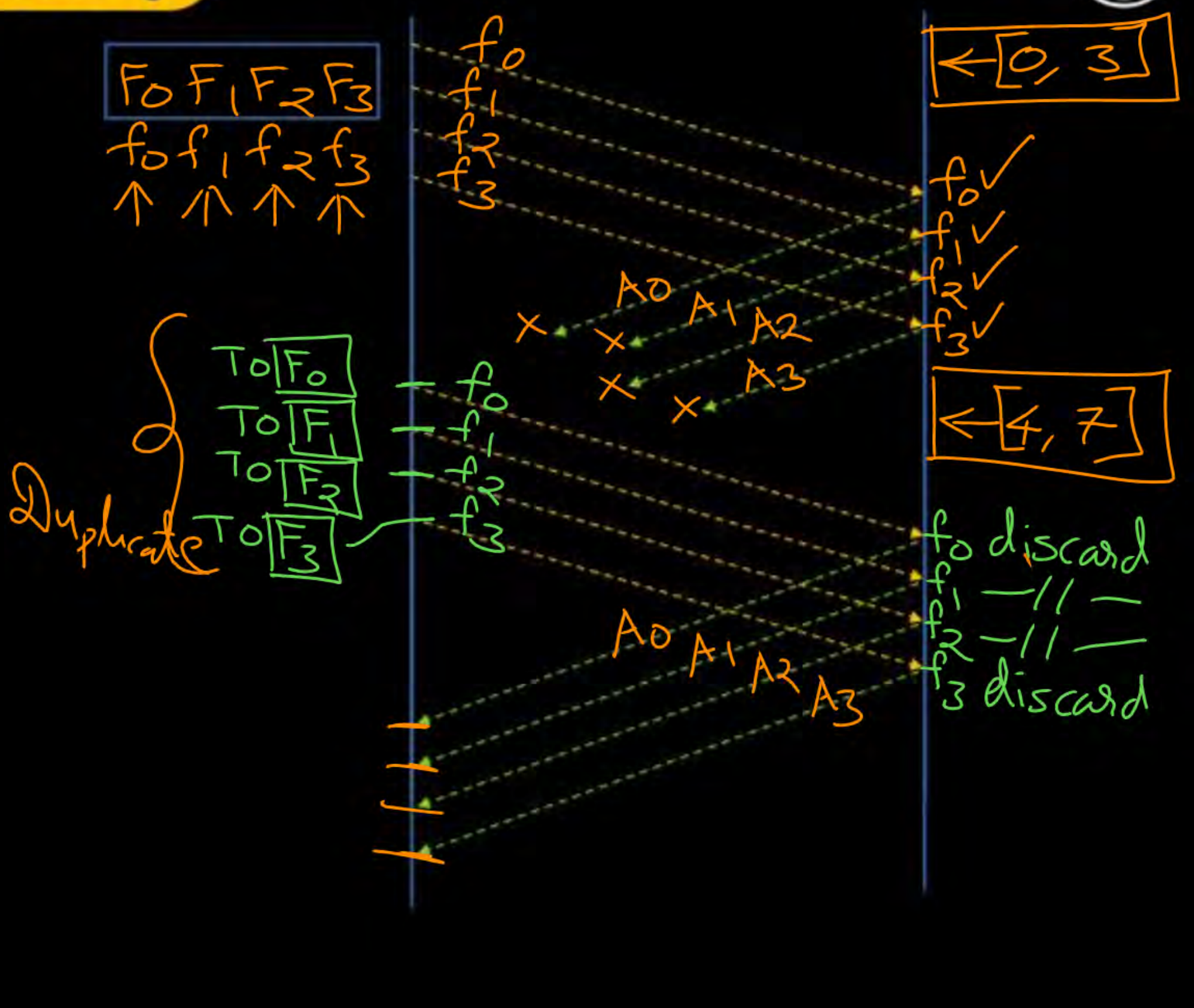
CASE III :

Suppose N = 4

Sequence Number = 0 to 7

Expected seq. no. = i

Expected seq. no. range
= i to (i + N – 1)



Topic : Selective Repeat ARQ

→ Transmitter transmit N frames without any acknowledgment

→ Receiver transmit "individual acknowledgment"
[for every successfully received frame]

→ "Cumulative (combine) acknowledgment" does not exist in this protocol

→ Whenever transmitter gets time-out or received NACK,
it retransmit that perticular frame only

Selective Repeat

Topic : Selective Repeat ARQ / Selective Reject

→ Expected sequence number range
= Expected sequence number to (Expected sequence number + N – 1)

→ When receiver receives a frame which is out of order
[Sequence number of the frame is different then expected sequence number]

if Sequence number belongs to expected sequence number range
then buffer the frame in receiving window
and send individual acknowledgment of that frame
else
discard the frame and send individual acknowledgment of that frame

↳ Selective Reject

#Q. Consider a 128×10^3 bits/second satellite communication link with one-way propagation delay of 150 milliseconds. Selective retransmission (repeat) protocol is used on this link to send data with a frame size of 1 kilobyte. Neglect the transmission time of acknowledgment. The minimum number of bits required for the sequence number field to achieve 100% utilization is _____.

[GATE-2016, Set-2, 2-Mark]

IISC, H.W.

#Q. Consider a selective repeat sliding window protocol that uses a frame size of 1 KB to send data on a 1.5 Mbps link with a one-way latency of 50 msec. To achieve a link utilization of 60%, the minimum number of bits required to represent the sequence number field is _____.

[GATE-2014, Set-1, 2-Mark]

IIT-KGP, H.W.

#Q. In a sliding window ARQ scheme, the transmitter's window size is N and the receiver's window size is M. The minimum number of distinct sequence numbers required to ensure correct operation of the ARQ scheme is

[GATE 2004]

A. min(M, N)

B. max(M, N)

C. M + N

D. MN

Ans: C

Solution :-

Transmitter's transmitting window size = N

Receiver's receiving window size = M

Total number of sequences = (N + M)

Total number of sequences =
Transmitter's transmitting window size
+ Receiver's receiving window size

$(N > 1)$

1) Go Back N ARQ

$M = 1$

2) Selective Repeate

$M = N$

Transmitter's transmitting window size = N

(N > 1)

1. Sliding Window Protocol

Total number of sequences = N

2. Go Back N ARQ

Total number of sequences = (N+1)

3. Selective Repeat ARQ

Total number of sequences = (N+N) = (2N)

Minimum number of bits required for sequence number field

$= \lceil \log_2(\text{Total number of sequences}) \rceil$ bits

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Suppose, Number of bits in sequence number field (Frame Header) = k bits

Total number of sequences = 2^k

0 to $(2^k - 1)$

Number of bits in sequence number field = k

1. Sliding Window Protocol

Transmitter's transmitting window size = 2^k

2. Go Back N ARQ

Transmitter's transmitting window size = $(2^k - 1)$

3. Selective Repeat ARQ

Transmitter's transmitting window size = $2^{(k-1)} = \frac{2^k}{2^1}$

$$\eta = \frac{N * t_x}{\text{cycle time}}$$

#Q. The maximum window size for data transmission using the selective reject protocol with n-bit frame sequence numbers is:

[GATE 2005]

IIT-B

A 2^n

B $2^{(n-1)}$ $= \frac{2^n}{2}$

C $(2^n) - 1$

D $2^{(n-2)}$

Ans: B

2 mins Summary

Topic Go Back N ARQ

Topic Selective Repeat ARQ

↳ Receiver's protocol

THANK - YOU