Data Provided: None

The University Of Sheffield.

Spring Semester 2012-13 (2.0 hours)

EEE6432 Wireless Packet Data Networks and Protocols Solutions

1. **a.** Ans. i) Physical, Data link, Network, Transport, Session, Presentation and Application layers. (7 Marks)

ii) Session and Presentation layers are missing from the TCP/IP protocol suite. They are combined in the application layer of TCP/IP protocol suite. (2 Marks)

(9)

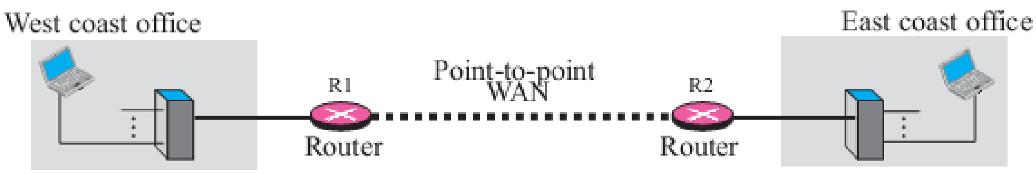
b. Ans. No. (1 Marks)

The reasons why OSI models are not widely implemented are as follows. First, OSI models were developed in 1980s. TCP/IP protocol stacks, which were developed in 1960s, had been widely used by then. (2 Marks)

Second, some layers in the OSI model were never fully defined. (2 Marks)

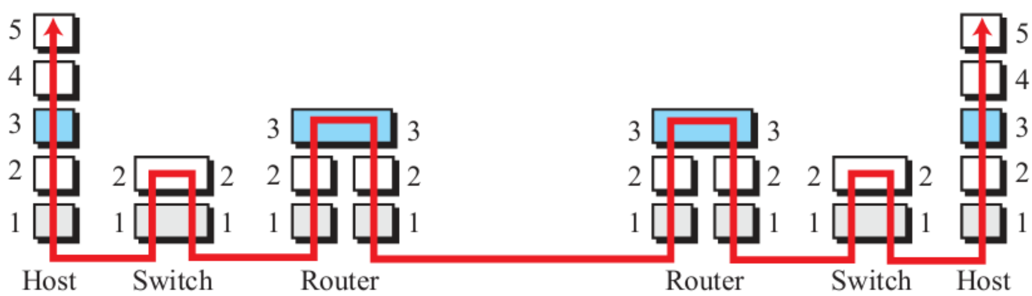
(5)

c.



Ans.

⁝ (layer 6 and 7) ⁝



Each network element worth 1 mark.

(6)

2. **a.** i) Ans. In block coding, we divide our messages into blocks of fixed size, e.g., each of k bits, called datawords. (2 Marks)

ii) Ans. A linear block code is a block code in which the exclusive-OR of any two codewords results in another codeword. (2 Marks)

iii) Ans. If the following two conditions are met, the receiver can detect a change in the original codeword: 1) The receiver has (or can find) a list of valid codewords; 2) The original codeword has changed to an invalid one. (2 Marks) **(6)**

b. Ans. We have k = 5 and n = 8. (2 Marks)

The size of the dividend is the same as the size of the codeword (8 bits). (1 Marks)

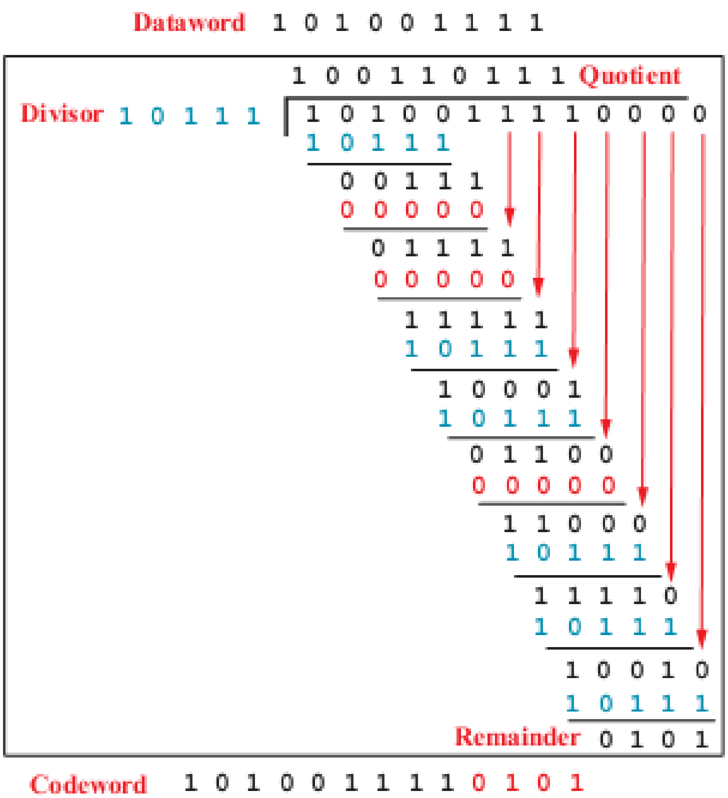
We need to augment the dataword with three 0s. (1 Marks)

