

UNIVERSITY OF LONDON

291 0222 ZB

EXTERNAL PROGRAMME

B. Sc. Examination 2008 (Eastern)

COMPUTING AND INFORMATION SYSTEMS

2910222

Data Communications & Enterprise Networking

Duration: 3 hours

Date and time: Wednesday 14 May 2008 : 2.30 – 5.30 pm

This paper is in two parts, Part A and Part B. There are a total of three questions in each part. You should answer two questions from Part A and two questions from Part B.

Full marks will be awarded for complete answers to a total of four questions, two from Part A and two from Part B. Each question carries 25 marks. The marks for each part of a question are indicated at the end of the part in [.] brackets.

There are 100 marks available on this paper.

No calculators should be used.

THIS PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

SECTION A

Answer two questions from Section A.

Question 1

- (a) State, in your answer book, which two of the following statements are true and which two are false and, if false, you must write out a correct version of the statement:
- i. A signal to noise ratio of 40 deciBels means that the signal is 40,000 times more powerful than the noise.
 - ii. A diagram that represents each symbol transmitted by a modem by showing the amplitudes and frequencies of signals is called a constellation diagram.
 - iii. Transmission delays are proportional to the capacity of outgoing channels and occur at each and every router in an internetwork.
 - iv. Frame Relay is a managed connection-oriented network that only supports data connections of 2Mbit/s or less.

[3]

- (b) State Nyquist's Theorem, defining each of the terms and giving the units in which they are usually measured.

[2]

The receiver on a radio channel operating between 1 MHz and 1.1 MHz samples a data signal at 800 kbit/s. Calculate the number of signalling states that the channel must support.

[4]

- (c) Describe the data transparency problem that data link protocols have to solve, and explain how HDLC and other modern data link protocols overcome this problem.

[5]

- (d) Show, with the aid of a diagram, how the byte 10100111 will be transmitted using the amplitude modulation of a carrier wave.

[4]

- (e) Show how the byte 10110010 can be encoded using an even Hamming Code.

Another even Hamming coded byte was received with one bit corrupted. The bits received were 101110110100. Show how the error can be detected and then corrected. What was the original byte that should have been transmitted?

[7]

Question 2

- (a) State, in your answer book, which two of the following statements are true and which two are false and, if false, you must write out a correct version of the statement:
- i. The maximum size of an IP datagram is $2^{16} - 1 = 65,535$ bytes.
 - ii. Class B IP addresses allow for $2^{16} = 65,536$ hosts.
 - iii. The checksum of an IP datagram has to be recalculated at each router, because the identification field is changed at each router.
 - iv. If an IP implementation receives packets at a faster rate than it can process them, it will discard them and may issue an ICMP choke packet.

[3]

- (b) A router receives a packet with an unknown IP address for a device on a LAN. Describe how the router resolves the physical address and handles another packet with the same IP address arriving immediately afterwards.

[5]

- (c) Describe how the traceroute command works.

[6]

- (d) Describe how the TCP connection identifier is formed and how it can be guaranteed to be unique.

[3]

- (e) Calculate the CRC-3 code generated for the 5-bit code 10110 using the generator 1001.

[4]

A 5-bit code 01011 is received followed by the 3-bit checksum 001. Perform a CRC check on the data plus checksum using the generator 1001 and state whether there is an error or not.

[4]

Question 3

- (a) State, in your answer book, which two of the following statements are true and which two are false and, if false, you must write out a correct version of the statement:
- i. Most errors occur in bursts, so Forward Error Correction protocols that can only correct single bit errors require bits to be reordered in their blocks before transmission.
 - ii. Connection-oriented transport services require state information to be held at the source host but not at the destination host.
 - iii. The IETF's Simple Network Management Protocol (SNMP) is an application protocol that uses a TCP stack which has to be implemented in each managed device.
 - iv. Hyper Text Transfer Protocol (HTTP) is one of many application layer protocols that are supported by browsers.
- [3]
- (b) Describe how a web server can store state information about its clients without having to save it on its own disk storage devices.
- [4]
- (c) Identify the main differences between the File Transfer Protocol (FTP) and the Trivial File Transfer Protocol. Give examples of a situation in which each protocol would be best suited.
- [6]
- (d) Describe the origin of the Telnet protocol and give two reasons why it is not used very much today.
- [4]
- (e) Explain the principle behind Huffman coding.
- [4]

Use the following table to construct a Huffman Tree and then use it to decode 00011011000111001101.

