CS3611 Computer Networks (Spring 2023) Homework 5

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1. To minimize the length of the checksum field, we divide the bit pattern into 4 rows and 4 columns. The two-dimensional parity scheme is shown in the following table.

1	1	1	0	1
0	1	1	0	0
1	0	0	1	0
1	1	0	1	1
1	1	0	0	0

2. Divide $D \times 2^4 = 10101010100000$ with $G = 10011$. We get the quotient $Q = 1011011100$ and the remainder $R = 0100$. Therefore, the value of R is 0100.

3. (1) The quotient $Q = 1011010111$ and the remainder $R = 1001$.
   (2) The quotient $Q = 1000110000$ and the remainder $R = 0000$.
   (3) The quotient $Q = 0101010101$ and the remainder $R = 1111$.

4. (1) The IP addresses are shown in the following table.

Network Interface	**IP Address**
A	192.168.1.1
B	192.168.1.2
C	192.168.2.1
D	192.168.2.2
E	192.168.3.1
F	192.168.3.2
R1	192.168.1.3 192.168.2.3
R2	192.168.2.4 192.168.3.3

   (2) The MAC addresses are shown in the following table.

Network Interface	MAC Address
A	00-00-00-00-00-01
B	00-00-00-00-00-02
C	00-00-00-00-00-03
D	00-00-00-00-00-04
E	00-00-00-00-00-05
F	00-00-00-00-00-06
R1	00-00-00-00-00-07 00-00-00-00-00-08
R2	00-00-00-00-00-09 00-00-00-00-00-10

(3)
- The forwarding table in E decides that the datagram should be forwarded to 192.168.3.3. The adapter in E creates a frame with the destination MAC address 00-00-00-00-00-10 and the source MAC address 00-00-00-00-00-05.
- R2 receives the frame and extracts the datagram. The forwarding table in R2 decides that the datagram should be forwarded to 192.168.2.3. The adapter with the IP address 192.168.2.4 in R2 creates a frame with the destination MAC address 00-00-00-00-00-08 and the source MAC address 00-00-00-00-00-09.
- R1 receives the frame and extracts the datagram. The forwarding table in R1 decides that the datagram should be forwarded to 192.168.1.2. The adapter with the IP address 192.168.1.3 in R1 creates a frame with the destination MAC address 00-00-00-00-00-02 and the source MAC address 00-00-00-00-00-07.
- B receives the frame and extracts the datagram. B finds itself as the destination of the datagram. Finally the datagram is delivered from E to B.

(4) E should first know the MAC address corresponding to the IP address 192.168.3.3. E sends an ARP query packet to the broadcast MAC address FF-FF-FF-FF-FF-FF. R2 receives the ARP query packet and sends an ARP response packet to E with the source MAC address 00-00-00-00-00-10 and the destination MAC address 00-00-00-00-00-05. E receives the ARP response packet and updates its ARP table. Then the steps are exactly the same as in the previous question.

5. A starts transmitting at $t = 0$ and finishes at $t = 576$. The first bit arrives at B at $t = 300$. In the worst case, B starts transmitting at $t = 299$. The first bit arrives at A at $t = 299 + 300 = 599$, which is later than $t = 576$. Therefore, A finishes transmitting before it detects that B starts transmitting. Hence, A incorrectly believes that its frame was successfully transmitted without a collision.

6. (1)
- Event: B sends a frame to E.
- State: The switch learns the address of B.
- Forward: A, C, D, E and F.

- Explanation: The switch table is initially empty. The switch does not know the address of E, so it forwards the frame to all the unknown links.

(2)
- Event: E replies with a frame to B.
- State: he switch learns the address of E.
- Forward: B.
- Explanation: The switch knows the address of B, so it directly forwards the frame to B.

(3)
- Event: A sends a frame to B.
- State: The switch learns the address of A.
- Forward: B.
- Explanation: The switch knows the address of B, so it directly forwards the frame to B.

(4)
- Event: B replies with a frame to A.
- State: The switch table remains unchanged.
- Forward: A.
- Explanation: The switch knows the address of B, so it learns nothing new. The switch knows the address of A, so it directly forwards the frame to A.