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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME : DATA COMMUNICATION
NETWORKS

COURSE CODE : BEB 40903

PROGRAMME : BEJ

EXAMINATION DATE : JUNE 2017

DURATION : 3 HOURS

INSTRUCTION : ANSWER **FIVE (5)** QUESTIONS ONLY.

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THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Explain the advantages of layering as in the TCP/IP architecture.

(4 marks)

(b) Suppose a protocol architecture has defined four layers for communication, which are base layer, net layer, transport layer, and max layer. The length of header for each layer: the base layer and the net layer is 2 bytes, the transport layer is 3 bytes and max layer is 4 bytes. In addition, the net layer has 1 byte trailer. If a total of 50-bytes packet is received at the base layer, determine the size of the actual message.

(4 marks)

(c) Given the audio bandwidth of a telephone transmission facility of 2800 Hz, a signal-to-noise ratio of 56 dB, and a certain level of distortion,

(i) calculate the theoretical maximum channel capacity of the telefone lines.

(ii) Shannon and Nyquist place an upper limit on the bit rate of a channel based on two different approaches. Differentiate between Shannon and Nyquist channel capacity theorem.

(8 marks)

(d) A UTP cable has a bit rate of 10 Mbps and a propagation delay of 4 µs/km. A sender intends to transmit a file of size 500 KB to the receiver that is connected with a cable with a length of 10,000 km. Compare the propagation time and the transmission time for transmitting this file.

(4 marks)

Q2 (a) Explain the differences between the NRZ-L and NRZ-I encoding scheme.

(4 marks)

(b) The waveform in **Figure Q2(b)** belongs to the Manchester-encoded binary data stream. Determine the data sequence.

(4 marks)

(c) A CRC is constructed to generate a 4-bit FCS for an 11-bit message. The generator polynomial is $X^4 + X^3 + 1$.

(i) Encode the data bit sequence 10011011100 (leftmost bit is the least significant) and give the codeword.

(ii) Now, assume that bit 7 (counting from the LSB) in the codeword is in error. Evaluate if this error can be detected at the receiver.

(8 marks)

(d) A popular World Wide Web (WWW) server is set up to receive relatively small messages from its client and to transmit very large message to them. Analyse the type of ARQ protocol (selective reject, go-back-N) that would provide less of a burden to the server.

(4 marks)

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Q3 For a long distance transmission beyond a local area, communication is typically achieved by transmitting the data from the source to destination through a switched communication network.

(a) Define 'switched communication network'.

(2 marks)

(b) Explain circuit switching and packet switching techniques in a switched communication network.

(6 marks)

(c) A message of length 3200 bits is to be sent on a wide area network (WAN) with 3 hops. Each link in the network has a maximum capacity equal to 9600 bps. Data is sent on the network by using fixed packet size of 128 bytes. Assuming the propagation delay per hop is 0.002 s and the call set-up time is 0.1s,

(i) calculate the end-to-end delay incur to transmit the whole message on circuit switched network;

(4 marks)

(ii) calculate the end-to-end delay incur to transmit the whole message on virtual circuit packet switching network; and

(6 marks)

(iii) discuss whether it is useful to use flow control in both of the above networks or not.

(2 marks)

Q4 (a) Define Local Area Network (LAN).

(2 marks)

(b) Describe the operation of Carrier Sense Multiple Access with Collision Detection (CSMA/CD) in IEEE 802.3 Ethernet.

(4 marks)

(c) Describe Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) that is used in IEEE 802.11 WiFi.

(4 marks)

(d) Assume that there are only two stations, A and B, in a CSMA/CD network. The distance between the two stations is 2000 m and the propagation speed is 2×10^8 m/s. If station A starts transmission at time, t_1;

(i) does the protocol allow station B to start transmitting at time $t_1 + 8us$; and

(2 marks)

(ii) does the protocol allow station B to start transmitting at time $t_1 + 11us$.

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(2 marks)

(e)   Suppose that a group of 10 stations is serviced by an Ethernet. Calculate the maximum possible throughput for the following topology configuration if:

      (i)   the 10 stations are connected to a 10 Mbps Ethernet hub;

(2 marks)

      (ii)   the 10 stations are connected to a 10 Mbps half-duplex Ethernet switch; and

(2 marks)

      (iii)   the 10 stations are connected to a 10 Mbps full-duplex Ethernet switch.

(2 marks)

Q5   (a)   Calculate the data transfer rate in bps of a signal that is encoded using phase modulation with eight different phase angles and a baud rate of 3000 symbols/s.

(3 marks)

   (b)   In the Internet, with regards to the packets in the transport layer, explain:

      (i)   Why some packets may be lost?
      (ii)   Why some packets may be duplicated?
      (iii)   Why some packets may be received out of order?

(6 marks)

   (c)   It is a common practice in most transport protocols for control data to be multiplexed over the same logical channel on a per-user-connection basis. Discuss the use of multiplexing in the context of a transport protocol.

(6 marks)

   (d)   Differentiate between the TCP and UDP of a transport layer protocol.

(5 marks)

Q6   (a)   IP addresses are logical address that are given to all devices that are connected to the Internet. In general there are three classes of IP address that can be used by the public, namely class A, B, and C. Provide the following parameter values for each of those three classes.

      (i)   The number of bits for the Network ID and the total number of networks allowed in each class.

(3 marks)

      (ii)   The range of network addresses for each class.

(3 marks)

      (iii)   The number of bit for Host ID and the total number of hosts per network allowed.

(3 marks)

(b)   You are a network engineer in an international electronic manufacturing company. The company is allocated with a class C network: 201.20.30.x. You are assigned by the network administrator to create the subnets for those four departments with the following number of hosts.

        Human Resource Department: 72 hosts

        Accounting Department: 35 hosts

        Technical Department: 20 hosts

        Service Department: 18 hosts

Design the network by giving a possible arrangement of subnet numbers, subnet mask, and IP addresses to make this possible. (Note: One department could be assigned with more than one subnets)

(11 marks)

- END OF QUESTIONS -

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Figure Q2 (b)

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