



The
University
Of
Sheffield.

DEPARTMENT OF ELECTRONIC AND ELECTRICAL ENGINEERING

Spring Semester 2012-13 (2.0 hours)

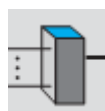
EEE6432 Wireless Packet Data Networks and Protocols

Answer **THREE** questions. **No marks will be awarded for solutions to a fourth question.** Solutions will be considered in the order that they are presented in the answer book. Trial answers will be ignored if they are clearly crossed out. **The numbers given after each section of a question indicate the relative weighting of that section.**

1. a. i) What are the seven protocol layers in the OSI model?
 ii) Which layers are missing from the TCP/IP protocol suite? (9)

- b. Is the OSI model widely implemented? Why? (5)

- c. Using the following figure, show the layers of OSI seven layer protocol stacks and the flow of data when two hosts, one on the west coast and the other on the east coast, exchange messages.



Switch

2. a. i) What are block codes? (6)
 ii) What is the definition of linear block codes?
 iii) How can errors be detected by using block coding? (6)

- b. In CRC, if the dataword is 5 bits and the codeword is 8 bits, how many 0s need to be added to the dataword to make the dividend? What is the size of the (6)

remainder? What is the size of the divisor?

- c.
- Given the dataword 101001111 and the divisor 10111, show the generation of the CRC codeword at the sender site (using binary division).
 - We can create a general formula for correcting any number of errors (m) in a codeword of size (n). Develop such a formula. Use the combination of n objects taking x objects at a time.

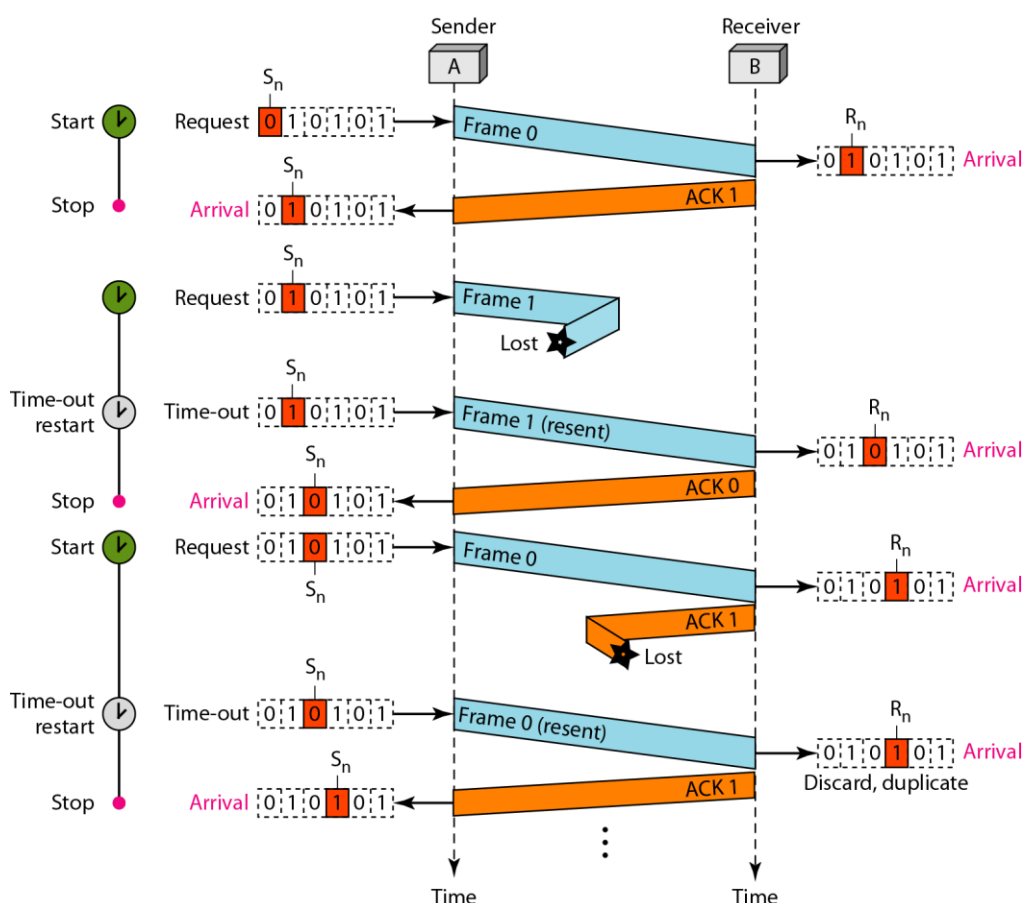
(8)

3. a. Using 5-bit sequence numbers, what is the maximum size of the send and receive windows for each of the following protocols?

- Stop-and-Wait ARQ
- Go-Back-N ARQ
- Selective-Repeat ARQ

(6)

- b. A flow diagram of a Stop-and-Wait ARQ Protocol is shown as follows. Explain the events that happened.



(6)

- c. The timer of a system using the Stop-and-Wait ARQ Protocol has a time-out of 6

(8)

ms.

- i) Draw the flow diagram for four frames if the round trip delay is 4 ms. Assume no data frame or control frame is lost or damaged. For an example of a flow diagram, refer to question 3-b.
- ii) Re-draw the flow diagram if the first frame (frame 0) is lost.

4. a. List two examples each for random-access, controlled-access and channelization multiple access protocols. (6)

- b. There is no acknowledgement mechanism in CSMA/CD, but we need this mechanism in CSMA/CA. Explain the reason. (6)

- c. A multiple access network with a large number of stations can be analysed using the Poisson distribution. When there are a limited number of stations in a network, we need to use another approach for this analysis. In a network with N stations, we assume that each station has a frame to send during the frame transmission time (T_{fr}) with probability p . In such a network, a station is successful in sending its frame if the station has a frame to send during the vulnerable time and no other station has a frame to send during this period of time.

- i) Find the probability that a station in a pure Aloha network can successfully send a frame during the vulnerable time.
- ii) Find the probability that a station in a slotted Aloha network can successfully send a frame during the vulnerable time.

(8)