UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	COMPUTER NETWORKS
COURSE CODE	:	BEC41003
PROGRAMME	:	BEJ
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTIONS	:	1. ANSWER **ALL** QUESTIONS IN **SECTION A** AND **THREE** QUESTIONS IN **SECTION B.** 2. ANY ANSWER WRITTEN IN PENCIL WILL **NOT BE EVALUATED.** 3. STUDENT IS **NOT ALLOWED** TO BRING OUT THE QUESTION PAPER.

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

SECTION A (40 MARKS)

INSTRUCTION: Answer ALL questions. Any answer written in pencil will not be evaluated.

Q1 (a) (i) List two of internet access technologies. Classify each one either as home access, or enterprise.

(2 marks)

(ii) What is the transmission rate of Ethernet LANs?

(3 marks)

(iii) What is the difference between network architecture and application architecture?

(3 marks)

(b) UDP and TCP use 1s complement for their checksums. Suppose you have the following three 8-bit bytes: 01010011, 01100110, 01110100.

(i) What is the 1s complement of the sum for these 8-bit bytes? (Note that although UDP and TCP use 16-bit words in computing the checksum, for this problem you are being asked to consider 8-bit sums). Show all work.

(3 marks)

(ii) How does the receiver in UDP detect the errors?

(2 marks)

(c) Consider the rdt 3.0 protocol. Draw a diagram showing that if the network connection between the sender and receiver can reorder messages where two messages propagating in the medium between the sender and receiver can be reordered, then the alternating-bit protocol will not work correctly. Your diagram should have the sender on the left and the receiver on the right, with the time axis running down the page, showing data (D) and acknowledgment (A) message exchange. Make sure you indicate the sequence number associated with any data or acknowledgment segment.

(7 marks)

Q2 (a) (i) Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding Table **Q2(a).**

Table Q2(a): Prefix Macth and its Interface

Prefix Match	Interface
1	0
10	1
111	2
otherwise	3

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

(8 marks)

(ii) State the address space of MAC , IPv4 and IPv6.

(3 marks)

(b) (i) What is the role of the SMI in network management?

(2 marks)

(ii) Explain the differences between a request-response message and a trap message in SNMP.

(5 marks)

(iii) In the SSL record, there is a field for SSL sequence numbers. State either this statement is True or False. Give the reason to your answer.

(2 marks)

SECTION B (60 MARKS)

INSTRUCTION: Answer THREE questions only. Any answer written in pencil will not be evaluated.

Q3 In modern packet-switched networks, including the Internet, the source host segments long, application-layer messages (for example, an image or a music file) into smaller packets and sends the packets into the network. The receiver then reassembles the packets back into the original message. We refer to this process as message segmentation. Figure **Q3** illustrates the end-to-end transport of a message with and without message segmentation. Consider a message that is 8×10^6 bits long that is to be sent from source to destination in Figure **Q3**. Suppose each link in the figure is 2 Mbps. (Ignore propagation, queuing, and processing delays).

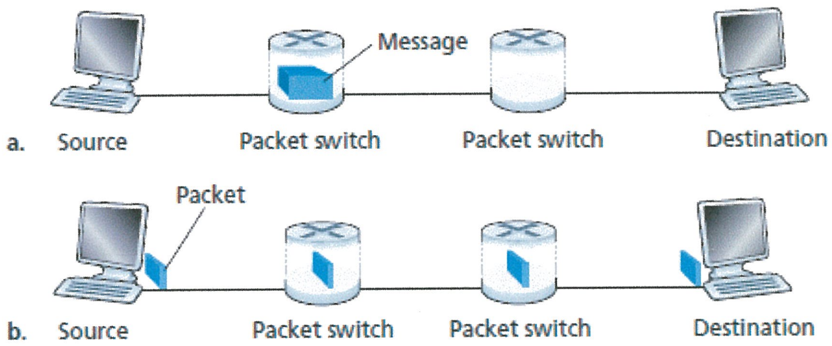

Figure Q3: End-to-end message transport: (a) without message segmentation; (b) with message segmentation

(i) Consider sending the message from source to destination without message segmentation. Keeping in mind that each switch uses store-and-forward packet switching, what is the total time to move the message from source host to destination host?

