UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

B. Sc. Examination 2012 (Internal)

COMPUTING AND INFORMATION SYSTEMS

IS52016A
Data Communications and Enterprise Networking

Duration: 3 hours

Date and time:

This paper is in two parts, Part A and Part B. There are a total of three questions in each part. ***You should answer <u>two</u> questions from Part A and <u>two</u> 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 calculator may be used.

THIS PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

PART A

Question 1

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

i. Ethernet frames are preceded by a 7-bit preamble of alternating 1s and 0s.
ii. The Network Access Layer in the DoD model maps onto the Network and Data Link Layers of the ISO Reference Model.
iii. Attenuation is the loss of signal strength over distance.
iv. MAC addresses are six bytes long and uniquely identify Network Interface Cards. The first three bytes identify the manufacturer of the card.

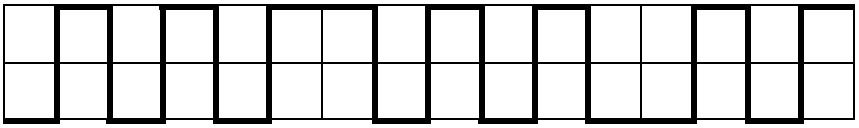
[3]

(b) Write down Shannon's Law as an equation, explaining each of the terms and giving the units in which they are usually measured. [3]

Use this equation to derive an expression for the minimum signal to noise ratio in dB that can be sustained in a 32 kHz channel carrying 16 kbit/s. [3]

(c) Describe the how the Carrier Sense Multiple Access / Collision Detection access method operates to resolve contention problems on Ethernets. What is the main disadvantage of this method over the token passing access method? [6]

(d) Write down the 8 bits coded in the diagram below, assuming that they are coded using Differential Manchester encoding.



[4]

(e) Calculate the Internet checksum on the following sequence of 4 bytes.

00011001 10001010 00011000 10100010

If the fifth bit from the left in the above sequence of bytes was corrupted, show how the Internet checksum would detect this. [6]

Question 2

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

i. TTL stand for Time To Live, but it is used as a maximum hop limit in IP v4.
ii. Subnetwork addresses of all 0s can never be allocated.
iii. UDP and TCP use a common range of transport layer port numbers to demultiplex to applications
iv. The TCP RST flag is used to restore the TCP Maximum Segment Size to its initial value.

[3]

(b) Describe the processes of Fragmentation and Reassembly as they are specified in IPv4, if the Maximum Transfer Unit size of the subnetwork to which it needs to forward the datagram is exceeded.

[5]

(c) Describe how the "traceroute" command works.

[6]

(d) Outline three advantages that IP Version 6 has over IP Version 4.

[3]

(e) Calculate the CRC-3 code generated for the 8-bit code 10110001 using the generator 1001.

[3]

An 8-bit code 10100111 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.

[5]

Question 3

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

i. File Transfer Protocol requires two TCP connections to be opened in order to work.
ii. Simple Network Management Protocol can either use UDP or TCP.
iii. POP3 allows users to view message headers on the server and choose which to download.
iv. JPEG is an example of a lossless compression algorithm.

[3]

(b) Give three reasons why an experienced application designer might choose to use an unreliable transport service.

[3]

(c) List three main international standards bodies for data communications and the type of standards they produce.

[3]

List the main advantages and disadvantages of standardisation.

[3]

(d) Identify the main differences between the File Transfer Protocol (FTP) and the Trivial File Transfer Protocol (TFTP). Give examples of a situation in which each protocol would be best suited.

[6]

(e) Show how the byte 11001101 can be coded using an even Hamming Code to support single bit error detection and correction.

[3]

Another even Hamming coded byte was received with one bit corrupted and the bits received were 101101000101. Show how the error can be detected and then corrected. What was the byte that was encoded originally?

