Computer Science Department

1996 Examinations

D52 Network Architecture

Answer THREE questions

The use of Electronic Calculators is not permitted in this examination.

Q1. a) E-mail is transferred using the "*Message Transfer System"* (*MTS*). Describe how an e-mail message might be transferred by the Internet *MTS*, include in your answer a description of the functionality of the "*Simple Mail Transfer Protocol"* (*SMTP*) and "*rfc822"* (the Internet version of protocols P1 and P2). What enhancements might you expect to these two protocols to support the transfer of *"Multimedia Internet Mail Extensions*" (*MIME*) messages?

[9 marks]

b) Design a system to provide e-mail to a user. Include in your answer a description of the functionality you might expect to be associated with the **mh 'inc'** command which is used on some Unix systems.

[12 marks]

c) What function would you expect "*Mail Exchange*" (*MX*) records to give when trying to send an e-mail message?

[2 marks]

d) If the mail system is being used for voice mail as well as e-mail, what functions would you expect a mail gateway to have to perform?

[10 marks]

Q2. a) *Time Division Multiplexing* (*TDM*) is not considered to be efficient for some modern traffic types. A new technology - *Asynchronous Transfer Mode* (*ATM*) - is being introduced to remedy these deficiencies:

i) Briefly explain what is meant by *Asynchronous Transfer Mode* and discuss what advantages it may have over TDM.

[9 marks]

[Question 2 continued overleaf]

ii) ATM uses small cells of fixed size. What advantages do designers of ATM expect to gain from these choices?

[6 marks]

iii) ATM uses virtual circuits internally. Explain what this means and discuss why this choice has been made.

[8 marks]

b) Some modern Wide Area Networks offer a “Frame Relay” service. In these networks the Data Link protocol typically uses neither acknowledgements nor windows. Discuss the reasons for this choice.

[10 marks]

Q3. a) What information is held in a “*Directory Name Server”* (*DNS*), compared to the “*X.500 Directory”* data-base? There are two options for the structure of a *DNS* data-base: flat or hierarchical. Discuss the advantages of choosing a hierachical data-base compared to a flat structure. Include in your discussion a description of domains.

[8 marks]

b) If the DNS provides name to address translation, how do you find the address of the DNS itself?

[2 marks]

c) What is the difference between *primary* and *secondary DNS* servers?

[8 marks]

d) Suppose we wished to make a connection from a machine ‘*samantha*’ located in a company ‘HSI’, and a machine ‘*danger*’ located in the computer science department, UCL. How would the address for *danger* be located?

[15 marks]

Q4. a) All current management frameworks have adopted an object-oriented approach based on *manager/agent* interactions and operations on *managed objects*. Explain the terms *manager*, *agent*, *management protocol*, *managed object* and discuss how they are related.

What is achieved by the *managed object* abstraction?

[11 marks]

b) Object-oriented modelling techniques have been adopted in the ISO/ITU management framework. Explain the concept of *managed object class* inheritance and discuss the benefits from modelling management information that way. Discuss the associated concepts of *polymorphism* and *allomorphism*. What is achieved through them?

[11 marks]

c) Traditionally management systems have been organised in a centralised fashion (single manager, many managed elements). Nowadays there is an tendency to move towards:

i) flat organisation, for horizontal integration

ii) hierarchical organisation, for vertical integration.

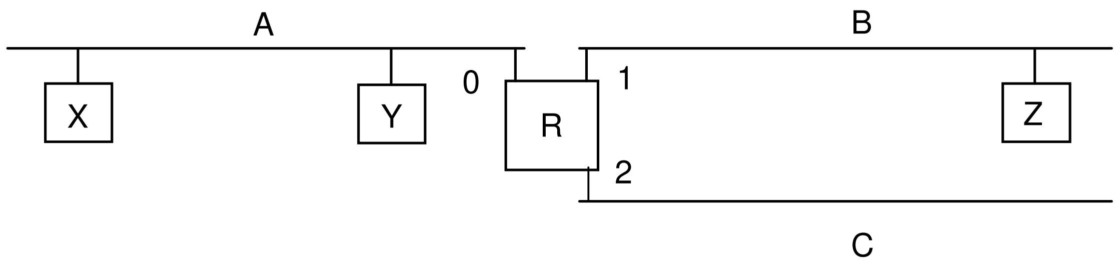
Discuss the main characteristics of these organisational models and their associated benefits.

[11 marks]

Q5. a) Describe three principal characteristics of the "*Internet Protocol*" (*IP*) as used on the Internet. What characteristics of the protocol and the service it provides do you think have influenced the success of the Internet?

[9 marks]

b) In the diagram below, R is an Internet router between three Ethernets A, B and C. Host X has IP address 128.16.8.4, Z has address 128.30.7.4. The interfaces of R (0, 1 and 2) have addresses 128.16.5.9 and 128.30.4.15 and 128.19.2.7 respectively. There are no other routers on A, B or C.



i) What can be said about the IP address of Y?

[2 marks]

ii) Explain how address resolution works when X sends an IP datagram to Y for the first time. How are things different when X sends to Y for a second time and how does the mechanism cope with a change to Y's Ethernet address?

[6 marks]

iii) Outline the IP address mappings and address resolution mappings which take place in X and R when X sends an IP datagram to Z. Your answer should make it clear what IP addresses are carried in any IP datagrams.

[9 marks]

iv) It would be possible to replace R with a Medium Access Control (MAC) bridge. Briefly discuss the impact this would have on the allocation of IP addresses within A, B and C. Briefly outline the advantages and disadvantages of the bridged approach.

[7 marks]