

THIS PAPER IS NOT TO BE REMOVED FROM THE EXAMINATION HALLS

UNIVERSITY OF LONDON

291 0222 ZB

BSc Examination
for External Students

COMPUTING AND INFORMATION SYSTEMS

Data Communications and Enterprise Networking

Dateline: Wednesday 20 May 2009 : 2.30 – 5.30 pm

Duration: 3 hours

This paper is in two parts, **Part A** and **Part B**. There are total of three questions in each part. Candidates 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 may be used.

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UL09/895

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SECTION A

Answer two questions from Section A.

Question 1

(a) State, in your answer book, which of the following statements are true and which are false and, if false, write out a corrected version of the statement:

- i. Bandwidth is the frequency that can be effectively carried by a channel and is measured in Hertz.
- ii. A distribution network supports end users and can be residential or institutional.
- iii. Jitter is caused primarily by queuing and processing delays.
- iv. A LAN switch is a layer 2 device while a telephone switch is a layer 3 device.

[3]

(b) What is the definition of the deciBel? Give two reasons why communications engineers like to express gains and losses using this unit.

[3]

A signal carried by copper cable experiences a loss of 30dB and is then amplified by an amplifier with a gain of 40dB. It is then carried by a second copper cable with a loss of 20dB. If the signal input to the first cable had a power of 20mW, calculate the power of the signal output from the second cable.

[2]

(c) Write down, in your answer book, the 8 bits coded in the diagram below, assuming that they are coded using Manchester encoding.



[4]

(d) Describe how the token passing access method works. What is the main advantage of this method over the CSMA/CD access method?

[6]

(e) Binary Coded Decimal is a code, which represents a decimal digit as a 4-bit binary number. (e.g. 2 is encoded as 0010 and 9 as 1001).

Show how the BCD code for the decimal digit 6 could be further coded to allow a single bit error to be corrected using an even Hamming Code.

[3]

A different even Hamming Coded BCD digit was received as 0110000 with one bit in error. Show how the error can be detected and corrected. What decimal digit was originally encoded?

[4]

Question 2

- (a) State, in your answer book, which of the following statements are true and which are false and, if false, write out a corrected version of the statement:
- i. Routers that support Classless Inter-Domain Routing must store the network prefix as well as the IP address of networks to which they forward packets.
 - ii. The Address Resolution Protocol is used to map a domain name to an IP address.
 - iii. UDP uses a connection identifier consisting of source and destination IP addresses and port numbers to uniquely identify a connection.
 - iv. When a TCP connection is opened, each end chooses its own initial sequence number, usually derived from the system clock.
- [3]
- (b) Describe how IP fragments and reassembles a datagram, if the Maximum Transfer Unit size of the subnetwork to which it needs to forward the datagram to is exceeded.
- [4]
- (c) Describe how an IP router decides how to forward a datagram to a classful network.
- [5]
- (d) Describe, with reference to the appropriate flag bits, the steps in the TCP three-way handshake.
- [6]
- (e) Calculate the CRC-3 code generated for the 5-bit code 01101 using the generator 1001.
- [3]

A 5-bit code 10111 is received followed by the 3-bit checksum 010. 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 of the following statements are true and which are false and, if false, write out a corrected version of the statement:

- i. The three upper layers of the OSI model map to the top layer of the TCP/IP model.
 - ii. FTP is a connection oriented file transfer protocol while TFTP is connectionless.
 - iii. HTTP defines a set of tags which determine how a browser displays data.
 - iv. POP3 allows messages to be stored in folders on the mail server.
- [3]

(b) Outline the five basic functions of a mail client.

[5]

(c) Provide four reasons why an application developer might want to use an unreliable transport protocol.

[4]

(d) Outline the how FTP transfers files with reference to the commands it uses.

[5]

(e) A company has been allocated the network address 192.19.128.0/22. What is the network mask, the broadcast address, the first and last usable host addresses in this range and how many host addresses can it allocate?

