UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

SUPPLEMENTARY 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

a) Describe the operation of the slotted Aloha protocol.

[5]

b) Why is slotted Aloha more efficient than pure Aloha?

[3]

c) Describe the operation of the Simplex Stop-and-Wait Protocol for a noisy channel. How does it differ from the Simplex Stop-and-Wait Protocol for a noiseless channel?

[5]

d)  For sliding window protocols, what is:
     the Sender Window?
     the Sender Window size?
     the Receiver Window?

[6]

e) Describe the **Go back N** sliding window protocol. What is the receiver's window for Go back n?

[6]

## QUESTION 2

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



[6]
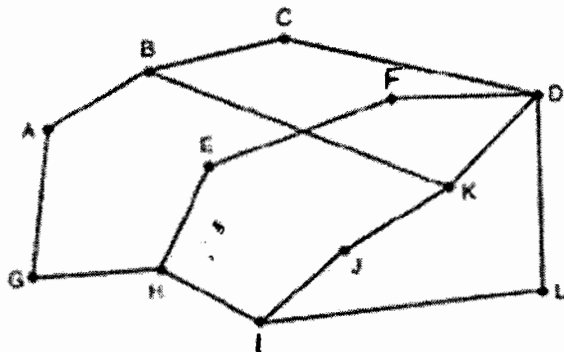
b) Using the subnet diagram in (a), how many packets are generated by a broadcast from L using
     (i) reverse path forwarding?
     (ii) sink tree?

[8]

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) Describe the three way handshake of TCP.

[3]

## QUESTION 3

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.?

[4]

c) Describe with the help of diagrams how a user on host A sends email to a user on host B who reads it using an email client.

[6]

d) Describe how machine A with IP address 196.11.124.2 sends a packet to machine B with IP address 196.11.124.45, and how machine A sends a packet to machine C with IP address 196.24.64.55

[6]

e) Describe the series of actions that occur when a user on a PC in the Computer Science lab accesses the url http://www.bbc.co.uk.

[5]

## QUESTION 4

a) Describe the RSA encryption method.

[6]

b) 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]

c) Describe the fields of an IP packet header.

[6]

d) 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 5

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

```
00 0b cd cb b0 db 00 0b  cd d0 a9 7e 08 00 45 00
00 30 00 00 40 00 3f 06  f7 68 c4 0b 7c 02 c4 18
40 39 00 50 07 c1 03 40  89 d9 49 5d 29 3e 70 12
16 d0 20 1a 00 00 02 04  05 b4 01 01 04 02
```

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?
  (iv) destination 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 = Mail; 69 = TFTP; 80 = WWW (http)

[10]

b) Given the IP address **C40B7C22** in hexadecimal, give it in the normal dotted decimal notation.

[4]

c) If the net mask for the IP address found in (b) is 255.255.255.224, what is the broadcast address of the network?

[3]

d) With the help of diagrams, describe the following routing strategies:
  (i)     Fixed routing
  (ii)    Adaptive routing
  (iii)   Random routing

[8]