GCQ 8

object size = 9 MSS

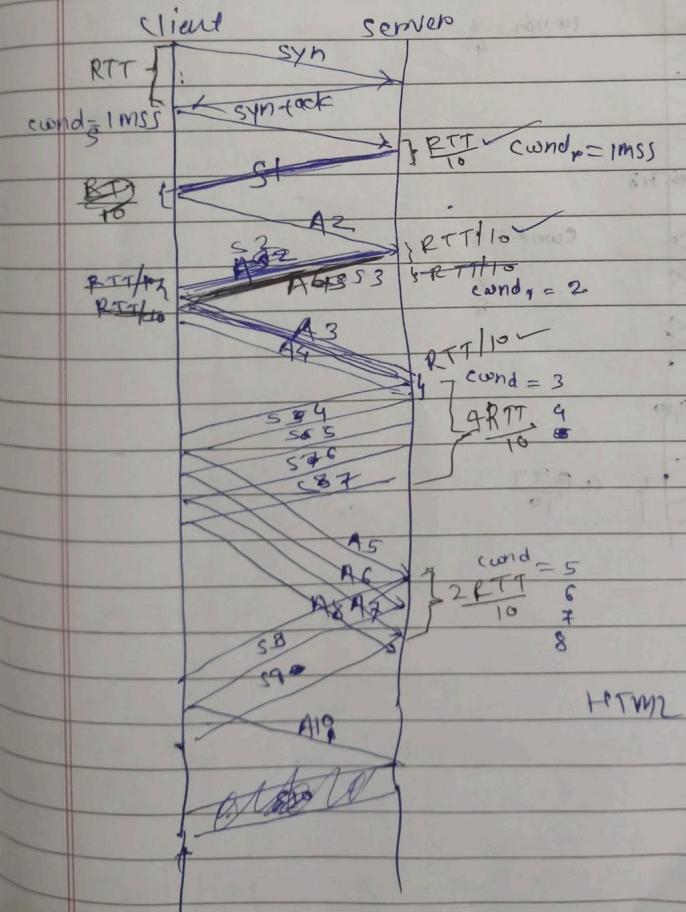
1 HTML + 4 objs × 9 MSS = 36 MSS

Tx time of MSS = $\frac{RTT}{10}$

Assume ssth = ∞

RTO = 5RTT ∴ DNS time = 3RTT

a) Non persistent pipeline + HTTP with 2 parallel connection

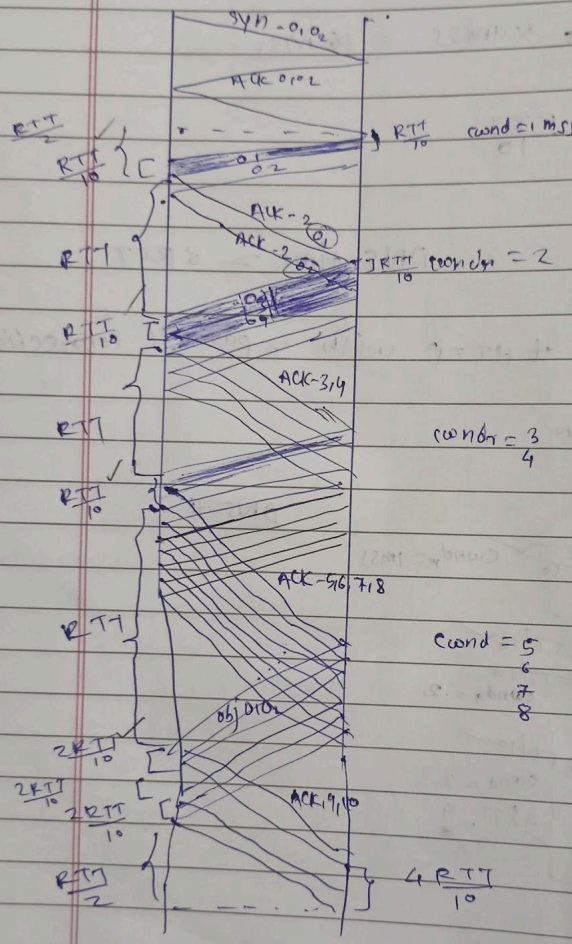


DNS ✓

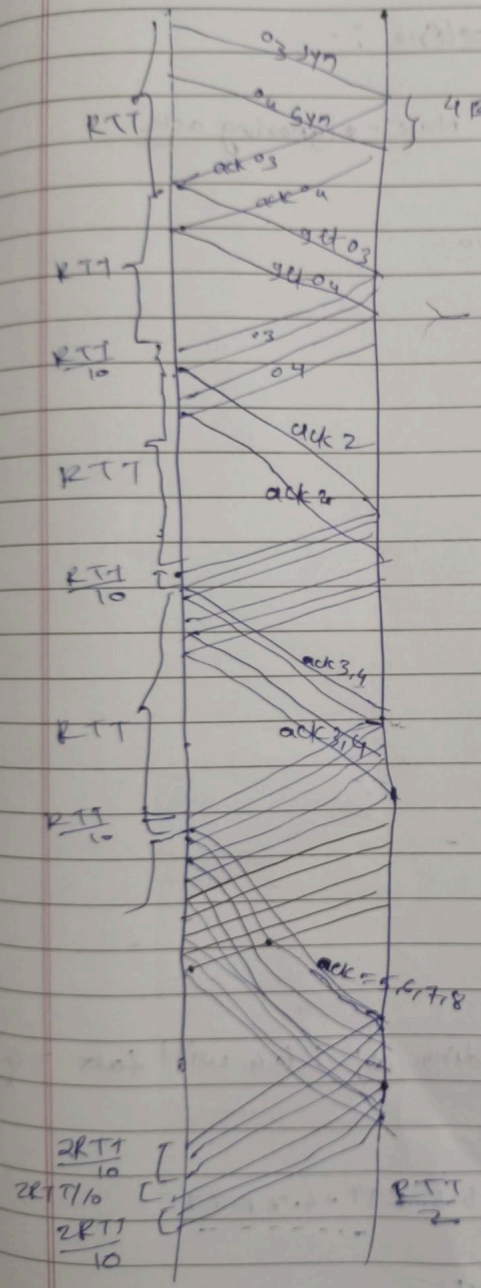
HTML file = 5RTT + $\frac{5RTT}{10}$

= 5.5 RTT

Fig: Transfer of base HTML file



