UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

BSc Examination 2003 (Internal)

COMPUTING AND INFORMATION SYSTEMS

IS52002A (CIS208) Telecommunications and Computer Communications

Duration: 3 hours

Date and time:

Answer FOUR questions.

Full Marks will be awarded for complete answers to <u>FOUR</u> questions.

Electronic calculators may be used. The make and model should be specified on the script and the calculator must not be programmed prior to the examination.

Wrong answers to multiple choice questions will be penalised, so there is no advantage to be gained from guessing.

THIS EXAMINATION PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

Question 1 (a) State whether each of the following statements are true or false:

i. Analogue signals can be regenerated by amplifiers
ii. Jitter is a measure of the variability of delays
iii. Parallel channels are designed to work over long distances.
iv. Synchronous communications do not require start and stop bits
v. A full duplex channel can also be operated in half duplex mode [5]

(b) A signal of 300 milliwatts is transmitted into a channel which suffers from an attenuation of 20dB. What is the power of the signal received at the receiver? [4]

(c) Describe with the aid of a diagram, how four channels can be frequency division multiplexed. [5]

(d) Draw a diagram to show how 5 nodes can be connected in the following topologies. Draw the topologies in order of resilience (most resilient first):

Ring
Bus
Full Mesh
Partial Mesh (with each node having at least three connections) [4]

(e) State 3 advantages of layered architectures. [3]

(f) Name 4 standards bodies (in full) and give an example of a communications standard that each of them have produced. [4]

Question 2 (a) Which of the following protocols are connection-oriented and which are connectionless:

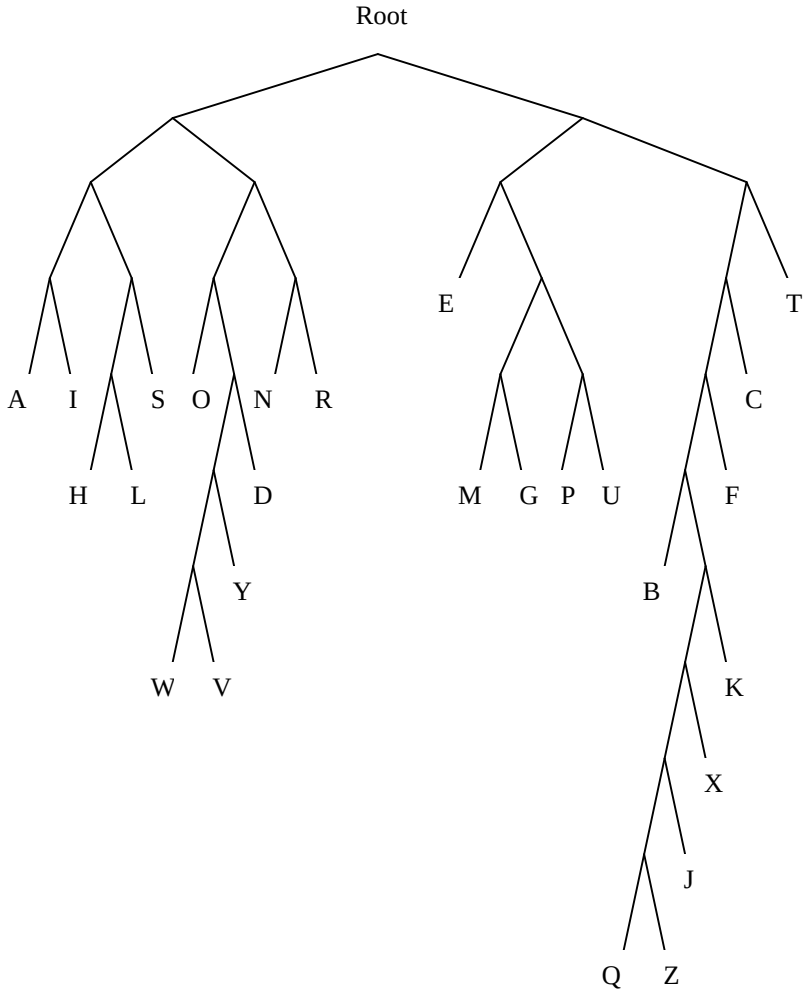
i. Hyper-Text Transfer Protocol (HTTP)
ii. Domain Name System (DNS)
iii. User Datagram Protocol (UDP)
iv. Asynchronous Transfer Mode (ATM)
v. High-Level Data Link Control (HDLC) [5]

(b) Binary Coded Decimal is a code which represents a decimal digit as a 4 bit binary number. (E.g. 3 is encoded as 0011 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. An even Hamming Coded BCD digit was received as 0101001. Show how the error can be detected and corrected. What decimal digit was originally encoded? [6]

(c) Describe how amplitude modulation works. [4]

(d) What bandwidth is required for a channel to transmit a 28.8 kbit/s signal if the signal to noise ratio is 1023:1? [4]

(e) The following Huffman Tree has been created to encode the letters of the alphabet in a Huffman Code.



