The Open University of Sri Lanka
Department of Electrical & Computer Engineering
ECX5234 Data Communications
FINAL EXAMINATION– 2014/2015 (CLOSED BOOK)

DATE: 28th August 2015 **0930 hrs – 1230 hrs**

Answer any 5 questions.

Q1. (a) Briefly describe the following with reference to OSI reference model:
(i) Protocol
(ii) PDU
(iii) Encapsulation
(iv) Peer to peer process [08]

(b) Explain the main function of the following protocols and match them to the related layer in the OSI model.
(i) RS232 (ii) http (iii) UDP
(iv) IGMP (v) IEEE 802.11 [05]

(c) A voice grade telephone channel has a bandwidth of 3400 Hz. If the SNR on the channel is 30 dB, determine the capacity of the channel. If the above channel is to be used to transmit 4.8kbps of data, determine the minimum SNR required on the channel. [07]

Q2. (a) Draw the encoded bit pattern of the data sequence 1110001101 for the following coding schemes:
(i) Polar RZ
(ii) Manchester
(iii) Differential Manchester [06]

(b) Consider a frame consisting of three characters of 4 bits each. Assume that the probability of a bit error is 10^{-3}, and the bit errors are independent of each other.
(i) What is the probability that the received frame contains at least one error?
(ii) Now add even parity bit to each character, what is the probability that the received frame contains at least one error?
(iii) Does adding parity bits reduce the error probability? Why? [05]

(c) A communication system uses Cyclic Redundancy Check (CRC) method for error control. If the polynomial used in CRC is $x^4 + x + 1$:
(i) What is the binary representation of the polynomial? [01]
(ii) If the transmitted message sequence is 11011100101100 followed by the CRC which was generated by using the above polynomial, find the original message and the Frame Check Sequence. [04]
(iii) If the 4th bit from the left is inverted during transmission, show how this error will be detected by the receiver. [04]

Q3. (a) Consider building a CSMA/CD network running at 10 Mbps over a 2km cable with no repeaters. Assume that the propagation speed of electromagnetic waves sent over the cable is 200,000 km/sec.

(i) What is the minimum frame size (in bits) necessary to ensure that CSMA/CD will work properly for this network? Explain your reasoning. [05]

(ii) Using Gigabit Ethernet we can get the bits out ten times faster than normal Ethernet. For the above network show how it is possible to increase the data rate 10 times faster by maintaining the same minimum frame size? [03]

(b) List two key similarities and two key differences between the classic 10Mbps Ethernet LAN and the current IEEE 802.11 WiFi LAN standard. [04]

(c) TCP is a stream delivery protocol running in Transport layer, providing two-way, reliable, end-to-end exchange of data. The information provided in the TCP header makes TCP possible to be a reliable protocol. Briefly explain the purpose of the following information contained in the TCP header.

(i) Source and destination port.
(ii) Sequence number. [04]

(d) Briefly explain the three way handshakes for TCP to establish a connection and the handshakes for TCP to successfully terminating a connection. [04]

Q4. (a) Explain the difference between propagation delay, transmission delay and queuing delay. For a fixed network path and a fixed packet size, which of these 3 can vary? Explain with reasons. [05]

(b) Consider the following parameters for a switching network.

N = number of hops between two given end systems
L = message length in bits
B = data rate in bits per second, on all links
P = fixed packet size, in bits
H = overhead (header) bits per second
S = call setup time (circuit switching or virtual circuit) in seconds
D = propagation delay per hop in seconds

Derive general expressions for end-to-end delay for
(i) circuit switching
(ii) virtual circuit packet switching
(iii) datagram packet switching

Assume that there are no acknowledgements. Ignore processing delay and queuing delay at the nodes. [12]

(c) Derive an expression for the condition under which the circuit switching delay and virtual circuit packet switching delay are equal. [03]

Q5. (a) Compare the following 3 main ARQ techniques for flow control:

(i) Stop & Wait
(ii) Go-Back-N
(iii) Selective Repeat [06]

(b) Consider the Go-Back-N protocol. Using a 3 bit sequence number, explain with a scenario what would happen

(i) if the maximum sequence number is greater than Go-Back-N protocol's window size and acknowledgements of the first set of N frames are lost.
(ii) if the maximum sequence number equals to Go-Back-N protocol's window size and acknowledgements of the first set of N frames are lost.
(iii) if the maximum sequence number is less than Go-Back-N protocol's window size and acknowledgements of the first set of N frames are lost.