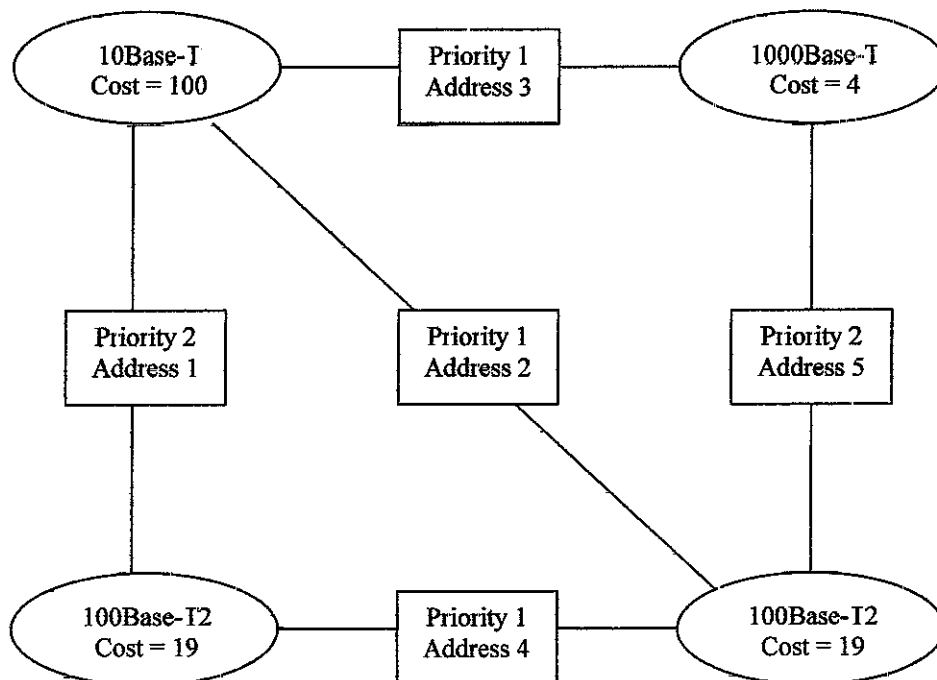
[8]

SECTION B

Answer two questions from Section B.