[4]

PART B

Question 4

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

i. Local Loop Unbundling requires incumbent operators to offer space in their telephone exchange buildings for other operators to connect equipment.
ii. Any two devices on a Bluetooth network can communicate with each other directly.
iii. E1 and T1 circuits are normally provided over a 2-wire copper circuit.
iv. Most Ethernet switches can detect the speed at which devices connect to them and can configure themselves accordingly.

[3]

(b) A company wishes to grow its business. Briefly describe the four growth strategies by which it can achieve this.

[4]

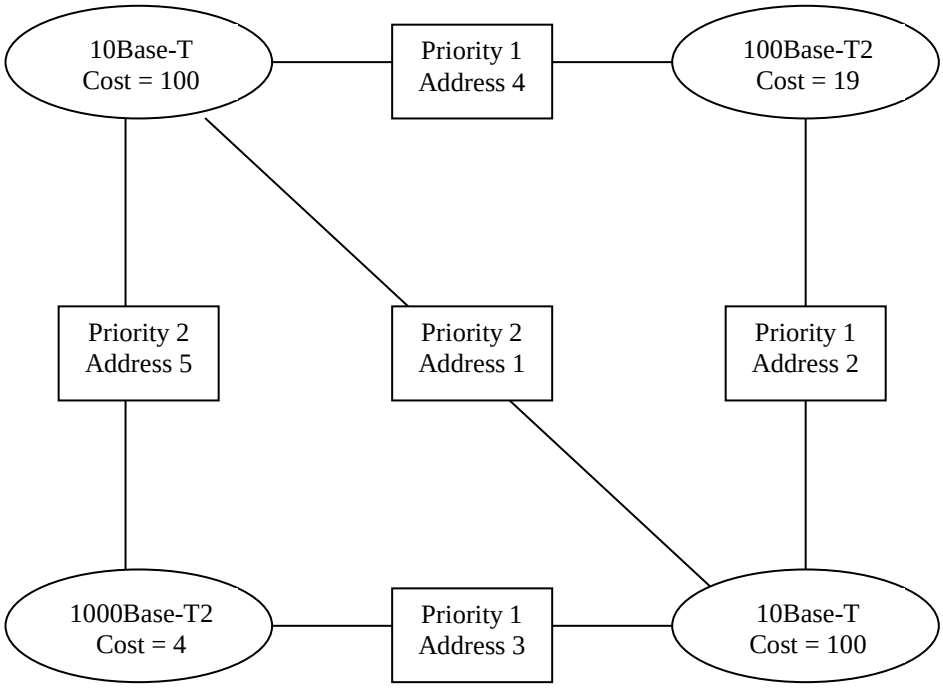
(c) What are the main differences between a hubbed and a switched Ethernet? How else might the two types of Ethernet be described?

[5]

(d) Describe how a VSAT network can operate with a small satellite dish. What is the main disadvantage of using such a network?

[6]

(e) Use the Spanning Tree Protocol to determine which bridge ports should be blocked in the following LAN topology. Copy this diagram into your answer book and draw the spanning tree by using thick lines on the diagram. (If you want to use a different colour that would also be acceptable.) Show which bridge is elected as the root bridge by means of a thick lined (or coloured) box 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. [7]



Question 5

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

i. IP VPNs provide security by employing the IPSec protocol to tunnel between two firewall routers.
ii. The Public Switched Telephone Network normally codes voice at 64 kbit/s using Pulse Amplitude Modulation.
iii. The current location of a GSM mobile phone is stored in the phone's mobile network operator's Home Location Register.
iv. Distance Vector routing algorithms require complete routing tables to be exchanged regularly between neighbouring routers.

[3]

(b) Identify three main difficulties network operators had with the Plesiochronous Digital Hierarchy that caused them to migrate all their digital circuits to the Synchronous Digital Hierarchy.

[3]

(c) List six differences which can occur between different subnetworks that make internetworking problematic.

