CS & IT ENGINEERING

COMPUTER NETWORKS

TCP & UDP

Lecture No-10

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Basic Algorithm

Disadvantage of Basic Algorithm

$$TO = 2 * RTT$$

$$\boxed{T.O = 4 \ast ID + RTT}$$

Pkt-1

$IRTT = 10 \sec$

$ID = 5 \sec$

$\alpha = 0.5 = \dfrac{1}{2}$

$T.O = 4 \ast ID + RTT$

$T.O = 4 \ast 5 + 10$

$T.O = 30 \sec$

$ARTT = 20 \sec$

$AD = |IRTT - ARTT|$

$AD = |10 - 20|$

$AD = 10 \sec$

$NRTT = \alpha(IRTT) + (1-\alpha)ARTT$

$\qquad = 0.5 \ast 10 + 0.5 \ast 20$

$\qquad = 5 + 10$

$NRTT = 15 \sec$

$ND = \alpha(ID) + (1-\alpha)AD$

$\qquad = 0.5 \ast 5 + 0.5 \ast 10$

$\qquad = 2.5 + 5$

$ND = 7.5$

Pkt-2

$IRTT = 15\,sec$

$ID = 7.5\,sec$

$T.O = 4*ID + RTT$

$\quad = 4*7.5 + 15$

$T.O = 45\,sec$

$ARTT = 30\,sec$

$AD = |IRTT - ARTT|$

$AD = |15 - 30|$

$AD = 15\,sec$

NRTT = $\alpha(IRTT) + (1-\alpha)ARTT$

$\quad = 0.5*15 + 0.5*30$

$\quad = 7.5 + 15$

$NRTT = 22.5\,sec$

$ND = \alpha(ID) + (1-\alpha)AD$

$\quad = 0.5*7.5 + 0.5*15$

$\quad = 3.75 + 7.5$

$ND = 11.25\,sec$

Pkt-3

$IRTT = 22.5\,sec$

$ID = 11.25\,sec$

$T.O = 4*ID + RTT$

$T.O = 4*11.25 + 22.5$

$T.O = 45 + 22.5$

$T.O = 67.5\,sec$

$ARTT = 10\,sec$

$AD = |IRTT - ARTT|$

$AD = |22.5 - 10|$

$AD = 12.5$
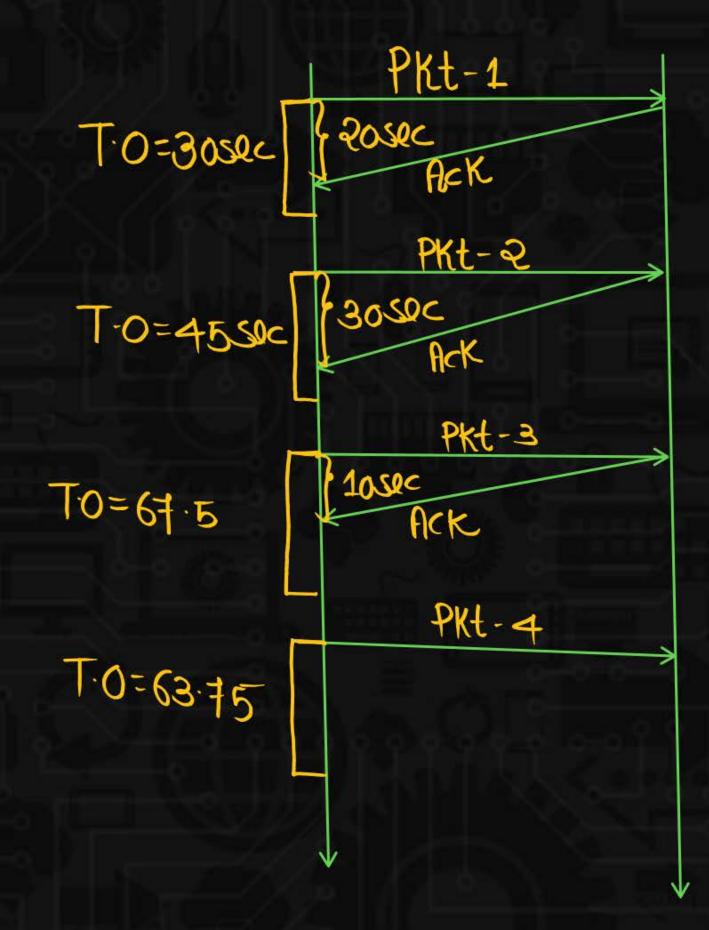
$$NRTT = \alpha(IRTT) + (1-\alpha)ARTT$$
$$= 0.5 * 22.5 + 0.5 * 10$$
$$= 11.25 + 5$$