A	0000	N	0110
C	1101	O	0100
E	100	P	10110
G	10101	R	0111
I	0001	S	0011
L	00101	T	111
M	10100	U	10111

[4]

SECTION B

Answer two questions from Section B.

Question 4

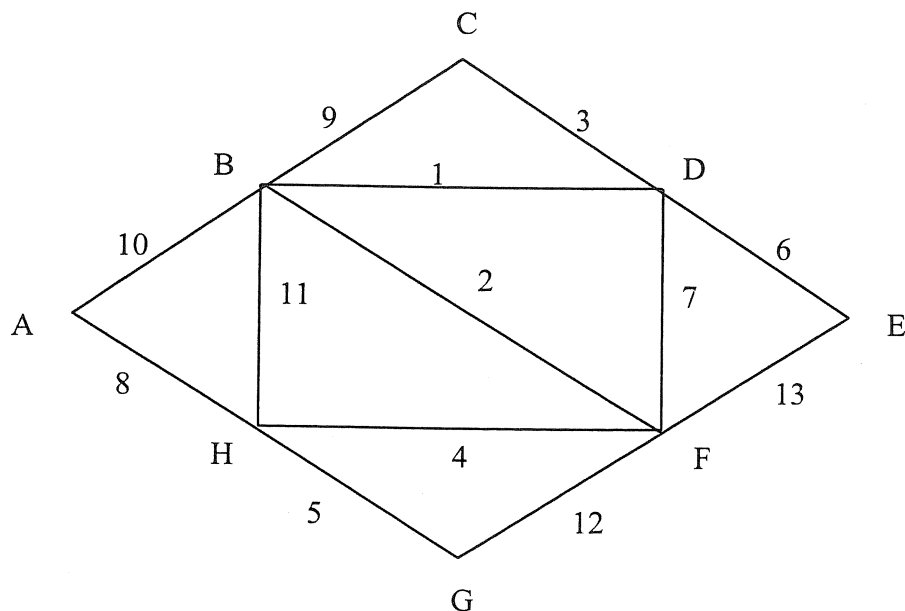
- (a) State, in your answer book, which two of the following statements are true and which two are false and, if false, you must write out a correct version of the statement:
- Launching a new product into a new market is called product development.
 - FireWire is a peer-to-peer protocol, standardised by the IEEE and ideally suited for fixed bandwidth video applications.
 - Fibre Channel can carry many block based protocols such as Small Computer Systems Interface (SCSI) as well as IP.
 - Token Ring is a connectionless protocol that offers no acknowledgement of data delivery.
- [3]
- (b) Outline Porter's three generic strategies that a company can follow. Give an example of a company that follows each of the strategies.
- [6]
- (c) Explain how Ethernet II is able to demultiplex frames to the correct network layer and why this does not work for IEEE 802.3 LANs and explain why the two data link protocols can be used on the same LAN. Identify two sub-layer protocols that can be used on IEEE 802.3 LANs to overcome this problem.
- [5]
- (d) Describe three main advantages of VLANs and identify four different ways by which a network manager can define a VLAN work group.
- [5]
- (e) Calculate the missing values from the table below and write them down in your answer book against the appropriate Roman numeral. The table is a part of a subnetwork addressing scheme for an IP Class C network with the network address 195.6.7.0, supporting 2 subnetworks of up to 62 hosts, 3 subnetworks of up to 30 hosts and up to 8 point-to-point WAN circuits. The boundaries between the subnetwork part of the address and the host part of the address are shown as vertical bars (|).

