

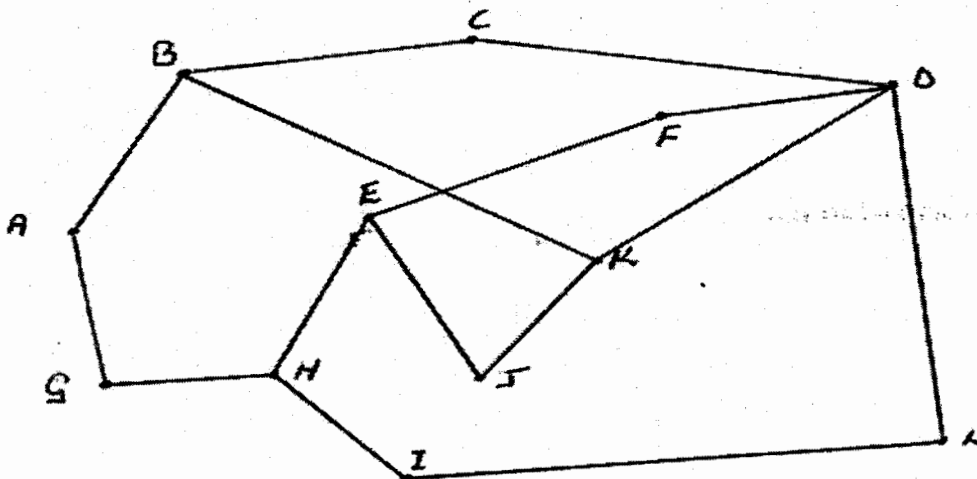
### QUESTION 1 (Compulsory)

a) An organization has **750 desktop computers (PCs)**, **5 network printers** and **4 servers**. The organization uses applications which use the IP protocol for communication at the network layer and it has been assigned 5 blocks of class C addresses, these being 194.24.65, 196.24.66, 196.24.67, 196.24.68 and 196.24.69. For security reasons, the servers and 1 printer must be on one class C network segment, with no PC connected to it. The desktop PCs are located on several class C network segments, with each having at least 1 printer.

You have been asked to design the network to fulfil the above requirements. Your proposed diagram should indicate why the chosen design, what extra equipment is required to enable the computers, servers and printers to communicate with each other using IP.

[10]

b) Compute a multicast spanning tree for router B in the subnet below for a group with members at routers B, C, E, F, G, I and K.



c) The following terms are used when describing the Internet Protocol. Define what they mean

[5]

- (i) Internet Protocol Address.
- (ii) Fragmentation.
- (iii) Maximum Transmission Unit.
- (iv) IP Router.

d) Give two examples of the function of ICMP.

[7]

[3]



### QUESTION 3

- a) Describe the leaky bucket method of congestion control. [5]
- b) With the aid of a diagram, describe a simple http session in which a user requests information that is stored in a database. [7]
- c) Given the IP network 196.24.66.0, how many subnets would result if the maximum number of hosts per subnet is 30? What is the subnet mask? Why are some IP addresses not assigned to hosts in the subnet? [8]
- d) With the help of diagrams, describe the following routing strategies: [5]
- (i) Fixed routing
  - (ii) Random routing

### QUESTION 4

- a) Describe how a user on host A sends email that is read by the recipient on Host B. The protocols SMTP and POP3 are used. [8]
- b) Describe the RSA encryption method. What type of encryption is it, and how does it differ from an encryption that uses DES? [8]
- c) What is the function of ARP? [4]
- d) Describe the series of actions that occur when a user on a PC in the Computer Science lab accesses the url <http://www.voip.com>. [5]

### QUESTION 5

- a) Describe how DNS works. [5]
- b) Explain how slow start congestion control in TCP works. [5]
- c) Describe how machine A with IP address 196.24.64.34 sends an ip packet to machine B with IP address 196.24.65.34. [4]
- d) What is a socket in TCP/IP? Briefly describe how a network program that acts as a server is coded using sockets. [4]

e) An Ethernet protocol analyser observes the following frame:

```
00 0b cd 4d a0 6b 00 14 38 4e a4 2e 08 00 45 00
02 7a b7 07 40 00 40 06 b7 1f 3d b8 c7 58 c0 a8
04 9e 00 50 06 3e 2a ee 84 05 01 41 45 c2 50 18
19 20 0c 6d 00 00 48 54 54 50 2f 31 2e 30 20 32
30 30 20 4f 4b 0d 0a 41 67 65 3a 20 39 32 34 30
31 38 38 38 0d 0a 41 63 63 65 70 74 2d 52 61 6e
```

By decoding the hexadecimal bytes of this frame, determine the:

- (i) Ethernet Destination Address
- (ii) IP Destination Address
- (iii) What type of transport layer protocol is being transported?
- (iv) source port

Service Access Point (SAP) codes:

Ethernet: (in hexadecimal): 0x0800 = IP; 0x0806 = arp

IP: (in decimal) 1 = ICMP; 2 = IGMP; 6 = TCP; 17 = UDP

TCP: (in decimal) 23 = telnet; 25 = smtp (mail); 69 = tftp; 80 = http (www).

[7]