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Q1.

a) 10000 bits ÷ 10^8 bps = 10^{-4} s = 0.1 ms

b)

end-system(E_1) → router(R) → end-system(E_2)

There will be twice receive(R & E_2) and twice transmission (E_1 & R)

So the total time is: $4 \times (20000 \text{ bits} \div 10^7 \text{ bps}) = 8 \times 10^{-3}$ s = 8 ms

Q2.

i) The source address. Won't change. It's the IP address of the client.

ii) The Destination address won't change. It's the IP address of the server.

iii) TTL will decrease by 1 once the packet passes a router.

iv) The checksum will change when TTL decreases. Because it's calculated by all header field including TTL.

Q3.

a) Longest-prefix matching

i) 37 = 0b 00100101, 00100101 & 11111000 = 00100000 == 00100 000

↑ the prefix 00100

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00100101 & 11111110 = 00100100 == 00100100

The prefix b

00100101 & 11100000 = 00100000

The prefix of c

All prefix match 37.128.5.5, but according Long-Prefix matching. It will select interface b.

ii). 34 = 0b 0010 0010

For a: 1111 0000 & 0010 0010 = 0010 0000 , match

For b: 1111 1110 & 0010 0010 = 0010 0010 , un match

For c: 1110 0000 & 0010 0010 = 0010 0000 , match.

a and c match IP 34.255.255.254. But prefix a is longer. So it will select interface a.

b)

i) the prefix is 0010 0101.1

cause 0010 0101 1 & 1111 1100 = 0x00100 matches the existed prefix b, and the hop interface is same. So no need to add entry.

ii) the prefix is 0010 0101 11

the above prefix matches prefix a and prefix b, while those are longer than prefix c, so it's necessary to add a new entry. Otherwise, it will be routed to interface b.

	prefix	Next Hop Interface
The new entry is	0010 0101 11	C.

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Q4.

a)

i) The network will be idle in the most of time. The performance will decrease.

ii) There will too many the same retransmission in the network. The network load will be too heavy.

b) Because in most cases the network is reliable. ~~and~~ The ~~wait~~ time waiting for ACK message is a great waste under stop-and-wait ARQ. It could have been used to transmit more messages.

c) It's necessary to have flow control between them. Because flow control can not only ~~control~~ avoid congestion in network but also make sure the transmission speed is appropriate so that the receiver can receive in time.

It' isn't necessary to have congession control. Because the network is just end-to-end and doesn't have a router. So there is no network congestion issue in this system.

~~Q5.~~

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Q5.

a) 1st segment is 1650 - 1200 = 450 B

2nd segment is 2070 - 1650 = 420 B

b) The seq no. of the segment that host B wants to receive next is 2070. So the ACK no. is 2070.

c) Host B wants to receive the 2nd segment again. So the ACK is 1650.