The size of the remainder is r = n − k = 3 bits. (1 Marks)

The divisor is r + 1=4 bits. (1 Marks)

(6)

c. i) Ans. The following shows the calculation of the codeword (101001111<u>0101</u>).



Each correct step worth 1/2 mark. 5 mark in total (half mark will be rounded to 1 mark)

(8)

ii) Ans. If we need to correct *m* bits in an n bit codeword, we need to think about the combination of n objects taking no object at a time or Com(n, 0), which means the state of no error, the combination of n objects taking one object at a time or Com(n, 1), which means the state of one-bit error, the combination of n objects taking two objects at a time or Com(n , 2), which means the state of two-bit error, and so on. We can have the following relationship between the value of *r* (number of redundant bits) and the value of *m* (the number of errors) we need to correct. Therefore, the formula is as follows:

$2^r \geq$ Com (n , m) + Com (n , m−1) + … + Com(n, 1) + Com(n, 0) (3 Marks)

3. a. Ans.

Stop-And-Wait ARQ: send window = 1 receive window = 1 (2 Marks)

Go-Back-N ARQ: send window = $2^5 - 1 = 31$ receive window = 1 (2 Marks)

Selective-Repeat ARQ: send window = $2^4 = 16$ receive window = 16 (2 Marks)

(6)

b. Ans.

Frame 0 is sent and acknowledged. (1 Marks)

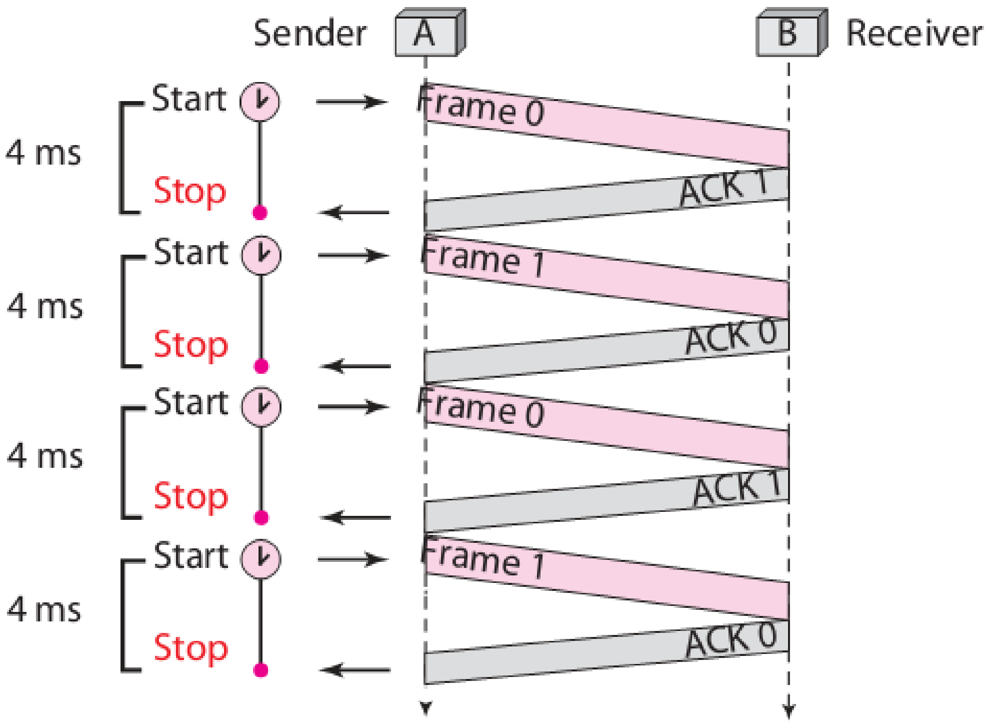
Frame 1 is lost and resent after the time-out. (1 Marks)

