

University of London International Programmes
Computing and Information Systems/Creative computing
CO2222 Data communications and enterprise networking
Coursework assignment 2 2017–18

Introduction

This assignment aims to develop your skills in applying the knowledge you have gained from the course to the solution of real world problems.

Learning objectives

You should be able to:

- identify and apply relevant analytical methods
- compare and contrast various networking techniques and protocols
- identify and evaluate potential solutions to network design problems
- gain experience of answering examination style questions.

Submission

Please submit **one** pdf document, named using the following convention:

YourName_SRN_COxxxxcw#.pdf (e.g. MarkZuckerberg_920000000_CO2222cw2.pdf)

- **YourName** is your full name as it appears on your student record (check your student portal)
- **SRN** is your Student Reference Number, for example 920000000
- **COXXXX** is the course number, for example CO2222, and
- **cw#** is either cw1 (coursework 1) or cw2 (coursework 2).

Important reminder

It is important that your submitted assignment is your own individual work and, for the most part, written in your own words. You must provide appropriate in-text citation for both paraphrase and quotation, with a detailed reference section at the end of your assignment (this should not be included in the word count). Copying, plagiarism and unaccredited and wholesale reproduction of material from books or from any online source is unacceptable, and will be penalised (see: [How to avoid plagiarism](#)).

Question 1

- a) A 400mW signal is transmitted down a 40km optical fibre and is received as a 4mW signal. Calculate the overall loss of the fibre in decibels per kilometre.

[4 marks]

- b) A byte followed by a CRC-3 checksum has been received as: 01001110110. Carry out a CRC check using the generator 1001 and state whether or not an error has occurred.

[4 marks]

- c) (i) The following frame has been built from 7-bit ASCII characters by using both longitudinal and vertical even parity. After transmission it has been received with a single bit error. Detect and correct the single bit error.

[2 marks]

1	0	1	0	1	0	1	0
1	0	0	1	1	0	0	1
0	1	1	0	0	1	1	0
0	1	0	0	0	1	0	1
1	1	0	0	1	1	0	0
0	0	1	1	0	0	1	1
1	1	1	1	0	0	0	0
0	0	0	0	1	1	1	1

- (ii) Define Hamming Distance and prove that any set of exclusive eight bit codes that has even parity has a minimum Hamming Distance of at least two.
- (iii) The bit pattern quoted in part (b) of the question is to be retransmitted after converting it to a Hamming Code (for single bit errors). How many additional parity bits will be needed?
- d) The following bit pattern has been received. It is known that it has been generated by applying Huffman Coding to the characters of a string according to the table below. What was the original character string?

[2 marks]

[3 marks]

001101000000010110011010011010001

Character Coding:

E = 1; T = 01; G = 001; C = 0000; A = 0001.

- e) Compare non-adaptive and adaptive routing. Give, with full description, one example of a routing algorithm using non-adaptive routing and one example of a routing algorithm using adaptive routing.

[7 marks]

Question 2

- a) A bus LAN, with no repeaters, has a length of 1 km, a transmission rate of 10Mbps and a propagation speed of 2×10^{10} cm/sec. A frame is 512 bits, including the header and other overheads. On receipt of a frame the receiver must immediately send a 64 bit acknowledgement frame. Treating the overhead as data, and assuming no collisions, what is the effective data rate?

[7 marks]

- b) A large office block consists of twenty stories. Each level is capable of holding one department (e.g. sales, finance, human resources, strategic management) of the company whose head office is located in the office block. Each department has its own 10Base-2 IEEE802.3 LAN. Describe, by drawing diagrams, three technically different ways in which the company could implement a backbone in order to link the individual LANs into a single whole and compare these three ways in terms of scalability and likely compatibility with newer technologies.

