Midterm solo

1.

(a) Bandwidth, also called throughput, indicates that the number of bits that can be transmitted over the network in a certain period of time, e.g., 1 Mbps...
Latency corresponds to how long it takes a message to travel from one end of a network to the other.

(b) ARP (Address Resolution Protocol) allows the host to get the corresponding link-layer address (MAC address) for the specified IP address.

(c) DHCP (Dynamic Host Configuration Protocol) allows the device to get an IP address from the DHCP server. Once the least time expires, the server is free to return IP address to its pool.

2.

(a) $M(x) = x^7 + x^6 + x^3 + 1$
$C(x) = x^3 + 1$

```
          1 1 0 1 0 0 1 1
      ---------------------
1001 | 1 1 0 1 0 0 1 0 0 0
       1 0 0 1
       -------
         1 0 1 1
         1 0 0 1
         -------
           1 0 0 0
           1 0 0 1
           -------
             1 1 0 0
             1 0 0 1
             -------
               1 0 1 0
               1 0 0 1
               -------
                   1 1
```

$P(x) = x^{10} + x^9 + x^6 + x^3 + x + 1$

⇒ 11001001011 ✱

(b) 11001001011 → invert the leftmost bit → 01001001011

```
          0 1 0 0 0 0 0 1
      ---------------------
1001 | 0 1 0 0 1 0 0 1 0 1 1
       1 0 0 1
       -------
         0 0 0 1 0 1 1
           1 0 0 1
           -------
             0 0 1 0
               1 0 0 1
               -------
                   1 0
```

① The message the leftmost bit is inverted divides by 1001 (x^3+1), and gives a remainder of 10.
② The fact that the remainder is non-zero tell us a bit error occurred.

3.

(a)

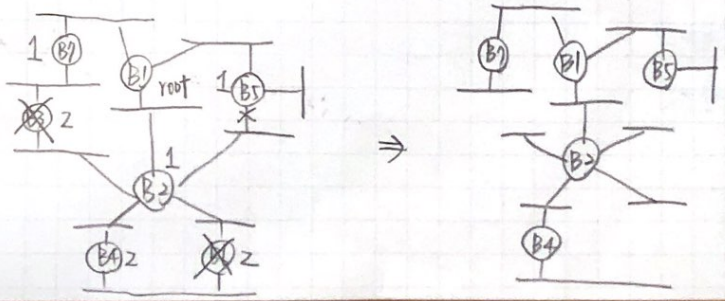
		subnet mask	subnet number	Next Hop
C4.5E.2.0/23	⇒ C4.5E.2.0 AND	FF.FF.FE.0	⇒ C4.5E.2.0	A
C4.5E.4.0/22	⇒ C4.5E.4.0 AND	FF.FF.FC.0	⇒ C4.5E.4.0	B
C4.4C.0.0/14	⇒ C4.4C.0.0 AND	FF.FC.0.0	⇒ C4.4C.0.0	C
C0.0.0.0/2	⇒ C0.0.0.0 AND	C0.0.0.0	⇒ C0.0.0.0	D

So. C4.4B.31.2E's next hop is D ✱

(b)

C4.5E.3.87's next hop is A ✱

4.



5.

Step	Confirmed	Tentative
1	(A, 0, –)	
2	(A, 0, –)	(B, 1, B) (C, 4, C)
3	(A, 0, –) (B, 1, B)	(C, 3, B) (H, 3, B) (G, 5, B) (D, 5, C) (E, 7, C)
4	(A, 0, –) (B, 1, B) (C, 3, B)	(H, 3, B) (G, 5, B) (D, 4, B) (E, 6, B) (F, 8, C)
5	(A, 0, –) (B, 1, B) (C, 3, B) (H, 3, B)	(G, 5, B) (D, 4, B) (E, 5, B) (F, 7, B)
6	(A, 0, –) (B, 1, B) (C, 3, B) (H, 3, B) (D, 4, B)	(G, 5, B) (E, 5, B) (F, 6, B)
7	(A, 0, –) (B, 1, B) (C, 3, B) (H, 3, B) (D, 4, B) (E, 5, B)	(G, 5, B) (F, 6, B)
8	⋮ +(G, 5, B)	(F, 6, B)
9	+(F, 6, B)	

6.

(a)

	A	B	C	D	E	F
A	0	∞	5	∞	∞	∞
B	∞	0	1	∞	∞	3
C	5	1	0	∞	1	∞
D	∞	∞	∞	0	7	∞
E	∞	∞	1	7	0	6
F	∞	3	∞	∞	6	0

(b)

	A	B	C	D	E	F
A	0	6	5	∞	6	∞
B	6	0	1	∞	2	3
C	5	1	0	8	1	4
D	∞	∞	8	0	7	13
E	6	2	1	7	0	6
F	∞	3	4	13	6	0

(c)

	A	B	C	D	E	F
A	0	6	5	13	6	9
B	6	0	1	9	2	3
C	5	1	0	8	1	4
D	13	9	8	0	7	12
E	6	2	1	7	0	5
F	9	3	4	12	5	0

7. (a). $2 \times (3 \times 10^4 \times 10^3 \div 3 \times 10^8) = 0.2$ (s) *

(b) $0.2\,(s) \times (1 \times 10^6) = 2 \times 10^5$ bits *

(c) 2×10^5 (bits) $\div$ (8×10^3 bits) = 25 packets *

(d) If RWS = SWS, the sequence number space must cover twice the SWS, or up to 50. Therefore, 6 bits are needed for the sequence number.

8.

① A → S1[3] → S2[2] → C

② A → S1[3] → S2[3] → S3[2] → D

③ B → S1[3] → S2[3] → S3[3] → E