

UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION DECEMBER 2015

TITLE OF PAPER : NETWORKS AND CODING THEORY - I

COURSE NUMBER : CS437

TIME ALLOWED : THREE HOURS

INSTRUCTIONS : ANSWER ANY FOUR QUESTIONS.

EACH QUESTION CARRIES 25 MARKS.

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

## QUESTION 1

- a) What are reasons for using layered protocols? What is the OSI Model? Describe the function of any three layers of the OSI Model. [10]
- b) What are differences between connection-oriented and connectionless communication? [4]
- c) What is network topology? Describe different types of network topology with diagrams. [7]
- d) An image is  $1024 \times 768$  pixels with 3 bytes/pixel. Assume the image is uncompressed. How long does it take to transmit 10 images over 1-Mbps cable modem? [4]

## QUESTION 2

- a) Differentiate between Guided and Unguided transmission media. Give one example of each. Also describe any one guided transmission media in detail. [6]
- b) What is Multiplexing? Briefly explain about Time Division Multiplexing and Frequency Division Multiplexing. [10]
- c) Show the encoded signal if the bit stream 10001100010111 is encoded using [5]
- i. NRZI encoding
  - ii. Manchester encoding
  - iii. Bipolar encoding
- d) State the Shannon's major result formula for Maximum Data Rate of a Channel and calculate the capacity of a noisy channel whose bandwidth is 1 MHz and signal-to-noise ratio 40 dB. [4]

### QUESTION 3

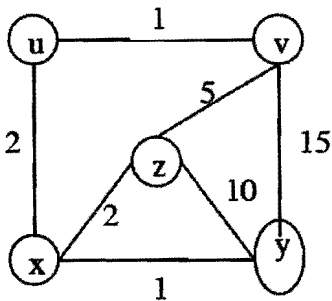
- a) Explain the method of framing employed at data link layer in bit-oriented synchronous data lines. [6]
- b) What is Hamming Distance? Find the Hamming Distance for the codewords 00100001001, 01000000001, 11000000011, 10001110001. [5]
- c) Given the data,  $M(x) = 1101011111$  assuming CRC is used with a generator function  $G(x) = x^4 + x + 1$ . Find the bit string  $T(x)$  to be transmitted. [8]
- d) Explain what is Simplex Stop-and-Wait protocol for a noisy channel? [6]

### QUESTION 4

- a) Explain how pure ALOHA system and slotted ALOHA system work. [10]
- b) Given a static FDM with 10 independent channels. Calculate the mean time delay if the channel capacity is 100 Mbps with frames arrival rate of 5000 frames/sec and the frame average length 10000 bits. [5]
- c) Briefly explain what happens in CSMA/CD when a node detects that its data has suffered a collision? [4]
- d) Explain the comparison of 802.16 with 802.11 and 3G. [6]

### QUESTION 5

- a) Consider the network shown below, and assume that each node initially knows the costs to each of its neighbors. Consider the distance vector algorithm and show the distance table entries at node z. [3]



- b) Write down comparison between Virtual-Circuit and Datagram Networks. [5]
- c) Calculate Burst length if the maximum output rate is 125 MB/Sec, the token bucket capacity 9600 KB and the token arrival rate 25 MB/Sec. [3]
- d) Write a short note about following items: [12]
- i. DHCP
  - ii. IMCP
  - iii. NAT
  - iv. Packet Scheduling
- e) A network on the internet has a subnet mask of 255.255.240. What is the maximum number of hosts it can handle? [2]

**End of Question Paper**