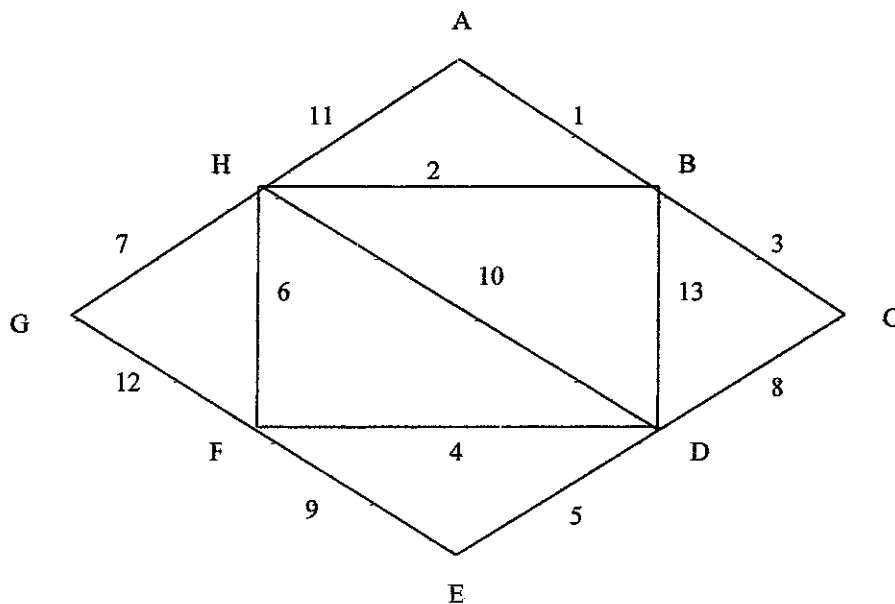
Question 4

- (a) State, in your answer book, which of the following statements are true and which are false and, if false, write out a corrected version of the statement:
- Developing a new product for a new market is called product development.
 - Universal Serial Bus is an example of a Personal Area Network.
 - Ethernet II and IEEE 802.5 can co-exist on the same LAN because the type field defined in Ethernet II does not allow a value of 1500 or less.
 - 10 Gbit/s Ethernet is full duplex and does not require any collision detection. [3]
- (b) List the five forces identified by Porter that drive competition in a market. [5]
- (c) What would be the standard designation of an Ethernet running at 10 Gbit/s, using twisted pair cable as its physical medium? [3]
- (d) Outline how the CSMA/CA access method operates in IEEE802.11 Wireless LANs. [7]
- (e) Use the Spanning Tree Protocol to determine which bridge ports should be blocked in the following LAN topology. Draw this diagram in your answer book. Show which bridge is elected as the root bridge and show the path costs from each bridge port to the root bridge. Mark all the root ports with an R and all the designated ports with a D and all the blocked ports with an X. Draw the spanning tree with thick lines on the diagram. [7]



Question 5

- (a) State, in your answer book, which of the following statements are true and which are false and, if false, write out a corrected version of the statement:
- i. Every ATM cell is 48 bytes long (including the header).
 - ii. Synchronous Digital Hierarchy circuits suffer from occasional frame slips which result in burst errors.
 - iii. GSM mobile phones make use of both frequency division and time division multiple access.
 - iv. The Public Switched Telephone Network uses 2-wire circuits in its access network but 4-wire circuits in its core.
- [3]
- (b) Identify five main differences between transparent bridges and source route bridges.
- [5]
- (c) List five different metrics that can be used (often in combination) by routers to determine the best paths through networks.
- [5]
- (d) Describe the circumstances in which satellite communications might provide a cost effective communications solution. Identify two of the disadvantages of such a solution.
- [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.



[7]

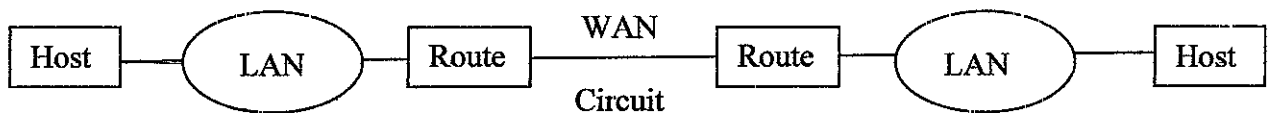
Question 6

- (a) State, in your answer book, which of the following statements are true and which are false and, if false, write out a corrected version of the statement:
- i. The popular MP3 audio compression format was developed by the Motion Picture Expert Group for compressing sound tracks on videos.
 - ii. Real Time Streaming Protocol is implemented in browsers to provide similar control functions as a Video Cassette Recorder and usually runs on top of TCP.
 - iii. Classless Inter-Domain Routing requires routing protocols to make use of network prefixes in their routing tables.
 - iv. Network managers can use SNMP to upgrade software in PCs.
- [3]
- (b) List the main numerical network performance and reliability criteria that should be specified in a Requirements Document and indicate the units in which they are normally measured. [4]
- (c) Identify the type of network requirement for which a Frame Relay design would be most suitable. [4]
- (d) List five advantages that result from using a trouble ticketing system to handle faults. [5]
- (e) What is meant by availability? [2]

Explain why availability can be calculated from the following formula:

$$\frac{MTBF}{MTBF + MTTR} \quad [2]$$

Consider the following network.



Derive an expression for the overall availability of the communications service between the two hosts, where the availability of each LAN is 99.99%, the availability of the WAN circuit is 99.8%, the MTBF of each router is 9990 hours and their MTTR is 10 hours. [3]

Derive an expression for the availability, if the WAN circuit was replaced by two equivalent circuits which are diverse and separate? [2]

END OF EXAMINATION