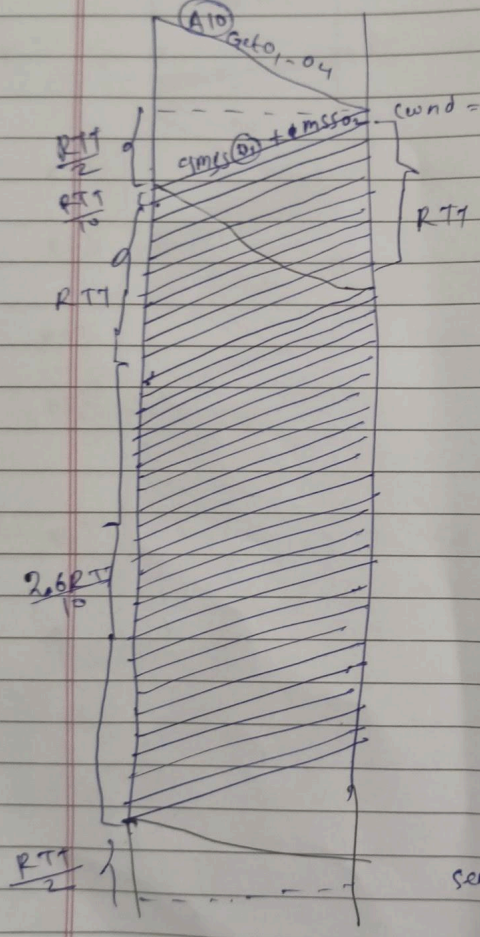
syn - $O_1 O_2$
ACK $O_1 O_2$
$\frac{RTT}{2}$
$\frac{RTT}{10}$
$\frac{RTT}{10}$
cwnd = 1 mss
O_1
O_2
ACK - 2
ACK - 2
$\frac{RTT}{10}$
cwnd = 2
RTT
$\frac{RTT}{10}$
ACK-3,4
RTT
cwnd = 3
4
$\frac{RTT}{10}$
ACK-5,6,7,8
RTT
cwnd = 5
6
7
8
obj $O_1 O_2$
$\frac{2RTT}{10}$
$\frac{2RTT}{10}$
$\frac{2RTT}{10}$
ACK,9,10
$\frac{RTT}{2}$
$4\frac{RTT}{10}$



