

UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION 2005

TITLE OF PAPER: DATA NETWORK AND CODING THEORY (II)

COURSE NUMBER: CS440 (II)

TIME ALLOWED: THREE HOURS

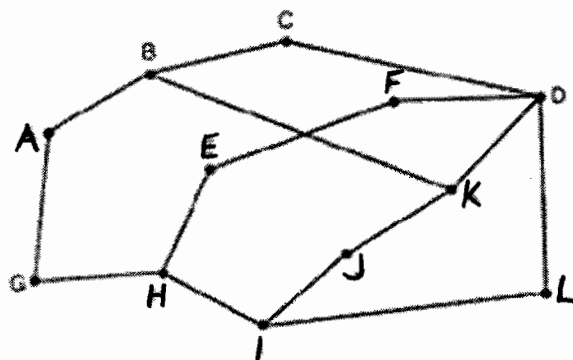
INSTRUCTIONS: ANSWER ANY **FOUR** QUESTIONS.

EACH QUESTION CARRIES **25** MARKS.

DO NOT OPEN THE PAPER UNTIL PERMISSION HAS BEEN GIVEN  
BY THE INVIGILATOR.

**QUESTION 1**

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



b) Using the subnet diagram in (a), how many packets are generated by a broadcast from K using

- (i) reverse path forwarding?
- (ii) sink tree?

[6]

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

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

[8]

d) Give two examples of the function of ICMP.

[8]

[3]

**QUESTION 2**

a) Give a detailed explanation of the operation of ARP.

[4]

b) Illustrate the basic structure of an IP address. In what way does this structure vary between address classes A, B and C.?

[3]

c) Given the IP network 192.168.4.0, how many subnets would result if the maximum number of hosts per subnet is 14? What is the subnet mask? Why are some IP addresses not assigned to hosts in the subnet?

[8]

d) Describe the fields of an IP packet header.

[5]

e) Why is it useful to have more than one possible path through a network for each pair of stations?

[2]

f) What causes congestion?

[3]

### QUESTION 3

(a) An Ethernet protocol analyser observes the following frame:

```
0800 2086 354b 00e0 f726 3fe9 0800 4500
b0054 aafb 4000 fc01 fa30 8b85 e902 8b85
d96e 0000 45da 1e60 0000 335e 3ab8 0000
42ac 0809 0a0b 0cod 0eof 1011 1213 1415
1617 1819 1a1b 1c1d 1e1f 2021 2223 2425
2627 2829 2a2b 2c2d 2e2f 3031 3233 3435
```

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

(i) Ethernet Source Address

(ii) IP Destination Address

(iii) What type of transport layer protocol is being transported?

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 = Mail; 69 = TFTP; 80 = WWW (http)

[8]

b) Describe the leaky bucket method of congestion control

[5]

c) Describe a congestion avoidance technique

[3]

d) Is the ISBN 3-540-61990-8 valid?

[4]

### QUESTION 4

a) Describe with diagrams how a user on host A send email to a user on host B who reads it using an email client.

[6]

b) Describe the three way handshake of TCP.

[5]

c) Describe how machine A with IP address 192.168.4.3 sends a packet to machine B with IP address 192.168.4.13, and how machine A sends a packet to machine C with IP address 192.168.5.13

[6]

d) A TCP machine is sending windows of 65, 535 bytes over a 1-Mbps channel that has a 25 millisecond round-trip delay. What is the maximum throughput achievable? What is the line efficiency?

[4]

e) Compare ARP and BOOTP

[4]

### QUESTION 5

a) Describe the series of actions that occur when a user on a PC in the Computer Science lab accesses the url <http://www.google.com>.

[5]

b) Briefly describe the following: SMTP, POP3, and MIME.

[6]

c) Describe the RSA encryption method.

[5]

d) Describe SNMP.

[5]

e) Describe how you would use a firewall to make an organizations' network secure.

[4]