EASTERN UNIVERSITY, SRI LANKA
DEPARTMENT OF MATHEMATICS
THIRD EXAMINATION IN SCIENCE - 2014/2015
SECOND SEMESTER (Dec. /Jan., 2018)
CS 302 – COMPUTER NETWORK

ANSWER ALL QUESTIONS **TIME ALLOWED: 02 HOURS**

Q1). A computer network is a group of interconnected computers and it may be classified according to a wide variety of characteristics.

a) List down five components of a computer network. [10%]

b) Explain how a *peer-to-peer* network model differs from a *client-server* network model with the aid of suitable diagrams. [20%]

c) Compare and contrast each of the following:

i. *Star topology* Vs *Ring topology* [08%]

ii. *Switching* Vs *Routing* [08%]

iii. *Local Area Network* Vs *Personnel Area Network.* [08%]

d) Briefly describe the three ways of *data flow* in data communication with the aid of suitable examples. [12%]

e) Explain how data is transmitted along a fibre optic cable and indicate at least three advantages fibre optic cable has over copper cable. [16%]

f) For each of the following three applications, state whether you would use TCP or UDP and explain the reasons for your choice:

i. File transfer [06%]

ii. Video streaming [06%]

iii. An audio conference. [06%]

Q2). The *ISO-OSI model* defines a hierarchical architecture that logically partitions the functions required to support system-to-system communication.

a) The *ISO Reference Model* defines seven protocol layers, each of which is responsible for a specific range of functions. By considering this model, mention three main functions performed by a protocol operating at the *Network layer*. [09%]

b) Give the names of the seven layers of the *ISO Reference Model* and the names of the four corresponding layers in the *TCP/IP protocol* stack, showing the correspondence explicitly. [11%]

c) An eight character data frame 'P ESC P Q ESC FLAG ESC FLAG' needs to be transmitted at data link layer. Assume that the following character encoding were used in data link layer protocol: P: 10111111; Q: 11101011; FLAG: 01111110; ESC: 11100111.
Find the bit sequence transmitted if the following framing methods are used:

i. Character count [04%]

ii. Flag bytes with byte stuffing. [06%]

iii. Starting and ending flag bytes, with bit stuffing. [06%]

d) Given the output after byte-stuffing: FLAG I J ESC ESC K ESC ESC ESC FLAG ESC FLAG L M N FLAG. What is the original data? [10%]

e) Suppose a bit stream 111101111 is to be transmitted across a data link layer using a *cyclic redundancy check (CRC)* for error detection.
If the generator polynomial is, $G(x) = x^2 (x+1)$;

i. Find the actual bit stream transmitted. [12%]

ii. Suppose that the fifth bit from the left is inverted during transmission. Show that this error is detected at the receiver side. [12%]

f) Suppose that a message 1101111011101011 is transmitted using *Internet Checksum* (4 bit word).

i. Estimate the value of the *checksum*. [15%]

ii. Reconstruct the actual message transmitted. [05%]

iii. Suppose that the third bit from the left is inverted during transmission. Show that this error is detected at the receiver side. [10%]

Q3). Data communication refers to the exchange of data between a source and a destination.

a) The process for converting digital data into digital signal is said to be *line coding*. Distinguish between *unipolar, polar* and *bipolar* encoding. [15%]

b) Sketch each of the following line codes for the bit sequence 101011001:

i. *Return–to–Zero (RZ)* [06%]

ii. *Polar Non return–to–Zero (NRZ)* [06%]

iii. *Manchester* [06%]

iv. *Differential Manchester* [06%]

v. *Bipolar* [06%]

c) Briefly explain the *Digital to analog* conversion techniques with the aid of suitable example. [25%]

d) Explain the following modulation of analog signals using the binary code 101011001:

i. *Amplitude Modulation* [10%]

ii. *Frequency Modulation* [10%]

iii. *Phase Modulation.* [10%]

Q4). Data-link layer is responsible for implementation of point-to-point flow and error control mechanism.

a) Describe how flow control is handled in the *Stop and Wait* protocol. [10%]

b) Consider the *Stop and Wait* protocol. Draw pipelined timing diagrams to show how a *Stop and Wait ARQ* scheme copes up with:

i. a lost or damaged data frame, [08%]

ii. a lost acknowledgement, [08%]

iii. a delayed acknowledgement. [08%]

c) Describe the draw backs of the *Stop and Wait* protocol. [06%]

d) In *Go back 3*, if every 5th packet that is being transmitted is lost and if you have to send 15 packets, then estimate the number of transmissions that are required. [10%]

e) Given an 8-bit message 11011001, answer the following questions:

(*Note: count the bits from **left to right***):

i. If the message is transmitted using a *Hamming code*, estimate the number of check bits that are needed to ensure that the receiver can correct a single bit error. [10%]

ii. Assuming that an even parity is used in the *Hamming code*, show the bit pattern transmitted for this message. [15%]

iii. Suppose that the third bit of the answer of question in (*ii*) above is inverted due to transmission errors. Show how *Hamming code* detects and corrects it. [10%]

iv. Suppose that both bit 3 and bit 7 of the answer of question in (*ii*) above are inverted. Show how *Hamming code* cannot correct these errors. [15%]