

UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION 2013

TITLE OF PAPER: COMPUTER NETWORKS

COURSE NUMBER: EE572

TIME ALLOWED: THREE HOURS

INSTRUCTIONS: ANSWER ANY **FOUR** QUESTIONS.

EACH QUESTION CARRIES **25** MARKS.

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BY THE INVIGILATOR.

QUESTION 1

- a) Describe the ISO Open Systems Interconnection architecture indicating the functions of each layer of the model. [10]
- b) Using clear diagrams, show the encoding of the bit string **10110010110** using MLT-3 and Differential Manchester encoding. Assume the signal is at a positive voltage just before the first bit is transmitted [6]
- c) What is the difference between a switch and a hub? [3]
- d) Given two hosts, connected by a direct 2 Mbps transmission link and separated by 1000 Km with a propagation speed of 2.5×10^8 m/s, calculate the bit length of the link. The bit length of the link is defined as a frame whose size is such that when the first bit transmitted reaches the destination, the last bit leaves the sender. [3]
- e) Why does Ethernet require transmitted frames to be at least 64 bytes? [3]

QUESTION 2

- a) Differentiate between guided and unguided media, giving an example of each type of medium. [4]
- b) Describe frequency division multiplexing and time division multiplexing. [4]
- c) A channel has a propagation delay of 25 ms and a bit rate of 10 Kbps. For what range of frame sizes does stop-and-wait give an efficiency of at least 50%. [3]
- d) Describe two different network categories. [4]
- e) Describe the binary exponential backoff algorithm used by IEEE 802.3. [5]
- f) What is piggybacking? [2]
- g) What is the advantage of sliding-window flow control compared to stop-and-wait flow control? [3]

QUESTION 3

- a) Differentiate between circuit switching and packet switching [3]
- b) The bit string **100011011111101111111111100** needs to be transmitted at the data link layer. What is the transmitted string if bit stuffing is used? [4]
- c) Given a channel with a signal to noise ratio of 25 dB and allows signals with frequencies from 25.43 MHz and 30.25 Mhz to pass through without attenuation, what is the maximum data rate possible on the channel? [4]
- d) Define the Hamming Distance for a group of codewords. [3]
- e) The bit string **010111100** is to be encoded using an odd parity Hamming Code. How many check bits are needed to ensure that the Receiver can detect and correct single bit errors? Show the codeword after encoding the given bit string. [6]
- f) Describe Carrier Sense Multiple Access with Collision Detection. [5]

QUESTION 4

- a) Draw the diagram of an Ethernet II frame, explaining the functions of each field. [7]
- b) What distinguishes an IEEE 802.3 frame from an Ethernet II frame? [3]
- c) Two hosts are separated by three (3) links, with the data rate on the first link being 128 Kbps, on the second link the data rate is 512 Kbps and on the third link, the data rate is 256 Kbps. The propagation delay on the first link is 5 ms, on the second link it is 20 ms and on the last third link it is 240 ms. Given that a file which is 32 KB needs to be sent from the first host to the second, find the time to transfer the file using message switching and packet switching, given that packets have a maximum size of 5000 bytes. [6]
- d) Given the binary information **011011000101**, show the analogue signal form if it is transmitted over an analogue transmission medium using
(i) Amplitude modulation
(ii) Quadrature Phase shift modulation [5]
- e) If the characters **DLE ETX DLE A B C DLE STX Z R DLE E DLE** are subjected to character stuffing, what is the output after stuffing? [4]

QUESTION 5

a) Given a message $M(x) = x^9 + x^8 + x^6 + x^5 + x^2 + 1$ and the generator polynomial $G(x) = x^5 + x^2 + x + 1$, find the transmitted bit stream $T(x)$ if the cyclic redundancy checksum is used. How does the receiver determine if the received bit stream has not incurred any errors?

[7]

b) Explain the Selective Repeat sliding window protocol and indicate how it differs from Go-back-n.

[6]

c) Distinguish between single and multimode optical fibre. State three benefits of using optical fibre.

[5]

d) Describe the operation of the pure Aloha protocol.

[4]

e) What is ADSL? Why is ADSL suitable for connecting home users to the Internet?

[3]