
EE3009 Data Communications and Networks

Test (Solution)

Semester A, 2012/13

1. It is difficult to implement collision detection in a wireless LAN. Two fundamental reasons: 1) the hidden terminal problem makes it impossible for all communicating stations to “hear” a transmission. 2) When a node is transmitting it cannot also receive at the same time due to the generally very low signal level of a received signal (or receiver shut off when transmitting). [Any one reason is enough.]
2. In random access, there is no scheduled time for a station to transmit. Transmission is random among the stations. Stations compete with one another to access the medium.
3. CSMA is Carrier Sense Multiple Access. It means that stations listen to the medium before transmit - if there is already a transmission going on, they do not transmit. This reduces the chance of collisions. CD is Collision Detection. It means that stations can detect a collision while transmitting, so that they can stop transmission immediately. This improves throughput.
4. It is not redundant because:
 - a) It is not guaranteed that IP datagrams will arrive at the ultimate destination in the proper order.
 - b) IP can lose packets due to routing loops or equipment failures.
5. After the first event, there will be one entry in the switch table: (B, 2). The switch will forward the frame through its interfaces 1, 3, and 4.

After the second event, there will be two entries in the switch table: (A, 1) and (B, 2). The switch will forward the incoming frame through its interface 2, 3, and 4.

6.

- a) sequence number = 92.
- b) sequence number = 124
- c) No. It depends on whether timeout has occurred or not. If the second acknowledgement arrives at Host A before timeout occurs, then the first segment will not be retransmitted. Otherwise, it will be retransmitted.

7.

a) $\mu = \frac{R}{L} = \frac{9600 \text{ bps}}{2000 \text{ bits}} = 4.8 \text{ packets / sec}$

$$\lambda = 24 \times \frac{10}{60} \text{ packets / sec} = 4 \text{ packets / sec}$$

$$T = \frac{1}{\mu - \lambda} = \frac{1}{4.8 - 4} \text{ sec} = 1.25 \text{ sec}$$

b) $\mu = \frac{R}{L} = \frac{(9600 / 24) \text{ bps}}{2000 \text{ bits}} = \frac{1}{5} \text{ packets / sec}$

$$\lambda = \frac{10}{60} \text{ packets / sec} = \frac{1}{6} \text{ packets / sec}$$

$$T = \frac{1}{\mu - \lambda} = \frac{1}{(1/5) - (1/6)} \text{ sec} = 30 \text{ sec}$$

8.

- a) Maximum size of each fragmented datagram in user bytes = 980 - 20 = 960

$$\text{Number of fragments generated} = \left\lceil \frac{2420 - 20}{980 - 20} \right\rceil = 3$$

- b) Each fragment except the last one will be of size 980 bytes (including 20 bytes of IP header). The size of the last fragment is (2420 - 20) - 960 - 960 + 20 = 500 bytes.
- c) Values in the header fields of these fragments can be shown as follows.

	Identifier	More Flag	Offset
Fragment 1	456	1	0
Fragment 2	456	1	120
Fragment 3	456	0	240

9.

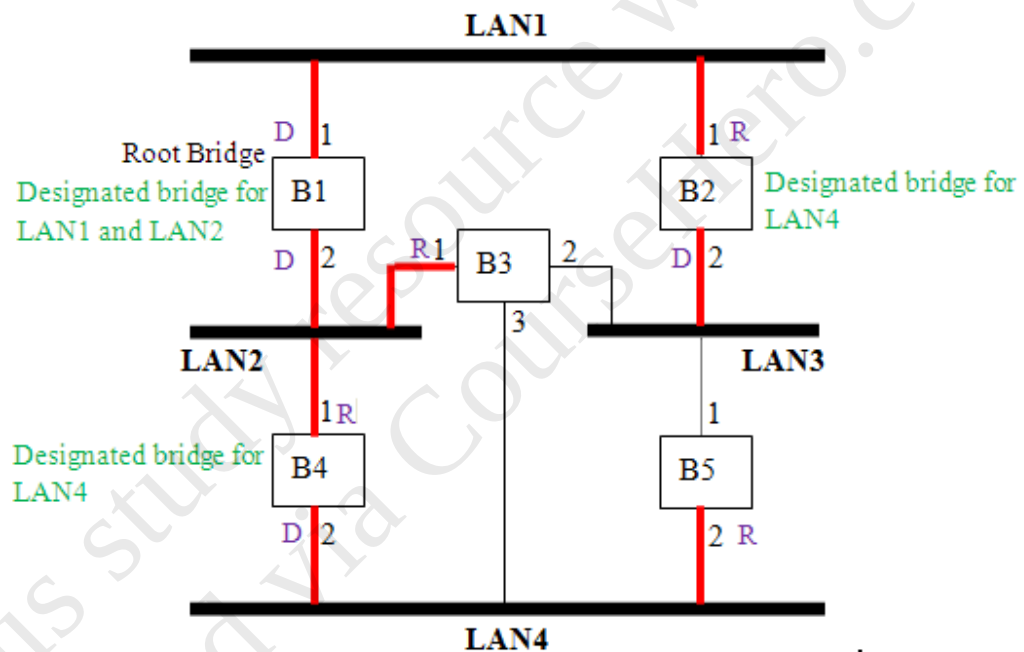
$$\begin{aligned} \text{a) Total throughput} &= 0.3 \cdot (1-p) \cdot (1-2p) + 0.7 \cdot p \cdot (1-2p) + 0.7 \cdot (1-p) \cdot 2p \\ &= -2.2p^2 + 1.2p + 0.3 \end{aligned}$$

$$\frac{\partial(-2.2p^2 + 1.2p + 0.3)}{\partial p} = -4.4p + 1.2$$

So when $-4.4p + 1.2 = 0$, $p = \frac{3}{11}$ or 0.273, we can get the maximum value of the total throughput.

$$\text{b) } 0.7 \cdot p \cdot (1-2p) = 2 \times 0.3 \cdot (1-p) \cdot (1-2p), \text{ which implies } p = \frac{6}{13} \text{ or } 0.46$$

10. Designated port is represented by D. Root port is denoted by R.



11.

Destination Address Range	Interface	Number of Addresses
0000 0000 ~ 0011 1111	0	2^6
0100 0000 ~ 0111 1111	1	2^6
1000 0000 ~ 1011 1111	2	2^6
1100 0000 ~ 1111 1111	3	2^6

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