$$NRTT = 16.25$$

$$ND = \alpha(ID) + (1-\alpha)AD$$
$$= 0.5 * 11.25 + 0.5 * 12.5$$
$$= 5.625 + 6.25$$

$$ND = 11.875$$

Pkt-4

$$IRTT = 16.25$$

$$ID = 11.875$$

$$TO = 4 \times ID + RTT$$

$$TO = 4 \times 11.875 + 16.25$$

$$TO = 47.5 + 16.25$$

$$TO = 63.75 \, sec$$

PKt-1

T.O=30sec 20sec
ACK

PKt-2

T.O=45sec 30sec
ACK

PKt-3

T.O=67.5 10sec
ACK

PKt-4

T.O=63.75
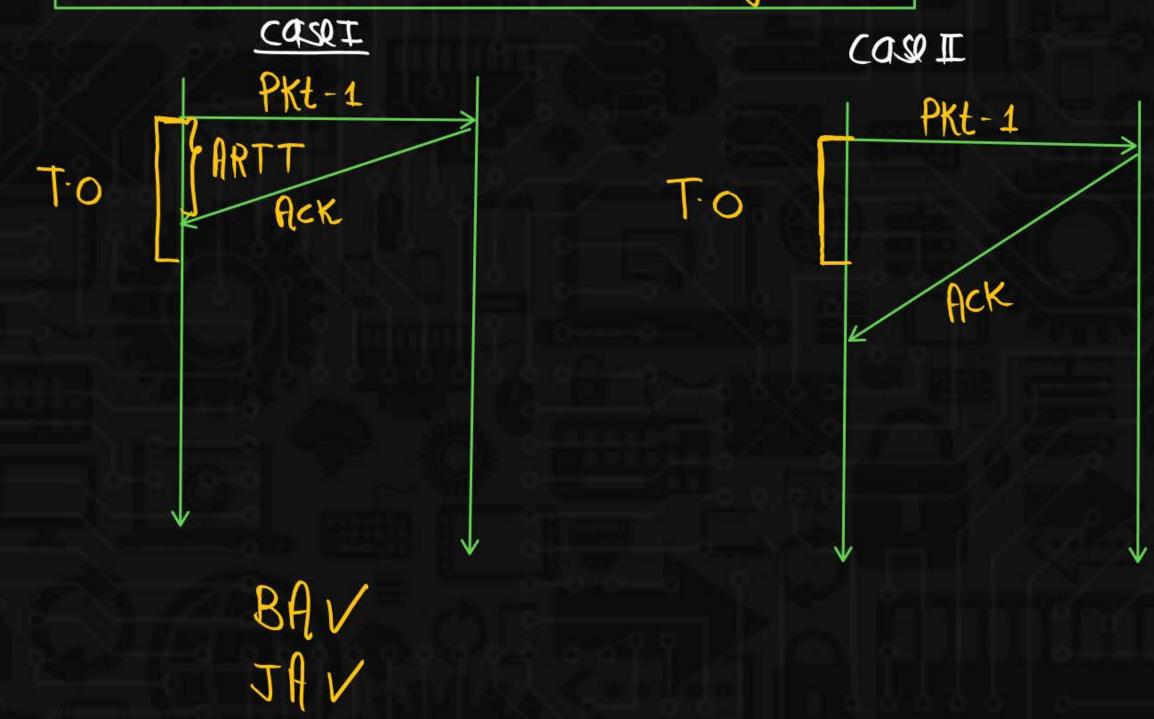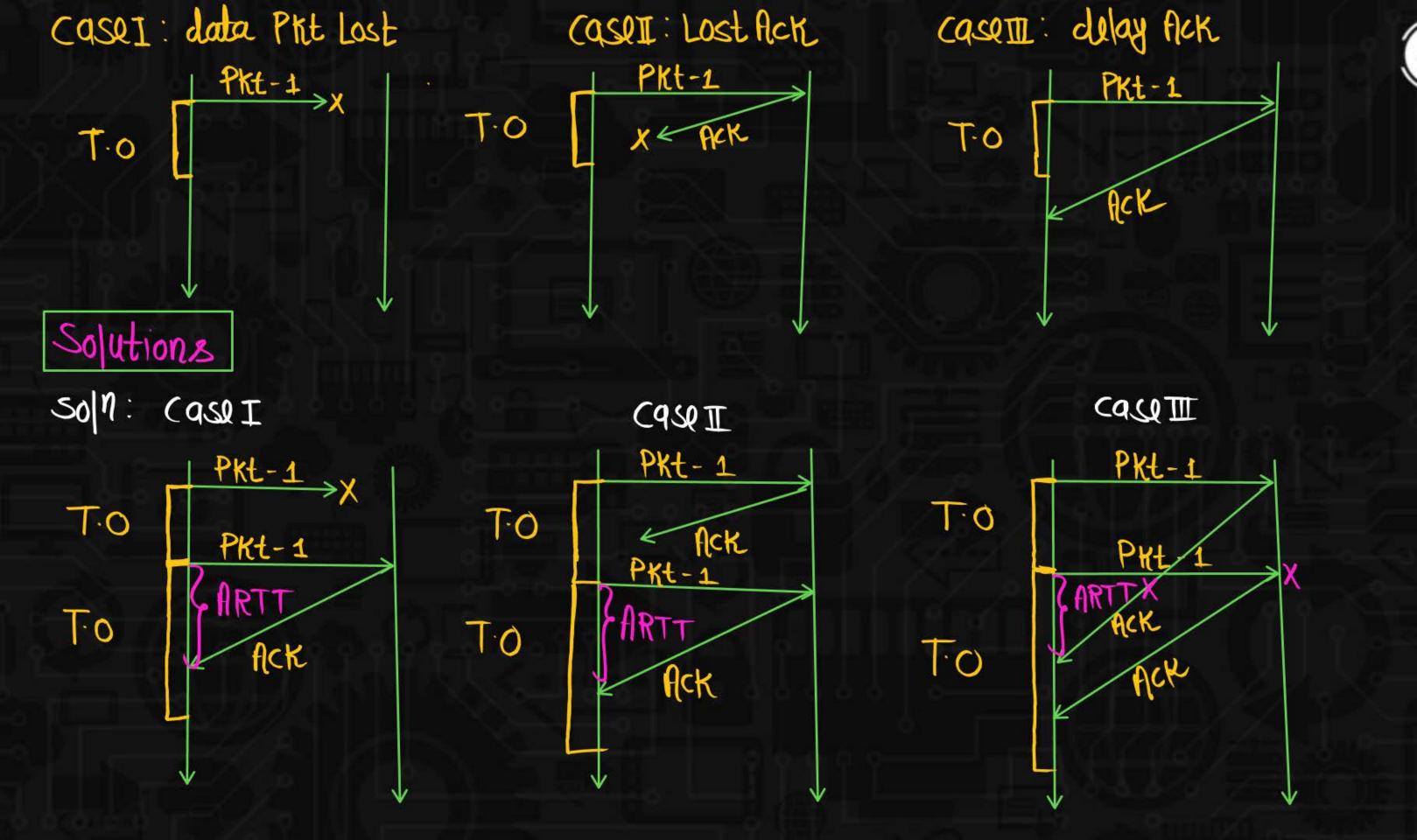
Problems in Basic and Jacobson's Algorithm

