

UNIVERSITY OF SWAZILAND
FACULTY OF SCIENCE
DEPARTMENT OF ELECTRICAL AND ELECTRONIC
ENGINEERING
SUPPLEMENTARY EXAMINATION 2012

TITLE OF PAPER: COMPUTER NETWORKS AND OPEN SYSTEMS
INTERCONNECTIONS

COURSE NUMBER: ECO520

TIME ALLOWED: THREE HOURS

INSTRUCTIONS: ANSWER ANY **FOUR** Questions

EACH QUESTION CARRIES **25 MARKS**.

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BY THE INVIGILATOR.

QUESTION 1

- a) Give the layers of the OSI Reference Model and give a short description of the function of each layer. [10]
- b) Give an example of guided media and unguided media. [4]
- c) A channel has a bit rate of 1000 Mbps. What is the bit time of the channel? How much time will it take to transmit 8000 bytes of data on the channel? [6]
- d) Geostationary Earth Orbit satellites are located 35, 650 km above the earth's surface, and a satellite acts as a relay or repeater for earth based stations. Given that the speed of electromagnetic waves in air and vacuum is 300, 000 km/s. Find the time it takes for a bit from one earth station to reach the other earth station. [5]

QUESTION 2

- a) Describe the three different network categories. [6]
- b) Sketch the Manchester and differential Manchester encodings for the bit string **010111110010**. [6]
- c) The bit string **0111111100011111011111** needs to be transmitted at the data link layer. What is the string transmitted after bit stuffing? [5]
- d) A **2400 baud** modem uses a constellation diagram that has 16 points. What is the data rate of the modem? [3]
- e) Compute the CRC for the data frame $M(x) = 11111001101$, given the generator polynomial $G(x) = x^4 + x + 1$. [5]

QUESTION 3

- a) Describe the operation of the pure Aloha protocol. [5]
- b) Why is slotted Aloha more efficient than pure Aloha? [3]
- c) Draw the diagram of an HDLC frame indicating the different fields of the frame. [5]
- d) What are the 3 frames supported by HDLC? [3]

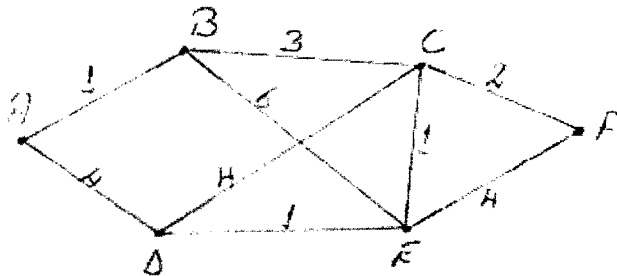
- e) Explain the operation of the data link layer sliding window protocol called Go back n. [4]
- f) What is piggybacking? [2]
- g) What is the advantage of sliding-window flow control compared to stop-and-wait flow control? [3]

QUESTION 4

- a) Draw a diagram of the **IEEE 802.3** frame, explaining the function of each field does. [10]
- b) How does the frame differ from an **Ethernet II (DIX)** frame? [2]
- c) What are the minimum and maximum frame sizes of the two frame types? [3]
- d) Given the IP addresses 198.25.63.21, 16.255.255.3, 121.121.121.121, 176.16.30.20, show which IP class each one belongs to. [7]
- e) Describe how CSMA/CD works. [3]

QUESTION 5

- a) Use Dijkstra's algorithm to compute the shortest path from node A to all other nodes on the network shown below



[5]

- b) Describe the RSA encryption method. [5]
- c) How is the IPv4 header checksum calculated? [3]
- d) What causes congestion? [3]
- e) Given the IP network 196.24.64.0, how many subnets would result if the maximum number of hosts per subnet is 30? What is the subnet mask? [5]
- f) What are the functions of ARP and RARP? [4]