Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	BROADBAND NETWORKS
COURSE CODE	:	MEP10403
PROGRAMME CODE	:	MEE
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWERS **FOUR (4)** QUESTIONS ONLY **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) In managing the TCP congestion, one of the efforts is to control the timeout by utilizing the Retransmission Timer Management. It is done by averaging the Roundtrip Time (RTT) that are obtained continuously in order to response to the network conditions. Using suitable mathematical expression, explain these **TWO (2)** averaging methods.

(i) Simple Averaging.

(ii) Exponential Averaging.

(6 marks)

(b) Consider the Window Management of TCP congestion control which include the Slow-Start, Dynamic Window Sizing and Congestion Avoidance.

(i) Analyze the process of TCP congestion control using suitable timing graph.

(7 marks)

(ii) Consider TCP is operating in a line of 100 Mbps link that has no congestion. Explain the behavior of slow start if the link has RTT as 20 ms, receive window of 20 Kbytes, and MSS(maximum segment size) of 1 Kbyte. What happens if the speed of the link is set at 1 Mbps and then at 100 kbps?

(12 marks)

Q2 (a) Consider the following definitions as applied to datalink layer transmission protocol,

P_f - probability that a frame transmission has an error, assumming that it is independent of other frames fransmission.

n_o - the number of overhead bit in a frame.

n_f - number of bits in the information frame.

W_s - size of the send window.

By taking errors into consideration, derive from first principle, the efficiency, η of the Go-Back-N ARQ and Selective-Repeat ARQ.

(16 marks)

(b) Evaluate the performance, in terms of efficiency, of Go-Back-N and Selective-Repeat with respect to the Bit Error Rate (BER) for different transmission bit rate of 1.5 Mbps and 45 Mbps, with the given parameters as follows:

$n_f = 1250$ bytes.

$n_a = n_o = 25$ bytes.

BER, $p = 0; 10^{-6}; 10^{-5}; 10^{-4}; 10^{-3};$

$(t_{proc} + t_{prop}) = 50\text{ms};$

$W_s = 20$ for bit rate 1.5 Mbps;

$W_s = 551$ for bit rate 45 Mbps;

Tabulate the result and discuss the performances.

(9 marks)

Q3 (a) In an M/M/2 communication node, packets arrive according to a Poisson process of rate 18 per second. The system has **TWO (2)** parallel crossbar switches, and each switch spends an exponentially distributed amount of time with mean 100ms to process a packet.

(i) Calculate the probability that an arriving packet must wait to be processed.

(ii) Find the mean number of packets in the system.

(iii) Find the mean time a packet spends in the system.

(iv) What is the probability that more than 50 packets are in the system?

(12 marks)

(b) Consider a high-speed node of a data network having parallel-plane switching fabrics, in which six packets can be processed at a time without any prior waiting time (M/M/6/6). Assume that the arrival rate is 100 packets/sec and that the mean service rate is 20 packets/sec.

(i) What is the probability of blocking a packet?

(6 marks)

(ii) How many more switches are required to reduce the blocking probability to 50 percent more?

(7 marks)

Q4 (a) Consider the used of compression techniques in the broadband networking environment. Compare and contrast between lossless and lossy compression techniques. State two examples for each technique.

(8 marks)

(b) Given a random variable V that takes on one of the eight possible values,

$$\{ v_1 , v_2 , v_3 , v_4 , v_5 , v_6 , v_7 , v_8 \}$$

with the corresponding probabilities of occurrence of V,

$$\{0.562, 0.198, 0.064, 0.059, 0.045, 0.034, 0.034, 0.004\}.$$

(i) Design a 3-bit code with one 3-bit value for each of the eight possible values of v showing the average length and the entropy.

(4 marks)

(ii) Design a variable length code based on Huffman Coding Technique, showing the average length and the entropy.

(8 marks)

(iii) Compare the first design and the second design in terms of their performances.

(5 marks)

Q5 In order to effectively improve the transmission of data packets within the broadband networks, various techniques of routing protocols are implemented. Intrinsically within the protocols two algorithms are utilized, that is the Dijkstra Algorithm and the Bellman-Ford Algorithm.

(a) (i) Produce the generalized Dijkstra Algorithm and the Bellman-Ford Algorithm using pseudo code. Elaborate in each step.

(8 marks)

(ii) Compare and contrast between these two algorithms.

(5 marks)

(b) A simplified network is given in **Figure Q5(b)** in a form of weighted graph calculate the shortest path using Dijkstra algorithm.

(12 marks)

-END OF QUESTIONS –

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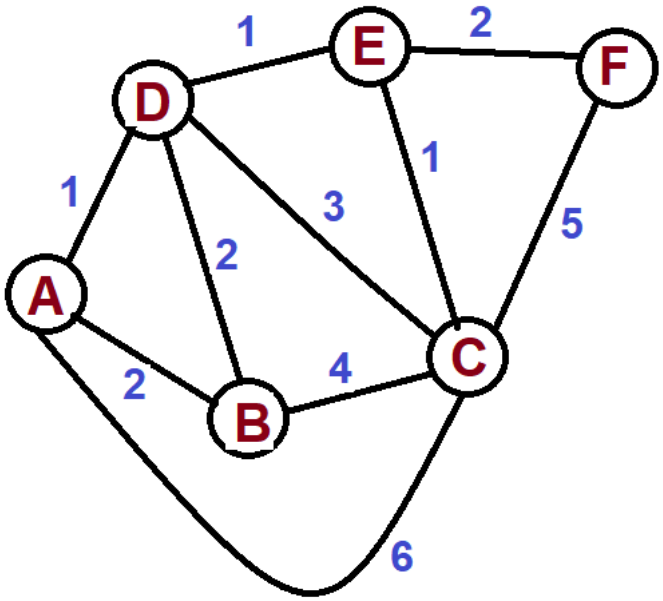

Figure Q5(b): A simplified network with weighted graph