

1.

a) 4 DNS before receives IP

1. Local DNS cache $RTT_0 = 1 \text{ msec}$

$RTT_1 = 1 \text{ msec}$

$RTT_2 = 9 \text{ msec}$

$RTT_3 = 15 \text{ msec}$

$RTT_{\text{HTTP}} = 6 \text{ msec}$

$2(RTT_0)$

Total time $7(1) + 1 + 9 + 15 + 6 = 33 \text{ msec}$

b) 7 obj neglecting transmission times

$7 + RTT_0 + 2 RTT_0 + RTT_1 + RTT_2 + RTT_3 = 34 \text{ msec}$

$9(1) + 1 + 9 + 15$

c) 5 parallel TCP connections

$RTT_1 + RTT_2 + RTT_3 + 2 RTT_0 + 4 RTT_0 = 31 \text{ msec}$

$1 + 9 + 15 + 6$

d) $3 RTT_0 + RTT_1 + RTT_2 + RTT_3 = 28 \text{ msec}$

$3 \quad 1 \quad 9 \quad 15$