UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION 2012

TITLE OF PAPER: COMPUTER NETWORKS AND OPEN SYSTEMS INTERCONNECTIONS

COURSE NUMBER: ECO520

TIME ALLOWED: THREE HOURS

INSTRUCTIONS: ANSWER **QUESTION 1** AND **ANY THREE** OF THE OTHER FOUR QUESTIONS.

EACH QUESTION CARRIES **25 MARKS**.

DO NOT OPEN THE PAPER UNTIL PERMISSION HAS BEEN GIVEN BY THE INVIGILATOR.

QUESTION 1

a) What functions are performed by the network layer, physical layer and data link layer in the OSI Reference Model?

[7]

b) A sender encodes 7 bit ASCII characters using an even parity Hamming code before transmission to a receiver. If the receiver gets the bit pattern **10111001001**, determine if the received bit string has no errors, and if it has an error, determine the bit position of the error.

[6]

c) Describe how CSMA/CD works.

[5]

d) How does TCP differ from UDP?

[2]

e) Given the IP address 172.16.45.82/26, calculate the broadcast address and the minimum ip address of the network.

[5]

QUESTION 2

a) Differentiate between guided media and unguided media, giving one example of each.

[3]

b) A person on a bicycle travelling at 40 Km/hr can carry 5 DVDs, each containing 4 GB of data. For what range of distances would it be faster to use the person on the bicycle to transfer information on 5 DVDs than to use a 10 Mbps data line to transfer the data?

[4]

c) Discuss the following CSMA protocols

(i) 1-persistent CSMA
(ii) p-persistent CSMA

[6]

d) What is the difference between ARP and RARP?

[2]

e) The bit string 00111000111101011100 needs to be transmitted at the data link layer. What is the string transmitted after bit stuffing?

[3]

f) Why is packet switching more efficient than circuit switching in data communications?

[3]

g) What differentiates LANs from WANs?

[4]

QUESTION 3

a) On which OSI Reference Model layer do the following devices belong?

(i) router
(ii) repeater
(iii) switch

[3]

b) Explain the operation of the data link layer sliding window protocol called Selective Repeat.

[3]

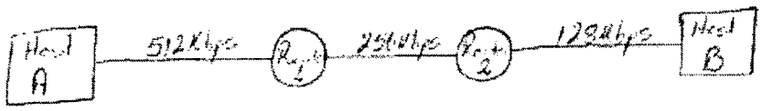
c) Sketch the NRZ-I encoding and differential Manchester encoding for the bit stream **1110001010**.

[4]

d) Sketch the diagram of an Ethernet frame discussing the function of the fields.

[6]

e) Given the diagram, which shows two hosts A and B separated by three (3) links, and the lengths of each link are negligible.



Calculate the time it takes to send a 512 KB file from host A to host B using

(i) message switching
(ii) packet switching, assuming that packets can be 1500 bytes inclusive of the header.

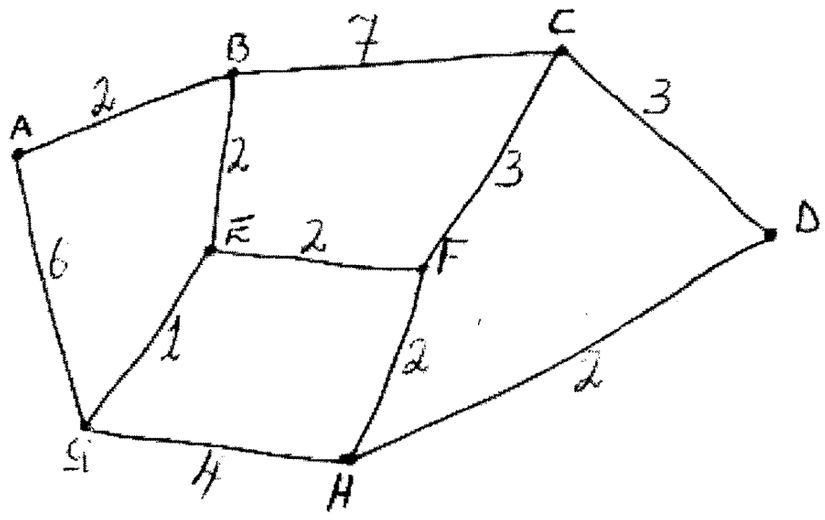
[6]

f) Explain the two main functions performed by a router.

[3]

QUESTION 4

a) Using Dijkstra's routing algorithm on the network of routers shown, find the minimum distances and routes between nodes A and all other nodes.



[8]

b) Compute the CRC for the data frame M(x) = **10011110101**, given the generator polynomial G(x) = **$x^4 + x + 1$**. Find R(x) and hence the complete transmitted frame bit pattern.

[5]

c) A **2400 baud** modem uses the constellation diagram show in figure 1. What is the data rate of the modem? What modulation scheme is the modem using?

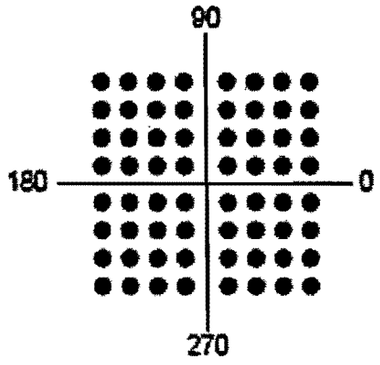


Figure 1: Constellation diagram

[4]

d) Describe the three way handshake of TCP.

[3]

e) Briefly describe the following: SMTP, POP3, and MIME.

[5]

QUESTION 5

a) A channel has a bit rate of 56 Kbps and a propagation delay of 25ms. For what range of frame size does stop-and-wait give an efficiency of at least 50%?

[4]

b) How is the IPv4 header checksum calculated?

[2]

c) What is a socket in TCP/IP?

[3]

d) Into how may classes can an IP address fall into, and how do you determine which class it belongs to?

[5]

e) Given the IP network 196.24.66.0, how many subnets would result if the maximum number of hosts per subnet is 30? What is the subnet mask?

[4]

f) What causes congestion?

[3]

g) Describe the RSA encryption method.

[4]