Total time = 3 RTT + 11.4 RTT + 5.5 RTT = 19.9 RTT
DNS HTML

Soln b) Persistant connection + pipelone :-

Note :- ignoring ack.



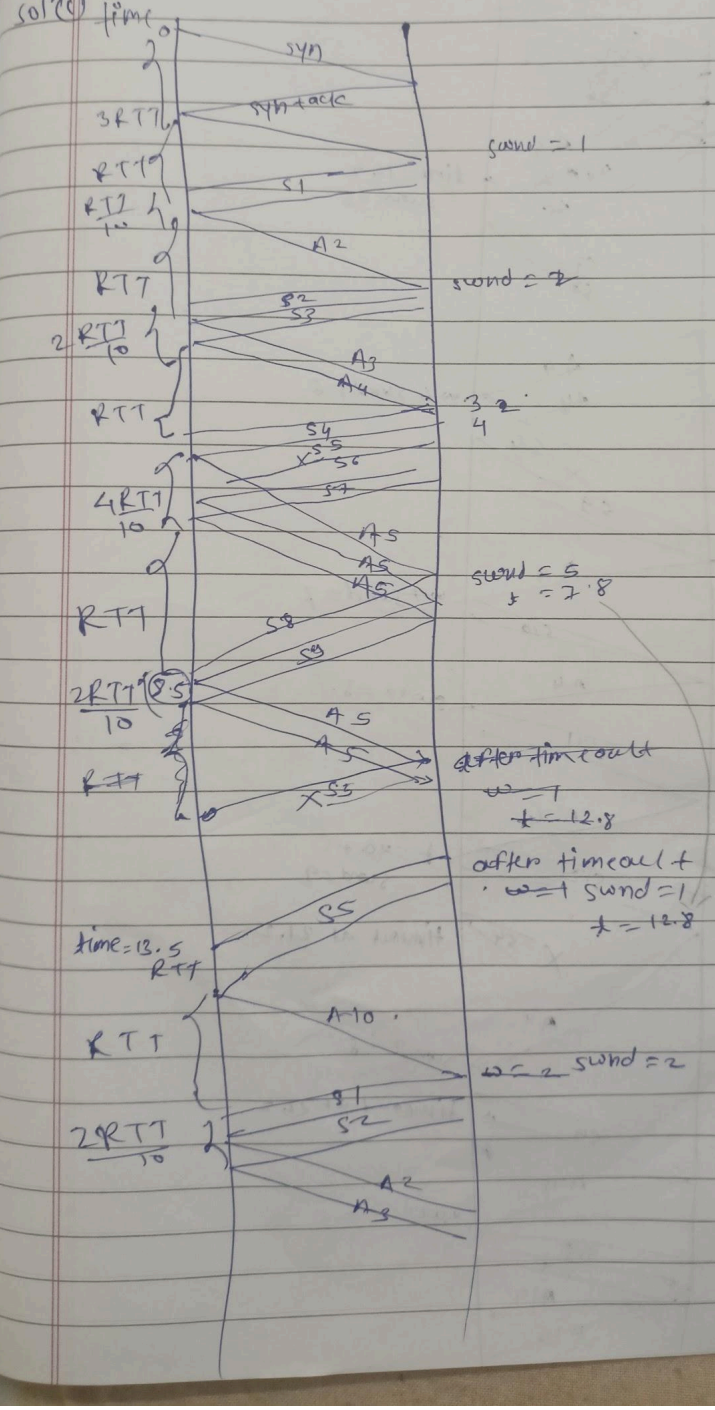
sending obj 1 to 4 will take = 4.7 RTT

Total time = 3 RTT + 5.5 RTT + 4.7 RTT

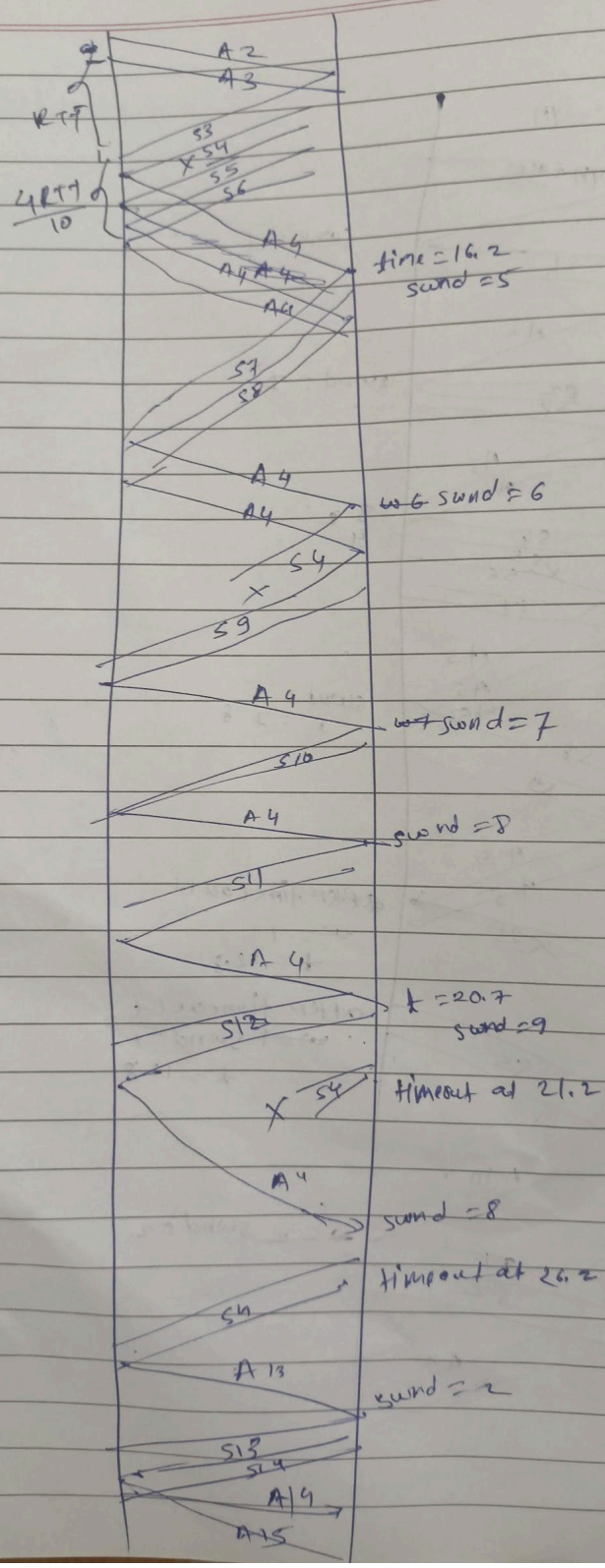
DNS

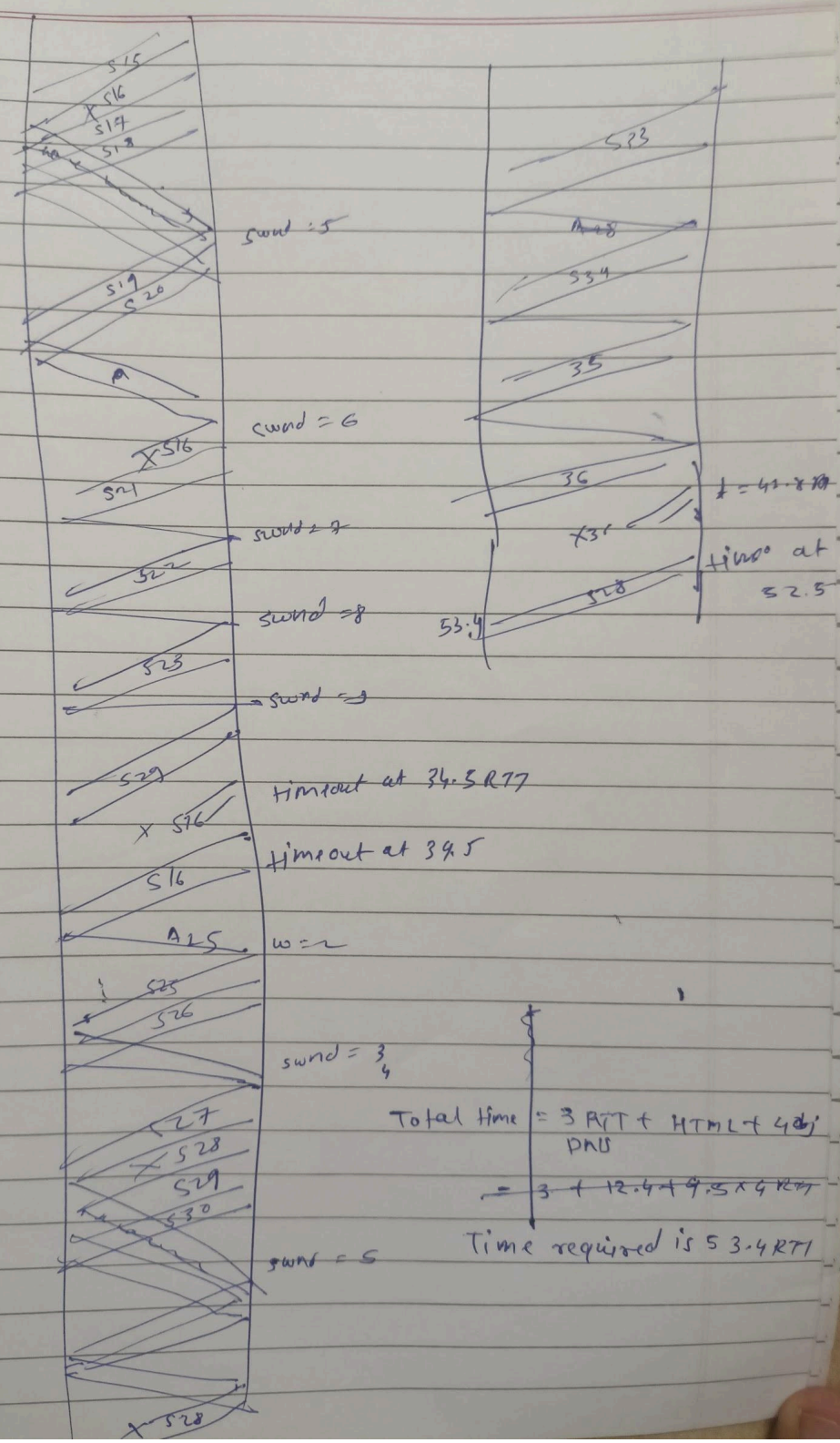