CASE I

Pkt-1

T·O

ARTT

Ack

BA ✓
JA ✓

CASE II

Pkt-1

T·O

Ack

CASE I : data Pkt Lost

Pkt-1 → X

T.O

CASE II : Lost Ack

Pkt-1
X ← Ack

T.O

CASE III : delay Ack

Pkt-1
Ack

T.O

Solutions

Soln : CASE I

Pkt-1 → X

T.O

Pkt-1
ARTT
Ack

T.O

CASE II

Pkt-1
Ack
Pkt-1
ARTT
Ack

T.O

T.O

CASE III

Pkt-1
Pkt-1 X
ARTT X
Ack
Ack

T.O

T.O

Note: If there is a time out timer then there is a possibility to Receive two Acknowledgement.

i) **From original Packet**

ii) **From retransmitted packet**

Then there is an Ambiguity that which acknowledgement must be considered for Next calculation and what must be the time out timer for retransmitted packet. Therefore Karn's has solved this problem by proposing the following strategy :

Karn's Modification
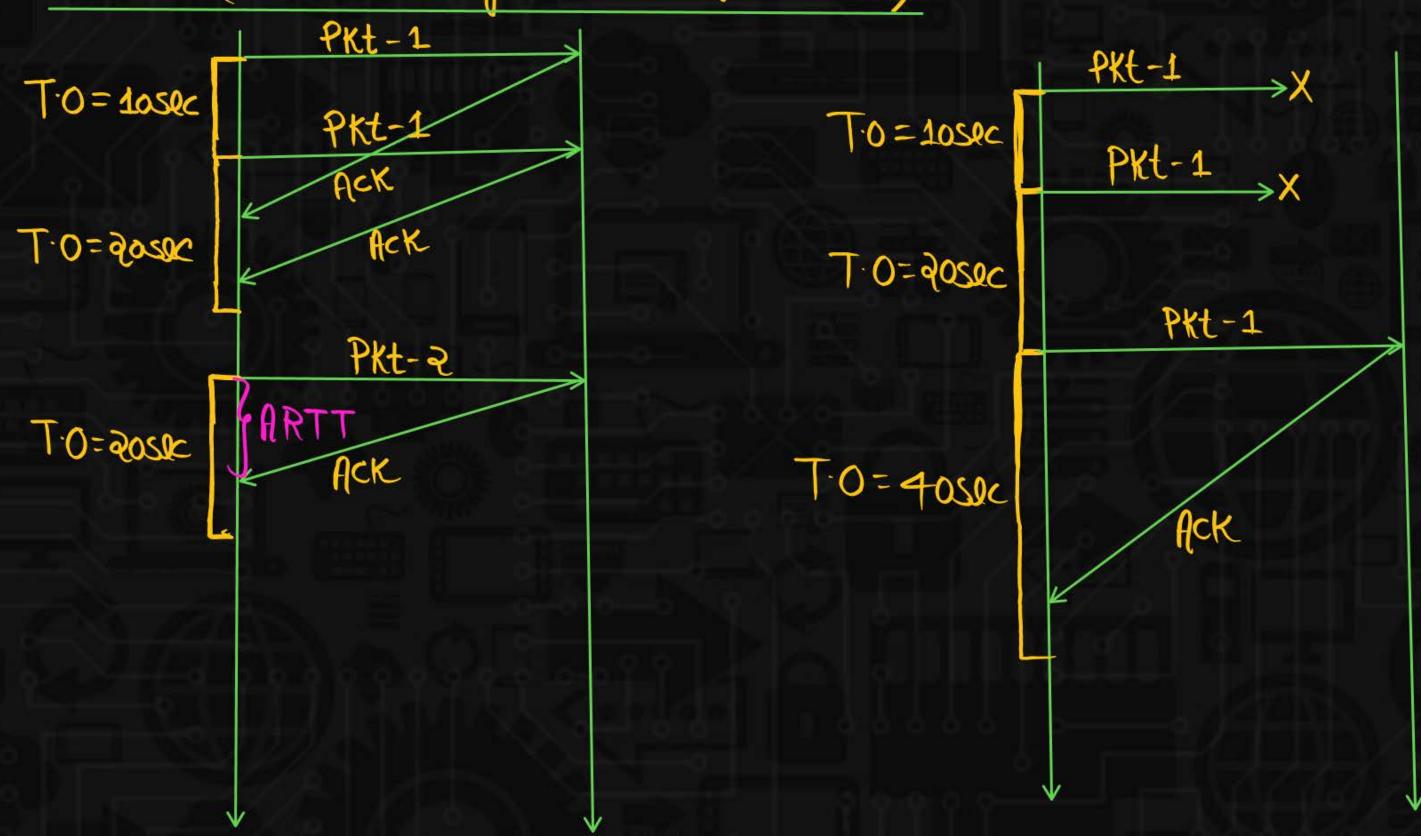
Karn's Modification :

