

UNIVERSITY OF LONDON

291 0222 ZA

EXTERNAL PROGRAMME

B. Sc. Examination 2008 (Western)

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. The bit rate can be calculated by dividing the baud rate by the number of signalling states used to represent each symbol.
 - ii. A channel of infinite bandwidth will be required to transmit successfully a perfectly square waveform.
 - iii. Transmission delay over satellite circuits results in RTTs of roughly 240 ms.
 - iv. Fibre Distributed Data Interface (FDDI) only operates at 100 Mbit/s.

[3]

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

[2]

A channel with a signal to noise ratio of 40dB can carry frequencies between 300 and 3,400 Hz. Use Shannon's Law to derive a simple expression for the maximum capacity of the channel.

[5]

- (c) Briefly describe the two variants of continuous RQ error correction that are usually implemented in data link protocols, and explain why one of them is not often used.
- (d) Show, with the aid of a diagram, how the byte 10100111 will be transmitted using the frequency modulation of a carrier wave.
- (e) Show how the byte 10110100 can be encoded using an even Hamming Code. Another even Hamming coded byte was received with one bit corrupted. The bits received were 110110101100. Show how the error can be detected and then corrected. What was the original byte that should have been transmitted?

[4]

[4]

[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. IP re-assembles datagram fragments only at the destination host.
 - ii. Class C IP addresses allow for only 254 hosts.
 - iii. The checksum field in the TCP header only checks the TCP header and a few fields from the IP header.
 - iv. If a UDP implementation receives packets at a faster rate than it can process them, it will discard them and issue an ICMP choke packet.

[3]

- (b) Describe three important advantages that IP Version 6 has over IP Version 4.

[3]

- (c) Describe how the ping command works.

[5]

- (d) Describe how TCP will discover that a data segment has been lost and how it will recover from the loss.

[6]

- (e) Calculate the CRC-3 code generated for the 5-bit code 11010 using the generator 1001.

[4]

A 5-bit code 01101 is received followed by the 3-bit checksum 110. 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. It is best to detect and correct errors in lower layers protocols.
- ii. Connection-oriented services are ideal for Client Server applications.
- iii. The ISO ASN.1 presentation layer protocol is used to define the IETF's Simple Network Management Protocol.
- iv. Hyper Text Transfer Protocol pipelining allows the browser to request many objects via a single TCP connection.

[3]

(b) Describe the security mechanism used by HTTP to ensure that only authorised users are able to access a web page.

[5]

(c) Describe, with examples of domains at each level, the hierarchical structure of the Domain Name System servers going down as far as fourth level domains.

[5]

(d) What does MIME stand for? Why is it essential that mail clients implement it?

[4]

(e) Explain the principle behind Huffman coding.

[4]

Use the following table to construct a Huffman Tree and then use it to decode 100000110101011110110.

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:
- A product with high market share and high growth is called a cash cow.
 - Bluetooth is a master/slave protocol that is being standardised as IEEE 802.15.
 - Network Attached Storage is best suited to transferring blocks of raw data from disk storage devices to processors.
 - Ethernet is a connectionless protocol that offers no guarantee of data delivery. [3]

- (b) Describe the life cycle of a typical product. [5]

Explain why it is important that companies have a balanced portfolio of products at each stage of the product life cycle (apart from one). [2]

- (c) Explain why IEEE 802.3 does not have a type field whereas Ethernet II does. Identify two sub-layer protocols that can be used on IEEE 802.3 LANs to decide how to demultiplex a frame to the correct network layer. [4]

- (d) What are the main differences between a hubbed and a switched Ethernet? How else might the two types of Ethernet be described? [5]