Using the above Huffman Tree, what is the Huffman Code for the word EXAM?
Using the above Huffman Tree, decode the Huffman Code 11000100100000101000. [6]

Question 3 (a) State whether each of the following statements are true or false.

i. Token Ring uses the Carrier Sense Multiple Access/Collision Detection access method
ii. Token Rings can operate at 10 and 16 Mbit/s
iii. The Token Ring standard is known as IEEE802.3
iv. Token Ring frames must have a minimum length and are padded out if they are shorter than the minimum length
v. Token Ring uses Differential Manchester encoding at the physical level [5]

(b) Describe how the Carrier Sense Multiple Access/Collision Detection access method works on an Ethernet. [5]

(c) How many B and D channels are provided on an ISDN Basic Rate Interface and at what bit rates? What is the purpose of the D channel? What protocol was developed to implement Broadband ISDN? [4]

(d) Describe, with the aid of a diagram, how FDDI recovers from a cable break. [4]

(e) Identify three distinguishing characteristics of a Wide Area Network which differentiate it from a Local Area Network. [3]

(f) Explain why network operators might choose to run Internet Protocol over Asynchronous Transfer Mode networks. [4]

Question 4 (a) State whether each of the following statements are true or false:

i. The majority of security threats come from inside a company rather than outside it
ii. Security is a technical problem rather than a management problem
iii. DES stands for Digital Encryption Standard
iv. DES is a public key encryption standard developed by the US Government
v. Private key encryption is also known as symmetric encryption [5]

(b) Encrypt the string IN THE HEAT OF THE MOMENT (excluding spaces) by means of a transposition cipher using the key "minute" and show how the original plaintext can be recovered. [4]

(c) What is meant by "Looking for an Edge" as a means of gaining competitive advantage? Give an example of how a company has gained competitive advantage by this means. [4]

(d) List 4 factors that are likely to affect a company's future business. [4]

(e) What is meant by distributed application logic in a client server system? Give an example of a system that would conform to this model. [4]

(f) List 4 advantages of a host-based system over a client server system. [4]

Question 5 (a) Place the following design steps in the correct chronological order.

i. Understand the current network
ii. Prepare a network design plan
iii. Define the geographical scope
iv. Conduct a feasibility study
v. Define the new network requirements [3]

(b) What are the 4 main criteria used to evaluate network designs? [4]

(c) A bank has a requirement to implement a new network to support cash machines in 1,000 locations throughout the country. The transactions are to be handed at a single large computer centre, with a back-up facility in another part of the country. There is a very high volume of transactions from each machine, and the estimated bandwidth requirement for each machine is 64 kbit/s. The bank is in the process of downsizing its staff and is looking for opportunities to drastically reduce its network management personnel. Consider a private network, ISDN, Frame Relay, ATM and X.25 as possible solutions. Outline a design that you would consider to be appropriate for this application, showing what technologies you would recommend for use at the cash machine sites and at the central sites, giving reasons for ruling out other solutions. [9]

(d) A manufacturing company with heavy electrical machinery wishes to implement a local area network across its factory floor. It has been estimated that the LAN traffic will be 20 Mbit/s at peak and network availability is of paramount importance as network outages will affect production. Outline a design for this LAN stating what technology and particularly what physical medium you would recommend. [5]

(e) Place the following networks in order of their maximum data rates (lowest speed first, indicate if any networks have the same maximum data rate):

i. Asynchronous Transfer Mode (ATM)
ii. X.25
iii. Primary Rate ISDN
iv. Frame Relay
v. Basic Rate ISDN [4]

Question 6 (a) State whether each of the following statements are true or false:

i. SNMP stands for Standard Network Management Protocol
ii. SNMP is an Internet Engineering Task Force standard
iii. MTBF stands for Maximum Time Between Failures
iv. MTBF is a measure of network reliability
v. Network Management represents a small proportion of total network costs

[5]

(b) What is meant by the term Mean Time To Repair (MTTR) and what other measurements when combined together give the Mean Time To Repair?

How are % Availability, Mean Time Between Failure and Mean Time To Repair related to each other? [5]

(c) Availability (expressed as a percentage) is defined by the following formula

$$\%\text{Availability} = \frac{\text{Total uptime} * 100}{\text{Total uptime} + \text{Total downtime}}$$

A 128 kbit/s private circuit between two offices is specified to have an availability of 99.7%. Calculate the number of hours of circuit downtime that could be expected over a period of 5 years and hence or otherwise the Mean Time Between Failures of the circuit, if the Mean Time To Repair is 15 hours. [8]

Assume that 1 year = 365.25 days.

If you do not have a calculator, present you answer as a fraction. You can still obtain maximum marks.

(d) Suggest a potential design that could improve the availability of the above communications without doubling the costs. [2]

(e) Describe briefly the 5 basic categories of test equipment. [5]