= 13.2 RTT.

sol^n (c)


time
syn
3RTT
syn+ack
RTT
swnd = 1
S1
RTT/10
A2
RTT
swnd = 2
S2
S3
2RTT/10
A3
A4
RTT
3 2
4
S4
S5
S6
S7
4RTT/10
A5
A5
A5
swnd = 5
t = 7.8
RTT
S8
S9
2RTT/10
8.5
A5
A5
after timeout
w = 1
t = 12.8
RTT
S3
after timeout
w = 1 swnd = 1
t = 12.8
S5
time = 13.5
RTT
A10
RTT
w = 2 swnd = 2
S1
S2
2RTT/10
A2
A3

= 4.7 RTT


A2
A3
RTT
S3
S4
S5
S6
4RTT
10
A4
A4 A4
A4
time = 16.2
swnd = 5
S7
S8
A4
A4
swnd = 6
S4
S9
A4
swnd = 7
S10
A4
swnd = 8
S11
A4
t = 20.7
swnd = 9
S12
S4
timeout at 21.2
A4
swnd = 8
timeout at 26.2
S4
A13
swnd = 2
S13
S14
A14
A15



Total time = 3 RTT + HTML + 4 obj DNS

~~= 3 + 12.4 + 9.5 × 4 RTT~~

Time required is 53.4 RTT