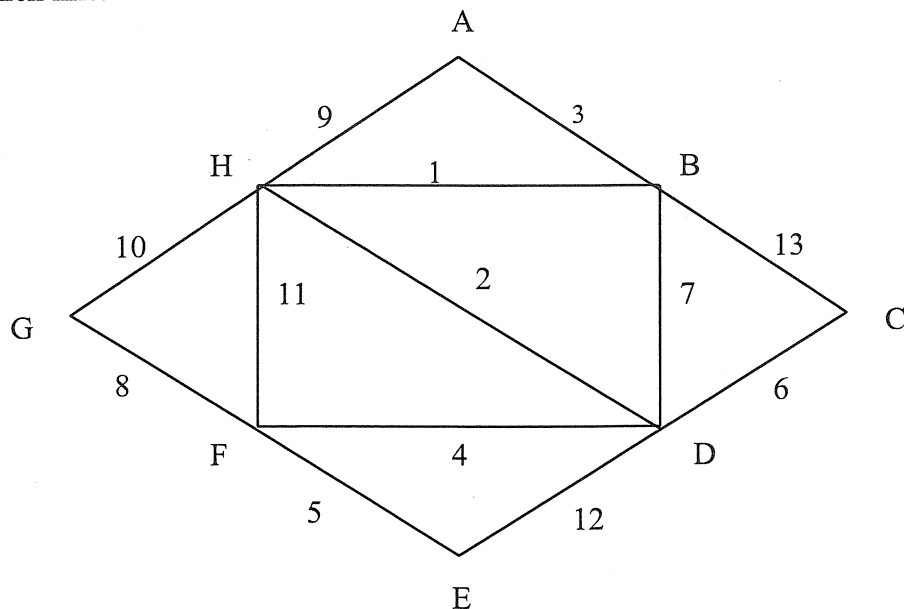
- (e) Calculate the missing values from the table below and write them down in your answer book against the appropriate Roman numeral. The table is a part of a subnetwork addressing scheme for an IP network with the network address 193.9.18.0/23, supporting 4 subnetworks of up to 62 hosts, 6 subnetworks of up to 30 hosts and up to 16 point-to-point WAN circuits. The boundaries between the network part of the address and the subnetwork part of the address and between the subnetwork part of the address and the host part of the address are shown as vertical bars (|).

Subnetwork	3 rd Byte	4 th Byte	Subnetwork Address	First Host Address	Last Host Address
LAN A	0001001 0	00 XXXXXX	193.9.18.0/26	193.9.18.1	193.9.18.62
LAN B	0001001 0	01 XXXXXX	i	193.9.18.65	193.9.18.126
LAN C	0001001 0	10 XXXXXX	193.9.18.128/26	193.9.18.129	193.9.18.190
LAN D	0001001 0	ii	193.9.18.192/26	193.9.18.193	193.9.18.254
LAN E	iii	iv	193.9.19.0/27	193.9.19.1	193.9.19.30
LAN F	v	vi	193.9.19.32/27	193.9.19.33	193.9.19.62
LAN G	0001001 1	010 XXXXX	193.9.19.64/27	193.9.19.65	193.9.19.94
LAN H	0001001 1	011 XXXXX	193.9.19.96/27	193.9.19.97	193.9.19.126
LAN I	0001001 1	100 XXXXX	193.9.19.128/27	193.9.19.129	193.9.19.158
LAN J	0001001 1	101 XXXXX	vii	viii	ix
Cct 1	0001001 1	110000 XX	x	xi	xii
...

[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. SMDS uses addresses which have the same structure as telephone numbers.
 - ii. The European Plesiochronous Digital Hierarchy is based on the 1.5 Mbit/s circuit, also known as E1.
 - iii. The Round Trip Time on a Very Small Aperture Terminal (VSAT) network will be at least 480ms.
 - iv. Details of a mobile phone's current location are stored in the Home Location Register at the Mobile Switching Centre.
- [3]
- (b) Describe how a transparent bridge learns how to bridge frames between two LANs to which it is connected, after it is switched on. [6]
- (c) What are the main reasons why network operators replaced their Plesiochronous Digital Hierarchy transmission networks with Synchronous Digital Hierarchy transmission networks? [5]
- (d) Identify the main differences between a distance vector and a link state routing protocol. [5]
- (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. Graphics Interchange Format (GIF) is a proprietary lossy data compression standard best suited for line drawings with limited colours.
- ii. The RSVP protocol is used by receivers to reserve resources on all the routers on the path from the transmitter.
- iii. All point-to-point circuits should be treated as individual subnetworks when designing a subnetwork addressing scheme.
- iv. Many enterprises set up a De-Militarised Zone (DMZ), between their firewall router and the first hub or switch on their intranet.

[3]

- (b) Describe a typical type of application where a frame relay WAN design would be most appropriate.

[4]

- (c) Explain what is meant by Electronic Software Delivery, and describe why it is useful to network managers.

[6]

- (d) Define what is meant by the three terms threat, vulnerability and attack in the context of network security. Include an example of each of the terms.

[6]

- (e) What is meant by MTBF and MTTR? What performance measure is represented by the formula below?

$$\frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}}$$

[3]

A router has an MTTR of 6 hours and its availability has been measured as 99.9%. What is its MTBF measured to the nearest day?

[3]