

UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

B. Sc. Examination 2012 (Internal)

COMPUTER SCIENCE

IS52017A

Data Communications and Algorithms

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 two questions from Part A and two questions from Part B. Your answers to Part A and Part B should be written in separate answer books.

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:

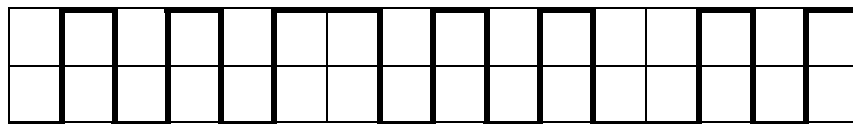
- i. Ethernet frames are preceded by a 7-bit preamble of alternating 1s and 0s.
 - ii. The Network Access Layer in the DoD model maps onto the Network and Data Link Layers of the ISO Reference Model.
 - iii. Attenuation is the loss of signal strength over distance.
 - iv. MAC addresses are six bytes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