Use timeline diagrams to illustrate your answer. You need to comment on the possibility of identifying the correct frame at the receiver in each case. [10]

(c) Using your answer in (b) derive the relationship between the maximum sequence number and Go-Back-N protocol's window size for its correct operation. [04]

Q6. (a) Differentiate the following:

(i) Subnetting and supernetting
(ii) IPv4 addressing and IPv6 addressing [04]

(b) Assume that you are the network administrator of a company. Your Company has 5 main divisions, say A,B,C,D & E which have separate local area networks. The maximum number of users of each division is as in the following table.

Division	Number of users
A	60
B	105
C	500
D	150
E	200

You have purchased the IP address block 203.128.128.0/21 for the above network. Provide the complete IP address plan for the above network. Your answer should include the network address, subnet mask, broadcast address and possible range of addresses for each subnet. [12]

(c) Assume that your superior complains that you are spending too much money on IP addresses. As an expert in networking, provide two network related solutions that you can propose to reduce the money on purchasing IP addresses. [04]

Q7. (a) Differentiate the following:

(i) Static routing vs dynamic routing
(ii) Interior routing protocols vs exterior routing protocols
(iii) OSPF vs RIP
(iv) Routing vs forwarding [08]

(b) Use Distance vector routing protocol to determine the shortest path from A to all other nodes of the network shown in figure Q7. Hence find the shortest path from A to F. Show how the algorithm works by using the following table.(Table Q7). [12]

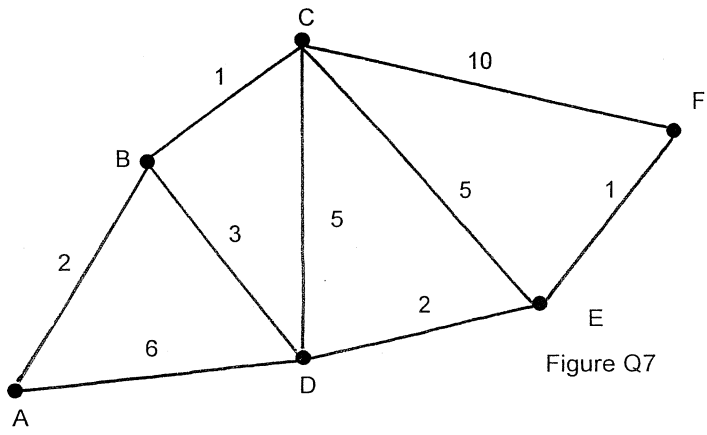

Figure Q7

Iteration	B		C		D		E		F	
	cost	path	cost	path	cost	path	cost	path	cost	path

Table Q7

Q8. (a) Assume that you are the network administrator of a Sales and Marketing company which currently uses single Ethernet subnet as its intranet. A private addressing scheme Is used and NAT is implemented. Your department has 3 main departments, Sales, Marketing and Accounts. These departments are not on separate floors but distributed in groups thoughout the entire premises. Most traffic is interdepartmental. You are currently using hubs and repeaters for connectivity. The network is performing poorly and you need to segment it into collision domains. You decided to implement VLANs.

(i) What do you mean by a collision domain? [02]

(ii) State the differences between hubs, bridges, repeaters and switches. [04]

(iii) You are asked to justify this strategy (Introducing VLANs) as opposed to using bridges and subneting the intranet using routers. How do you justify the use of VLANs? [05]

(b) "DNS is designed to be a distributed database as opposed to a centralized one." Critically discuss this statement explaining the reasons. [04]

(c) Assume that you are accessing the web site: www.ecs.victoria.ac.nz from a computer at OUSL premises. Clearly explain the steps to be followed in the DNS name resolving process and the DNS servers involved. State any assumptions you make. [05]