Do not consider the round trip time of a retransmitted packet in the calculation. Do not update the value of RTT until you send a segment and receive an Acknowledgement without need of retransmission.

If retransmission occurs value of time out timer is doubled for each retransmission.

Case III (Sol^n According to Karn's modification)

Left diagram labels:
- Pkt-1
- T·O = 10 sec
- Pkt-1
- Ack
- T·O = 20 sec
- Ack
- Pkt-2
- ARTT
- T·O = 20 sec
- Ack

Right diagram labels:
- Pkt-1 → X
- T·O = 10 sec
- Pkt-1 → X
- T·O = 20 sec
- Pkt-1
- T·O = 40 sec
- Ack

1. If the TCP round-trip time, RTT, is currently 30 msec and the following acknowledgement come in after 26, 32 and 24 msec, respectively, the new RTT estimate will be _____ ms.
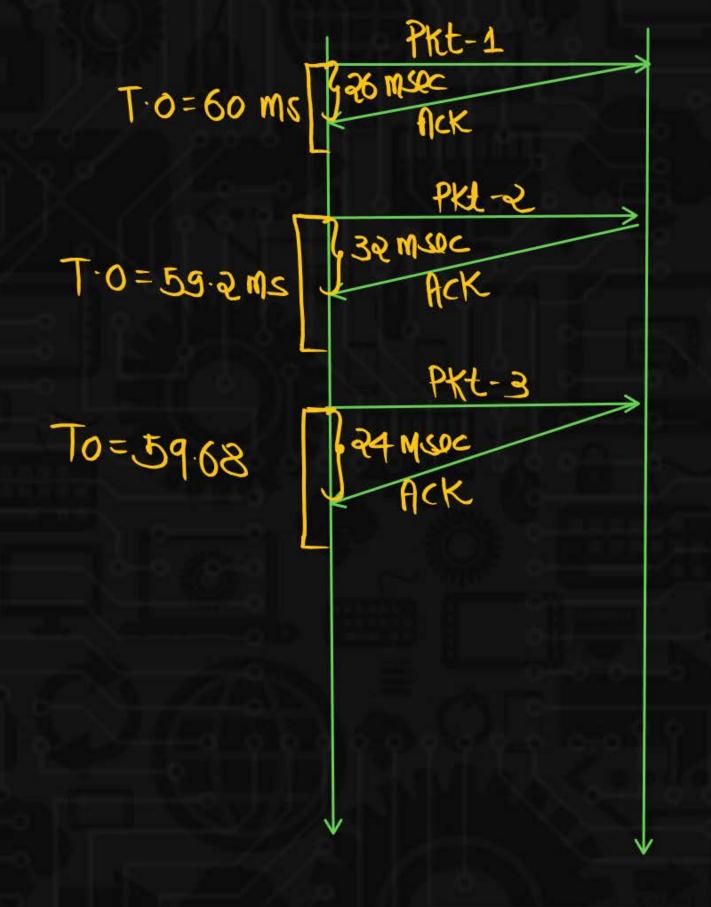
Note: (Use $\alpha = 0.9$.)