Subnetwork	4 th Byte	Subnetwork Address	First Host Address	Last Host Address
LAN A	00 XXXXXX	195.6.7.0/26	195.6.7.1	195.6.7.62
LAN B	i	ii	195.6.7.65	195.6.7.126
LAN C	iii	195.6.7.128/27	195.6.7.129	iv
LAN D	101 XXXXXX	v	vi	195.6.7.190
LAN E	vii	viii	ix	x
Cct 1	xi	xii	195.6.7.225	195.6.7.226
Cct 2	111001 XX	195.6.7.228/30	195.6.7.229	195.6.7.230
Cct 3	111010 XX	195.6.7.232/30	195.6.7.233	195.6.7.234
Cct 4	111011 XX	195.6.7.236/30	195.6.7.237	195.6.7.238
Cct 5	111100 XX	195.6.7.240/30	195.6.7.241	195.6.7.242
Cct 6	111101 XX	195.6.7.244/30	195.6.7.245	195.6.7.246
Cct 7	111110 XX	195.6.7.248/30	195.6.7.249	195.6.7.250
Cct 8	111111 XX	195.6.7.252/30	195.6.7.253	195.6.7.254

[6]

Question 5

- (a) State, in your answer book, which two of the following statements are true and which two are false and, if false, you must write out a correct version of the statement:
- i. Frame Relay uses addresses which have the same structure as telephone numbers.
 - ii. The European Synchronous Digital Hierarchy (SDH) is based on the 155 Mbit/s circuit, while the equivalent in North America called SONET is based on a lower speed but is fully compatible with SDH at its next level.
 - iii. On the Public Switched Telephone Network (PSTN), the telephone instrument filters out higher frequencies above 3,400 Hz and codes the voice signals into a digital format at 64 kbit/s.
 - iv. A mobile network can be thought of as a PSTN with wireless access and an intelligent network that supports mobility.
- [3]
- (b) Describe how a transparent bridge learns to bridge frames between two LANs to which it is connected, after it is switched on.
- [6]
- (c) List the main differences which can occur between different subnetworks that make internetworking problematic.
- [6]
- (d) Describe the two main types of routing protocols.
- [4]
- (e) Draw the network diagram below in your answer book and use Dijkstra's algorithm to calculate the shortest route between A and E, where the numbers represent distances between the nodes. On your diagram, show the node labels (including any temporary ones) you have used at each of step of the algorithm, and mark the shortest path with a thick line.



[6]

(a) **Question 6**

State, in your answer book, which two of the following statements are true and which two are false and, if false, you must write out a correct version of the statement:

- i. Session Initiation Protocol (SIP) is a connection-oriented protocol used to control Voice over IP (sessions) and which uses Uniform Resource Identifiers as addresses.
- ii. Multi-Protocol Label Switching (MPLS) lies between Layers 3 and 4 of the ISO reference model and attaches tags (called labels) in front of the transport layer headers.
- iii. All point-to-point circuits should be treated as /30 subnetworks in a subnetwork addressing scheme.
- iv. In Simple Network Management Protocol (SNMP), a trap is used to detect when unauthorised personnel attempt to reconfigure or examine the configuration of a managed device.

[3]

- (b) Outline three ways by which a network design can be tested.

[3]

- (c) Outline three of the five different methods (pilot, parallel, chronological, phased and big bang implementations) in which a new network can be implemented and for each method state whether the costs, risks and speed of implementation are low or high.

[6]

- (d) Describe three different security attacks and the countermeasures that network managers can use to defend their networks from these attacks.

[6]

- (e) What is meant by availability? Identify two ways by which network managers can improve the availability of their networks.

[3]

Two identical routers with an availability of 99.9% are connected to each other by two separate and diversely routed private circuit, each having an availability of 99.7%. Calculate the availability of the two circuits together and then derive an expression for the availability of the whole system (including the routers).

[4]