(4 marks)

(ii) Now suppose that the message is segmented into 800 packets, with each packet being 10,000 bits long. When the first packet is being sent from the first switch to the second switch, the second packet is being sent from the source host to the first switch. At what time will the second packet be fully received at the first switch?

(5 marks)

(iii) How long does it take to move the file from source host to destination host when message segmentation is used? Compare this result with message without segmentation.

(6 marks)

(iv) In addition to reducing delay, what are reasons to use message segmentation?

(3 marks)

(v) Give two drawbacks of message segmentation.

(2 marks)

Q4 Analyse Figure **Q4**. Assuming TCP Reno is the protocol experiencing the behavior shown below, answer the following questions. In all cases, you should provide a short discussion justifying your answer.

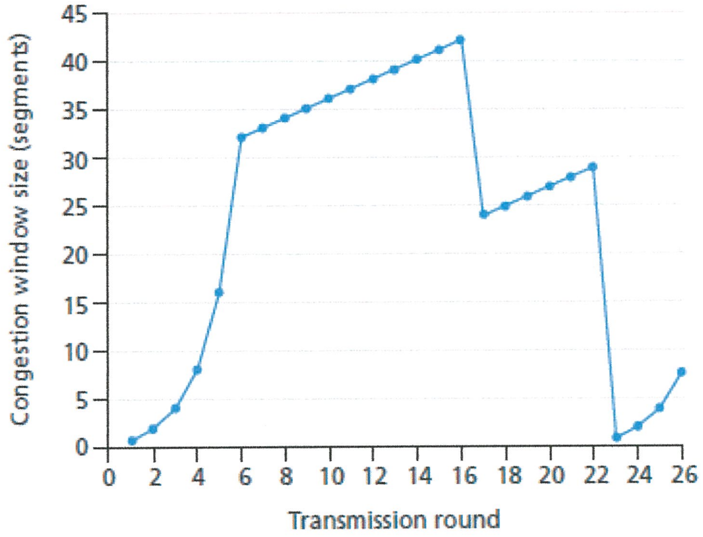

Figure Q4 : TCP window size as a function of time

(i) Identify the intervals of time when TCP slow start is operating.

(2 marks)

(ii) Identify the intervals of time when TCP congestion avoidance is operating.

(2 marks)

(iii) After the 16th transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

(2 marks)

(iv) After the 22nd transmission round, is segment loss detected by a triple duplicate ACK or by a timeout?

(2 marks)

(v) Determine the initial value of *ssthresh* at the first transmission round?

(2 marks)

(vi) Determine the value of *ssthresh* at the 18th transmission round?

(2 marks)

(vii) Determine the value of *ssthresh* at the 24th transmission round?

(2 marks)

(viii) Assuming a packet loss is detected after the 26th round by the receipt of a triple duplicate ACK, identify the values of the congestion window size and of *ssthresh*?

(2 marks)

(ix) Suppose TCP Tahoe is used (instead of TCP Reno), and assume that triple duplicate ACKs are received at the 16th round. What are the *ssthresh* and the congestion window size at the 19th round?

(2 marks)

(x) Again suppose TCP Tahoe is used, and there is a timeout event at 22^{nd} round. State how many packets have been sent out from 17th round till 22nd round, inclusive?

(2 marks)

Q5 (a) Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support at least 60 interfaces, Subnet 2 is to support at least 90 interfaces, and Subnet 3 is to support at least 12 interfaces. List three network addresses (of the form a.b.c.d/x) that satisfy these constraints.

