

Department of Computer Science
University College London

Cover Sheet for Examination Paper to be sat in May 2001

COMP2B10: Architecture II

Answer TWO questions from Section A and TWO questions from Section B

Calculators are permitted

Checked by First Examiner:

Date:

Approved by External Examiner:

Date:

SECTION A

Answer TWO questions from this section

1. a) Explain why digital rather than analogue transmission is favoured in modern communications systems.

[5 marks]

- b) "Pulse Code Modulation (PCM), as used in telephony, samples a signal at 8KHz using 256 quantisation levels". Briefly outline how this scheme works and, by reference to Nyquist's theorem, explain how the sampling rate was chosen.

[6 marks]

- c) There is much interest today in sending voice traffic across IP networks. Give reasons why this approach might make more efficient use of transmission capacity than the circuit-switched PCM scheme that has traditionally held sway.

[6 marks]

- d) One of the challenges of implementing interactive "voice over IP" is management of delay and jitter. Outline the sources of delay and jitter in the Internet and describe a technique for reducing the effect of jitter.

[8 marks]

2. a) Statistical analysis of football results shows that results occur with the following relative frequencies:

Home win (H)	25%
Away win (A)	12.5%
No-score draw (i.e neither side scores) (N)	25%
Score draw (i.e. 1-1, 2-2, etc.) (S)	37.5%

Given that we want to transmit the results of 1000 football matches as H, A, N or S, how many bits would we need to transmit using an ideal coding scheme?

[6 marks]

[Question 2 continued on next page]

[Question 2 continued]

- b) i) 1000-bit packets are transmitted over a channel with a *bit-error rate* (BER) of 10^{-5} . Assuming bit-errors are independent, calculate the probability that a packet will be affected by an error.

[3 marks]

- ii) The packets in i) are transmitted over a link which operates at 100,000 bits/sec with a propagation delay of 10ms. A *stop and wait ARQ* protocol is in use; acknowledgement packets are 100 bits and the transmit timeout is 100ms. What would be the throughput in packets per second on an error-free channel? What would be the throughput if the channel had the packet error rate calculated in i)? [You may ignore processing delays at the transmitter and receiver. State any further assumptions you make]

[6 marks]

- iii) The *stop and wait ARQ* protocol in ii) is replaced by a *continuous request go-back-n* protocol. Discuss what window size and timeout should be chosen for maximum throughput.

[3 marks]

- c) A channel on a wireless network is shared by stations which transmit packets at 100,000 bits/sec with a mean packet size of 1000 bits. The maximum propagation delay between any two stations is limited to 4ms. Discuss the feasibility and advisability of employing the CSMA-CD (Carrier-Sense Multiple Access – Collision Detection) strategy on this network.

[7 marks]

3. a) A web server runs on a computer with domain name haig.cs.ucl.ac.uk. A browser accesses a page with URL `http://haig.cs.ucl.ac.uk/foo.html`. Both the browser host, the web server host and the DNS host are connected to the same Ethernet LAN. Give an account of the steps that take place as the browser requests the page. [Assume no useful cached information is available at the start of the exchange. You do not need to account for **every** packet sent!]

[8 marks]

b) What is meant by “statistical multiplexing”. What are its strengths and weaknesses compared with other multiplexing techniques?

[7 marks]

c) Explain the operation of mesh-type networks which use the *virtual circuit* style of operation. Discuss the strengths and weaknesses of virtual circuits.

[10 marks]

SECTION B

Answer TWO questions from this section

4. a) Identify the main actions that have to be taken i) when scheduling a process pre-emptively and ii) when scheduling a thread. **[8 marks]**
- b) Distinguish between a *hard real-time system* and a *soft real-time system* giving an example of each to illustrate your answer. **[4 marks]**
- c) What issues need to be considered in addition to those for general process scheduling, when designing a *soft real-time operating system*? **[6 marks]**
- d) What problem do *critical sections* solve? Briefly describe how they can be implemented for a multiprocessor system. **[7 marks]**
5. a) Define the terms *authentication* and *access control*. **[6 marks]**
- b) As a manager of a large computer installation with many servers, what policies would you enforce regarding *passwords* used for authentication, indicating both the advantages and disadvantages of the policies? **[9 marks]**
- c) A text file contains the name, home phone number and salary of a company's employees. Using the Unix access control model, explain how you would only provide the names of employees to group A, their names and salary to group B and all their details to group C. **[10 marks]**

6. a) Define what is meant by the term *execution semantics* in a Remote Procedure Call (RPC) system. State the main properties of the three common forms.

[8 marks]

b) Why is it generally desirable to have *stateless* servers in distributed systems? Indicate with examples the differences that might be observed between *interfaces* for stateless and stateful servers.

[8 marks]

c) "*Despite 20 years of development, distributed systems still do not adequately address the issues of scale, heterogeneity and autonomous management that is needed for a modern company's computing environment.*"

Discuss this statement using appropriate examples to illustrate your points.

[9 marks]