[6]

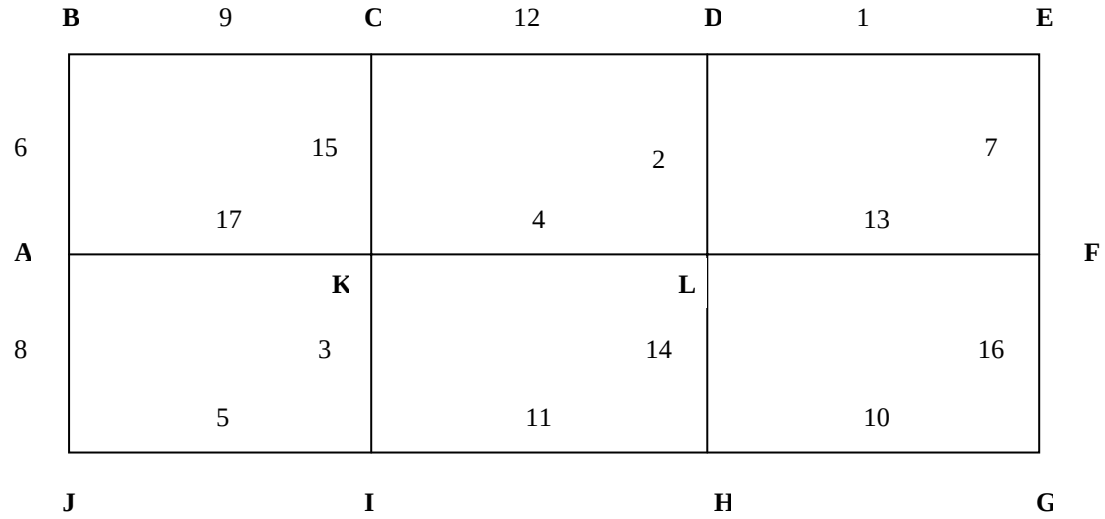
(d) Write down in your answer books the missing data represented by roman numerals in the table below:

[5]

ATM Service Category	**Abbreviation**	**Data rate**	**Loss**	**Delay**	**Jitter**	**Application**
(i)	CBR	Fixed	**(ii)**	Low	Low	Circuit Emulation
Real Time Variable Bit Rate	rt-VBR	**(iii)**	Low	Low	Low	**(iv)**
(v)	nrt-VBR	**(vi)**	**(vii)**	Variable	Some	Business critical applications
Unspecified Bit Rate	UBR	Arbitrary	Arbitrary	**(viii)**	Arbitrary	Best effort service
Available Bit Rate	ABR	Fair	Fair	Fair	**(ix)**	Business Applications
Guarantied Frame Rate	GFR	Variable	Intelligent	Arbitrary	Arbitrary	**(x)**

(e) Draw the network diagram below in your answer book and use Dijkstra's algorithm to calculate the shortest route between A and F, where the numbers represent distances between the nodes. On your diagram, show the node labels you have used at each step of the algorithm and mark the shortest path with a thick line

[6]



In your answer book, draw up a routing table which shows the next hop and the shortest distance from node A to each of the other nodes on the network.

[2]

Question 6

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

i. Frame Relay normally uses Data Link Connection Identifiers for addressing.
ii. Network design is an algorithmic process that can guarantee that the best possible design can be realised.
iii. A VLAN switch can switch traffic between VLANs at layer 2.
iv. SNMP is an IETF application layer protocol that allows data to be collected from network devices.

[3]

(b) Briefly describe the four main criteria used to evaluate network designs.

[4]

(c) Outline 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.

[5]

(d) Identify five characteristics of a network service that a network operator could use as the basis for billing. [5]

(e) Name three performance measures that can be summed to calculate Mean Time To Repair (MTTR).

Write down the relationship between MTTR, MTBF and availability and explain why they are related.

[4]

A router has an MTBF of 10,000 hours and on average it takes 1 hour for the network management centre to diagnose a problem with it, three hours for them to get an engineer to site and a further hour for the engineer to restore service. Two such routers are connected via a circuit with an availability of 99.8%. Derive an expression in its simplest terms for the overall availability of this system.

[4]