(6 marks)

(b) Consider the network fragment shown Figure **Q5(b)**, *x* has only two attached neighbors, *w* and *y*. *w* has a minimum-cost path to destination *u* (not shown) of 5, and *y* has a minimum-cost path to *u* of 6. The complete paths from *w* and *y* to *u* (and between *w* and *y*) are not shown. All link costs in the network have strictly positive integer values.

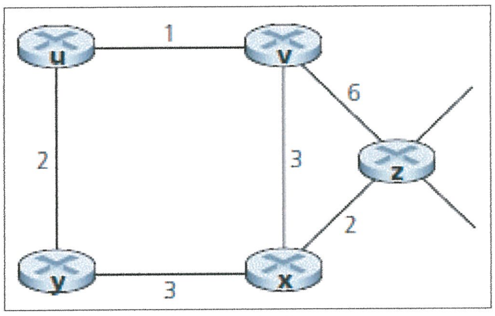

Figure Q5(b): Network fragment of routers

(i) Give x's distance vector for destinations w, y, and u.

(3 marks)

(ii) Write a link-cost change for either c(x,w) or c(x,y) such that x will inform its neighbors of a new minimum-cost path to u as a result of executing the distance-vector algorithm.

(9 marks)

(iii) Discover a link-cost change for either c(x,w) or c(x,y) such that x will not inform its neighbors of a new minimum-cost path to u as a result of executing the distance-vector algorithm.

(2 marks)

Q6 (a) (i) Consider an 8-block cipher. State how many possible input blocks does this cipher have and the possible mappings are there?

(4 marks)

(ii) Consider the two ways in which communication occurs between a managing entity and a managed device: request-response mode and trapping. Give the pros and cons of these two approaches, in terms of (1) overhead, (2) notification time when exceptional events occur, and (3) robustness with respect to lost messages between the managing entity and the device.

(6 marks)

(b) Consider the block cipher in Figure ***Q6***. Suppose that each block cipher T*i* simply reverses the order of the eight input bits (so that, for example, 11110000 becomes 00001111). Further suppose that the 64-bit scrambler does not modify any bits (so that the output value of the mth bit is equal to the input value of the *m*th bit).

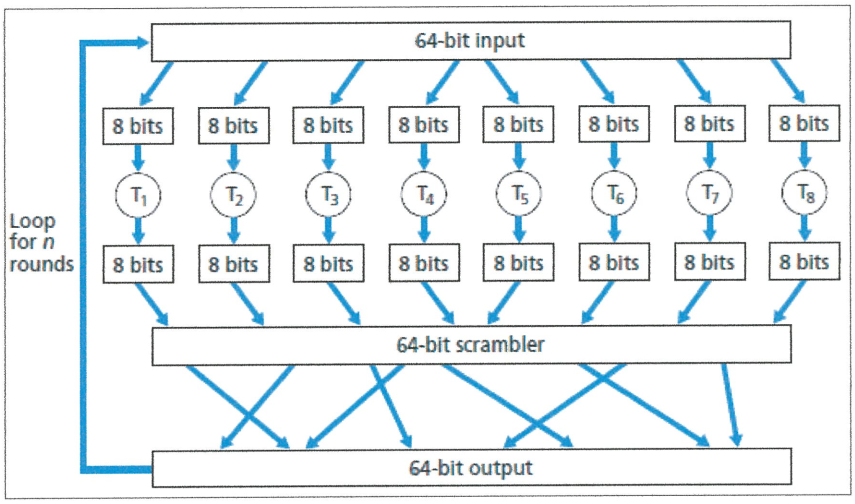

Figure Q6: An example of a block cipher

(i) With n = 3 and the original 64-bit input equal to 10100000 repeated eight times, identify the value of the output.

(2 marks)

(ii) Repeat part (b)(i) but now change the last bit of the original 64-bit input from a 0 to a 1.

(2 marks)

(iii) Repeat parts (b)(i) and (b)(ii) but now suppose that the 64-bit scrambler inverses the order of the 64 bits.

(6 marks)

- END OF QUESTIONS -