

**Computer Science Department**

**2000 Examinations**

**Z04 Questions**

## **SECTION A**

1. a) Services and protocols conforming to OSI standards have only a tiny share of the world's data communication market. Discuss some reasons why this situation has arisen despite the considerable international effort expended in defining and promoting OSI standards.

**[13 marks]**

- b) There has been a long-standing debate about the relative merits of X.400 as opposed to Internet e-mail. Discuss the following statements that might arise in such a debate:

'X.400 addresses are cumbersome, Internet e-mail addresses are not'

'Internet e-mail is specified in text, Inter-Personal Messages (IPMs) are specified in ASN.1'

'X.400 has receipt notifications, Internet e-mail has not'

**[12 marks]**

2. a) The emergency services in the UK have decided to bring on-line multimedia information to fire-fighters and other service personnel in the field. They are keen to use the Internet for its robustness and would like to provide access to sensitive information over mobile links using the IP service offered over the GSM network. The sensitive information (such as up-to-date maps and pictures of buildings with entrances, ducting etc) is currently stored in a large distributed database, based on X.500 technology.

Design a system for the emergency services to use the X.500 database, assuming that field personnel have a common portable computer with a web browser. Draw a block diagram of the system, (which indicates relevant protocols operating at layers above IP). Describe also a user-interface that offers the main X.500 features. Include in your design a description of the salient features of the protocols you have chosen.

**[15 marks]**

**[Question 2 continued on next page]**

**[Question 2 continued]**

- b) If the service is to be extended to situations of high-speed mobility, the potential for data-link layer service drop-outs of relatively long duration (such as travelling through tunnels) must be accounted for. Assuming a complete failure of the transport link, evaluate the potential role of the OSI upper layer architecture (ULA) or equivalent functionality in minimising disruption. Begin with a description of the ULA.

**[10 marks]**

3. a) Blobco's private IP network consists of routers owned by the Blobco connected by frame-relay "Data Link Connections" (DLC) hired from a network provider.

- i) Frame-relay was chosen because it was cheaper than hiring leased lines. Suggest technical reasons why this will tend to be the case.

**[6 marks]**

- ii) The provider of the frame-relay network offers two classes of DLC to its customers; "Type A" with neither error-control nor flow-control and "Type B" which has error-control and flow-control provided by an HDLC-like protocol. Blobco's network manager advocates the Type A service citing the "end-to-end argument". Explain what this means and how it can be applied to Blobco's situation.

**[10 marks]**

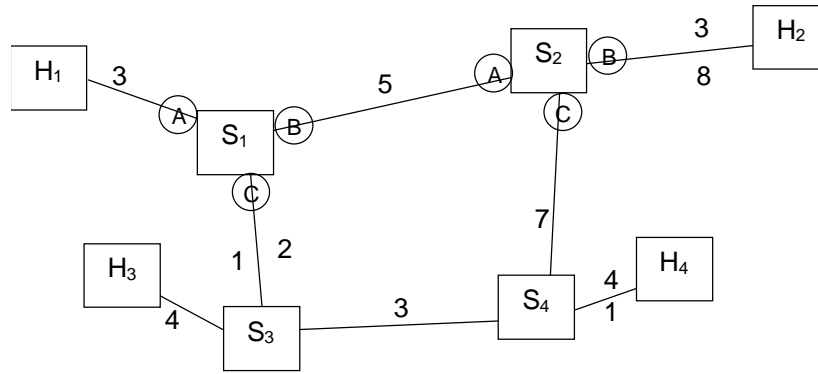
- b) i) An IPv6 router must match a 16 byte address when forwarding a datagram. An ATM switch must match a 3 byte VPI/VCI when forwarding a cell. Briefly explain why IPv6 addresses must be so much bigger than ATM VPI/VCIs.

**[2 marks]**

- ii) The diagram below shows the Virtual-Circuit Identifiers (VCI) currently allocated on a small packet network. The  $H_n$ s are hosts whilst the  $S_n$ s are switches. The circled letters identify individual ports on the switches.

**[Question 3 continued on next page]**

**[Question 3 continued]**



The VCIs identify three Virtual Circuits;

$$H_1 \leftrightarrow S_1 \leftrightarrow S_3 \leftrightarrow S_4 \leftrightarrow H_4$$

$$H_2 \leftrightarrow S_2 \leftrightarrow S_1 \leftrightarrow S_3 \leftrightarrow H_3$$

$$H_2 \leftrightarrow S_2 \leftrightarrow S_4 \leftrightarrow H_4$$

The forwarding tables below have one row for each VC segment contingent on a switch.

Table for S<sub>1</sub>

Incoming		Outgoing	
Port	VCI	Port	VCI
A			
B			2
C		A	
C			

Table for S<sub>2</sub>

Incoming		Outgoing	
Port	VCI	Port	VCI
B	3	C	

Produce completed versions of the two forwarding tables.

**[7 marks]**