Sol^n:

$RTT = 30 \, m\,sec$

$\alpha = 0.9$

Basic Algorithm

$T.O = 2 * RTT$

$T.O = 2 * 30 \, msec = 60 \, msec$

$ARTT = 26 \, msec$

$NRTT = \alpha(IRTT) + (1-\alpha)ARTT$

$= 0.9 * 30 + 0.1 * 26$

$= 27 + 2.6 = 29.6 \, msec$

Pkt-2

$IRTT = 29.6$

$T \cdot O = 2 \times RTT$

$T \cdot O = 2 * 29.6$

$T \cdot O = 59.2 \, msec$

$ARTT = 32 \, msec$

$NRTT = \alpha(IRTT) + (1-\alpha)ARTT$

$\quad = 0.9 * 29.6 + 0.1 * 32$

$\quad = 26.64 + 3.2$

$\quad = 29.84$

Pkt-3

$IRTT = 29.84$

$T \cdot O = 2 * RTT$

$T \cdot O = 2 * 29.84$

$T \cdot O = 59.68 \, msec$

$ARTT = 24 \, msec$

$NRTT = \alpha(IRTT) + (1-\alpha)ARTT$

$\quad = 0.9 * 29.84 + 0.1 * 24$

$\quad = 26.856 + 2.4$

$NRTT : 29.256$

Pkt-4

$IRTT = 29.256$

T.O = 60 ms — Pkt-1 — 20 msec — ACK

T.O = 59.2 ms — Pkt-2 — 32 msec — ACK

T0 = 59.68 — Pkt-3 — 24 msec — ACK

2. In TCP, the current Round trip time is 20 m sec and Acknowledgements come after 32 m sec. use $\alpha = 0.5$ and initial deviation as 4. Find the estimated round trip time & time out in Jacobson's Algorithm.
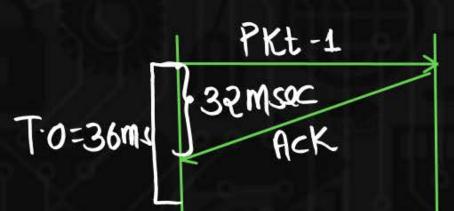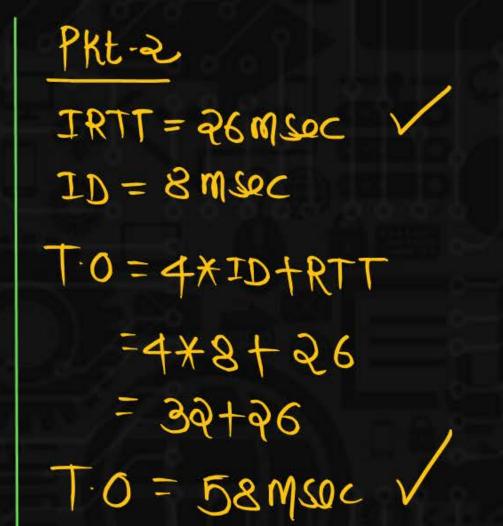
A. 28 m sec, 58 m sec

B. 26 m sec, 52 m sec

C. 26 m sec, 58 m sec ✓

D. 26 m sec, 56 m sec

Sol^n:

$RTT = 20$ m sec

$ID = 4$

$\alpha = 0.5$

$T\cdot O = 4 \times ID + RTT$

$= 4 \times 4 + 20$

$T\cdot O = 36$ m sec

Pkt-1

T.O=36ms {32msec ACK

$ARTT = 32 msec$

$AD = |IRTT - ARTT|$

$AD = |20 - 32|$

$AD = 12 msec$

$NRTT = \alpha(IRTT) + (1-\alpha)ARTT$

$\qquad = 0.5 \times 20 + 0.5 \times 32$

$\qquad = 10 + 16$

$NRTT = 26 msec$

$ND = \alpha(ID) + (1-\alpha)AD$

$\qquad = 0.5 \times 4 + 0.5 \times 12$

$\qquad = 2 + 6 = 8$

Pkt-2

$IRTT = 26 msec$ ✓

$ID = 8 msec$

$T.O = 4 \times ID + RTT$

$\qquad = 4 \times 8 + 26$

$\qquad = 32 + 26$

$T.O = 58 msec$ ✓

3. The TCP round trip time is currently 35 m sec, and it takes a segment at this moment to be acknowledged in 32 m sec after which the new RTT value is to be calculated then the next Acknowledgement comes in after 40 m sec, $\alpha = 0.9$ then finally what will be new estimated RTT in m sec. H·W

Basic Algorithm

A. 34. 7 m sec

B. 35.5 m sec

C. 35.23 m sec

D. 38.4 m sec