ELIZADE UNIVERSITY

ILARA-MOKIN

FACULTY: BASIC AND APPLIED SCIENCES
DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE
1st **SEMESTER EXAMINATION**
2016 / 2017 **ACADEMIC SESSION**

COURSE CODE: CSC 425

COURSE TITLE: Data Communication and Computer Networks

COURSE LEADER: Dr. Vincent Akpan

DURATION: 3 Hours

HOD's SIGNATURE

INSTRUCTION:

The paper will contain SIX Questions. You should answer any FOUR Questions.

Students are warned that possession of any unauthorized materials in an examination is a serious offence

1. (a) Define the following terms: (i) Signal bandwidth (ii) Channel bandwidth (iii) Channel capacity

(b) (i) Define the term Nyquist rate
(ii) State the Harley's law
(iii) State the Shannon-Hartley theorem for multi-level and multi-phase encoding techniques.
(iv) By comparing the Shannon's capacity to the Hartley's law. State and give one reason if there is any implication between the two?

(c) (i) A noisy telephone channel has a bandwidth of 3 kHz and a signal-to-noise ratio (SNR). Compute the maximum channel capacity.
(ii) For a noiseless 3 kHz channel with 4 number of different quadrature phase shift keying (QPSK) signaling values, compute the maximum channel capacity.
(iii) If the requirement is to transmit at 50 kbit/s, and a bandwidth of 10 kHz is used. Compute the minimum signal-to-noise ratio (SNR) required.

2. (a) (i) In what situation is multiplexing used?
(ii) Why are guard bands used in frequency-division multiplexing (FDM)?
(iii) Why is synchronous pulse required in time-division multiplexing (TDM)?
(iv) How is the wastage of bandwidth in TDM overcome by Statistical-TDM?
(v) What limitation of TDM is overcome by ATM and how?

(b) Using suitable diagrams, briefly discuss the following terms:
(i) Frequency-division multiplexing (FDM)
(ii) Wavelength-frequency division multiplexing (WDM)
(iii) Time-division multiplexing (TDM)
(iv) Statistical time-division multiplexing (STDM)
(v) Orthogonal frequency division multiplexing (OFDM)

3. (a) Using a suitable block diagram, briefly explain the Open System Interconnection model (OSI model).
(b) Briefly explain the function of the respective layers of the OSI model.

4. (a) Using a suitable block diagram, briefly explain the TCP/IP stack model.
(b) Using suitable diagrams where necessary, briefly explain the function of the respective layers of the TCP/IP stack model.

5. (a) (i) Can a client computer act as a server? Briefly discuss your choice of answer.
(ii) State three characteristics of a client/server computer network.
(b) Using a suitable diagram, show the how you would position a router, a bridge and a repeater between two host computers running TCP/IP protocol stack.
(c) What is internetworking?
(d) Briefly discuss the following internetworking technology terms:
(i) Voice/Data integration technologies
(ii) Quality of service networking technologies
(iii) Multiservice Access Technologies
(e) Briefly discuss the following terms:
(i) Code division multiple access (CDMA)
(ii) Collision detection and avoidance (CD/CA)
(f) Using a summary-flow block diagram, briefly carriers sense multiple access/collision avoidance (CSMA/CA) process.

6. (a) Design a BCD-to-seven segment decoder. The decoder has a 4-bit natural binary BCD input represented by ABCD where A is the *msb*. A seven-segment decoder is show in Fig. 1 and when any of its seven outputs (a to g) is true, the corresponding segment of the display is illuminated. Implement the resulting circuit using NAND gates only.
(b). Using the Quine-McCluskey method, determine the minimal sum of products form for the following multiple output system and implement the result using NAND gates only.

$$X(A,B,C,D) = \sum m(0,1,4,5,9,11,14,15) + \sum d(10,13)$$

$$Y(A,B,C,D) = \sum m(0,13,14,15) + \sum d(1,2,3,9,10,11)$$

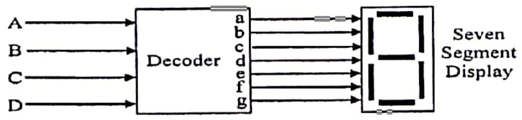

Fig. 1: Seven segment display for Question 6(a).