The resent frame 1 is acknowledged and the timer stops. Frame 0 is sent and acknowledged, but the acknowledgment is lost. (2 Marks)

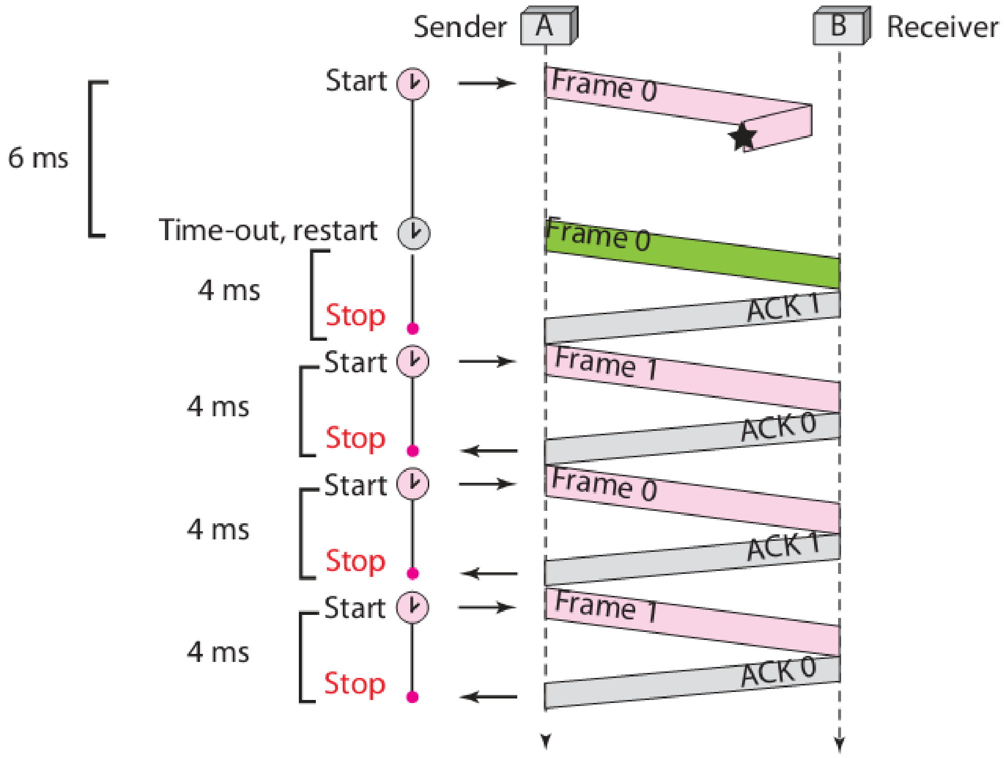
The sender has no idea if the frame or the acknowledgment is lost, so after the time-out, it resends frame 0, which is acknowledged. (2 Marks)

(6)

c. Ans. i) (4 Marks) each event worth 1 mark **(8)**



iii) (4 Marks) each event worth 1 mark



4. a. **(6)**

Ans.

Random access: any two of ALOHA, CSMA, CDMA/CD, CSMA/CA (2 Marks)
Controlled-access: any two of reservation, polling, token ring (2 Marks)

Channelization: any two of FDMA, TDMA, CDMA (2 Marks)

b. Ans. In CSMA/CD, the lack of detecting collision before the last bit of the frame is sent out is interpreted as an acknowledgment. (3 Marks)

In CSMA/CA, the sender cannot sense collision; there is a need for explicit acknowledgments. (3 Marks)

(6)

c. Ans.

i) In a pure Aloha network, a station can send a frame successfully if no other station has a frame to send during two frame transmission times (vulnerable time). The probability that a station has no frame to send is $(1 - p)$. The probability that none of the $N-1$ stations have a frame to send is definitely $(1 - p)^{N-1}$. The probability that none of the $N-1$ stations have a frame to send during a vulnerable time is $(1-p)^{2(N-1)}$. The probability of success for a station is then

P[success for a particular station] = $p\,(1-p)^{2(N-1)}$ (4 Marks)

ii) In a slotted Aloha network, a station can send a frame successfully if no other station has a frame to send during one frame transmission time (vulnerable time).

P[success for a particular station] = $p\,(1-p)^{(N-1)}$ (4 Marks)

(8)