ECE363 Midterm 2025 Solutions

Question 1

(a) **Propagation Delay:**

$$\text{Propagation delay} = \frac{\text{distance}}{\text{propagation speed}} = \frac{30,000 \text{ m}}{3 \times 10^8 \text{ m/s}} = 0.0001 \text{ s} = \boxed{0.1 \text{ ms}}$$

(b) **Transmission Time:**

$$\text{Transmission time} = \frac{\text{packet size}}{\text{data rate}} = \frac{10000 \text{ bits}}{200 \times 10^6 \text{ bps}} = 0.00005 \text{ s} = \boxed{0.05 \text{ ms}}$$

(c) **Location of the Last Bit:** The last bit is still on the link. Distance traveled by the first bit during transmission time:

$$\text{Distance} = 3 \times 10^8 \text{ m/s} \times 0.00005 \text{ s} = 15,000 \text{ m} = \boxed{\text{15 km from host A (midway on the link)}}$$

Question 2

CRC-Appended Bit String:

- Data: 1011011 (polynomial: $x^6 + x^4 + x^3 + x + 1$)
- Generator: $x^3 + 1$ (binary: 1001)
- Append 3 zeros: 1011011000
- Perform polynomial division. Remainder: 001
- CRC-appended bit string: 1011011 001

$$\boxed{1011011001}$$

Question 3

(a) **Slotted Aloha vs. Pure Aloha:**
Slotted Aloha divides time into fixed slots, forcing transmissions to start at slot boundaries. This reduces collision duration to a single slot, doubling maximum throughput (36% vs. 18% for Pure Aloha).

(b) **CSMA/CD vs. Slotted Aloha:**
CSMA/CD uses carrier sensing to check channel availability before transmission and detects collisions early, minimizing wasted time. Slotted Aloha lacks sensing, leading to collisions persisting for entire slots. This makes CSMA/CD more efficient in LANs.

Question 4

Iterations	B	C	D	E	F
Initially	(1, A)	(6, A)	(∞, .)	(∞, .)	(∞, .)
1	(1, A)	(6, A)	(4, B)	(3, B)	(∞, .)
2	(1, A)	(5, E)	(4, B)	(3, B)	(11, E)
3	(1, A)	(5, E)	(4, B)	(3, B)	(6, D)
4	(1, A)	(5, E)	(4, B)	(3, B)	(6, D)
5	(1, A)	(5, E)	(4, B)	(3, B)	(6, D)

The least cost **path** from A to other routers are:

From A to B: A $\rightarrow$ B (with cost **1**)

From A to C: A $\rightarrow$ B $\rightarrow$ E $\rightarrow$ C (with cost **5**)

From A to D: A $\rightarrow$ B $\rightarrow$ D (with cost **4**)

From A to E: A $\rightarrow$ B $\rightarrow$ E (with cost **3**)

From A to F: A $\rightarrow$ B $\rightarrow$ D $\rightarrow$ F (with cost **6**)

Question 5

Subnet Design for Class C Network (192.10.3.0/24):

- **Subnet Mask:** Borrow 2 bits $\rightarrow$ /26 ($\boxed{255.255.255.192}$)
- **Subnet 1:**
  - Subnet IP: 192.10.3.0/26
  - Host Range: 192.10.3.1 – 192.10.3.62
  - **Note**: 192.10.3.0 (all-zero at host domain) is used for network address, and 192.10.3.63 (all-one at host domain) is used for broadcast address
- **Subnet 2:**
  - Subnet IP: 192.10.3.64/26
  - Host Range: 192.10.3.65 – 192.10.3.126
- **Subnet 3:**
  - Subnet IP: 192.10.3.128/26
  - Host Range: 192.10.3.129 – 192.10.3.190