Question # 1:
Answers:
1.1.B.
1.2 B
1.3 C
1.4 D
1.5 B
1.6 B
1.7 C
1.8 C

Question # 2:

Solution:
T1= Transmission delay + processing Delay
T2= Propagation delay +T1
T3= Transmission delay + processing Delay+ T2
T4= Propagation delay+ T3
(2a)

T1	T2	T3	T4
2.5ms	5ms	7.5ms	10ms
5ms	7.5ms	10ms	12.5ms
7.5ms	10ms	12.5ms	15ms
10ms	12.5ms	15ms	17.5ms
12.5ms	15ms	17.5ms	20ms

(2b)

T1	T2	T3	T4
15.5ms	18.0	21	23.5
18.5	21.0	24	26.5
21.5	24.0	27	29.5
24.5	27.0	30	32.5
27.5	30.0	33	35.5

(2c) Answer is 11.11 % when we compare the total delay (from source to destination) for 1 packet in both cases.
Exact calculations are as follows:
Processing delay at each router = $Proc_d$= 2 ms
Propagation delay for each link $Prop_d$= 2.5 ms
Case 1: Transmission delay = T_{d1} = 0.5 ms
Total delay for Case 1: $4 * T_{d1} + 4 * Prop_d + 3 * Prop_d = 4 * 0.5 + 4 * 2.5 + 3 * 2 = 18$ ms
Case 2: Transmission delay = T_{d2} =1 ms

Total delay for Case 2: $4 * T_{d2} + 4 * \text{Prop}_d + 3 * \text{Prop}_d = 4 * 1 + 4 * 2.5 + 3 * 2 = 20$ ms

Percentage increase in delay= ((20-18)/18)*100= 11.11 %

Question # 3:

(3a):

Answer:

Step 1: Consult any of the 13 DNS root servers to get information about the dot com name-servers.

Step 2: Consult any of the dot com name servers to get information about the Google's name-servers.

Step 3: Consult any of Google's name servers to get the IP address of the name cloud.google.com

(3b):

Answer: None. Google can provide different IPs for its search website due to load balancing needs.

(3c):

Answer: DNS record type A

(3d):

Answer: (Taken from: https://gaia.cs.umass.edu/kurose_ross/interactive/browser_caching.php)

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(RTT * NUM_PACKETS) + (NUM_PACKETS * (PERCENT__NOT_CACHED / 100) * TRANS_DELAY)
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= (10 * 70) + (70 * ((100-50) / 100) * 1) = 735 ms

Question # 4:
(4a)
Answer:
(I) $(1 \times 10^9) / (40 \times 10^6) = 25$ users maximum
(II) Zero (0), as the link can sustain all 20 users simultaneously.

(4b)

Answer: Four (4). This is one shorter than the length of the generator

(4c)

Answer: 198.100.103.155/22

(4d)

Answer: Host B sends an ARP request for 192.168.0.10. Host A responds with the correct MAC address (00:1A:2B:3C:4D:5E). Host B updates its ARP table. Host B then communicates successfully with Host A

Question # 5:
(5a)
Solution:

(i) In Selective Repeat, only the lost packets are retransmitted. The sender retransmits **only packet 5** and **packet 9**. Total **2 packets** are retransmitted.

(ii) In Go-Back-N, if a packet is lost, the sender retransmits the lost packet and all subsequent packets in the window. Since packet 6 is lost. The sender retransmits **packet 6, 7, 8, 9, and 10**. Total **5 packets** are retransmitted in total.

(5b)

Solution:

(i) Sequence numbers:
t=1: 38
t=2: 463
t=3: 888
t=4: 1313

(ii) Acknowledgment numbers:
t=8: 463
t=12: 888

(iii) Sequence numbers:
t=15: 2163
t=16: 2588

Question # 6:

(6a):

Solution:

(i)   Packet 1: Port 1

(ii)   Packet 2: Error. Doesn't match any entry. ("Default" answer is not acceptable as router only has the above three entries and no other entry including any default entry)

(iii)   Packet 3: Port 0

(iv)   Packet 4: Port 2

(v)   Packet 5: Error. Invalid IP

(6b)

(i)

Answer : 3

(ii)

Answer : 1996, 1996, 1068

(iii)

Answer : 0, 247, 494

Question # 7:

(7a)

Solution

Step	N'	A D(A), p(A)	B D(B), p(B)	C D(C), p(C)	D D(D), p(D)	E D(E), p(E)
0	S	6,S	∞	∞	8,S	7,S
1	SA	6,S	15,A	∞	8,S	7,S
2	SAE	6,S	15,A	12,E	8,S	7,S
3	SAED	6,S	15,A	11,D	8,S	7,S
4	SAEDC	6,S	15,A	11,D	8,S	7,S
5	SAEDCB	6,S	15,A	11,D	8,S	7,S

(7b)

Answer: OSPF

(7c)

Answer: inter-AS routing

Question # 8:

(8a)

Answer:

Source MAC: 00E0.FE91.7799
Source IP: 10.1.1.10

(8b)

s

Answer:

Headers for packet 1:

Header Type	Source Address	Destination Address
Ethernet	**MAC 16**	**MAC 15**
IP	**3.0.1.2**	**1.2.3.4**

Header for packet 2:

Header Type	Source Address	Destination Address
Ethernet	**MAC 1**	**MAC 2**
IP	**10.0.0.2**	**3.0.1.2**

Header for packet 4:

Header Type	Source Address	Destination Address
Ethernet	**MAC 9**	**MAC 10**
IP	**1.2.3.4**	**3.0.1.2**