[7 marks]

- c) Banks continue to operate systems where branches handle cash and cheque transactions using tellers at security screened desks, and mortgage, insurance and investment transactions using staff at desks in an open area. Consider a typical bank that has a head office, where all decisions regarding interest rates, the types of insurance to be offered, commission and exchange rates for currency transactions, etc. are taken, and all the customer accounts are held. It has a number of branches in rural areas where there are, on average, ten dumb terminals which are linked directly over a private data communications line to the head office. Five of the terminals are in a back room and are used solely for entering the details of cash and cheque transactions which have taken place in the branch that day. One is behind the tellers' desks, to allow the tellers to make balance enquiries. One is in the office of the manager while the other three are on desks in an open area. These are used by staff who are discussing loans, mortgages, equity and insurance with potential customers. There is a single high speed printer in the bank. It is next to the terminals behind the tellers' desks. All printed material for the branch appears on that printer. The staff are very unhappy. The response time on all the terminals is very slow. The amount of information available via the terminals is limited. Although the printer is high speed nothing is ever printed at high speed because of the slowness of data coming down the communications line. Because of the slowness of response on the terminals, meetings with potential customers take a long time and queues of customers build up. The communication lines are prone to error and to break down causing more frustration. Suggest diagrammatically, a client/server architecture for the bank and its branches which would link a branch to the head office and speed up significantly the operations of a branch while maintaining customer accounts and overall control at the head office. Indicate, in detail, the communications lines, servers, etc.

[11 marks]

Question 3

- a) Describe ATM and its underlying technology. Comment on how the ATM reference model relates to the OSI reference model, how an ATM bridge

handles, for example, IEEE802.3 frames and how ATM based services are related to SONET based services and SDH based services.

[8 marks]

- b) A university institution is based on six major sites spread around a city, each site being approximately six kilometres or twelve kilometres from the others. Each site supports a series of 100Base-T local area networks linked to a single 1000Base-T switch on the site. It wishes to acquire facilities to provide links between the sites using high speed (>100Mbps) connections.

- (i) Identify four criteria which you would use to compare and evaluate any proposals which might be made by suppliers or service providers bidding to supply the links.

[4 marks]

- (ii) Identify two contenders (based on different technology) who could be likely to be chosen to supply the links and compare these two contenders in terms of the four criteria identified in (i).

[2 marks]

- (iii) Your comparison of the two contenders should show a preferred supplier. What topology is the chosen supplier likely to adopt to link the sites?

[3 marks]

- c) An ISP is able to allocate addresses in the range 135.47.128.1 to 135.47.191.254 to its customers.

- (i) What is the network address of the ISP (including the network prefix) and what network mask should be used? What is the maximum number of host addresses that it can allocate?

[6 marks]

- (ii) The ISP decides to split its whole address range into a number of /23 networks. How many network addresses will this provide and how many hosts can be accommodated on each /23 network?

[2 marks]

Question 4

- a) In each of the following situations detail a likely choice of media and supporting technology which a network manager might choose to support the application. Give reasons for your choice.

- (i) A travelling salesperson wishing to give confirmed quotes and take orders for immediate passing to the sales office while in the offices of a customer.

[2 marks]

- (ii) A start up company wishing to move into the supply of video on demand.

[2 marks]

- (iii) A child day care centre wishing to install TV cameras to allow parents the option of monitoring their children, either from home or from the office, during the middle of the day.
[2 marks]
- (iv) A bank wishing to communicate its daily policy updates to all the branches of the bank, and to know that those updates have been received and have been adopted.
[2 marks]
- b)
- (i) Define location technology. Compare GPS and active badges in terms of the technology that they use and their applicability.
[4 marks]
- (ii) Identify and detail one major application for which location technology is appropriate. Describe the technology on which the application may be based and examine the benefits which the application can offer.
[4 marks]
- c) Private Key and Public and Private Key are two techniques for encrypting data to be sent over a communication line. Say in what circumstances each of the two techniques would be used and identify two real business applications of networking, one of which is appropriate for the use of private key encryption and one of which is appropriate for the use of public and private key encryption.
[4 marks]
- d) Define and compare SSL and SET as possible mechanisms for achieving the full security of credit card numbers during the conduct of a B2C purchase transaction using the World Wide Web.
[5 marks]

[Total 100 marks]

[END OF COURSEWORK ASSIGNMENT 2]