

UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE

MAIN EXAMINATION 2007

TITLE OF PAPER: DATA NETWORK AND CODING THEORY II

COURSE NUMBER: CS438

TIME ALLOWED: THREE HOURS

INSTRUCTIONS: ANSWER QUESTION 1 AND ANY OTHER **THREE**
QUESTIONS.

EACH QUESTION CARRIES **25 MARKS.**

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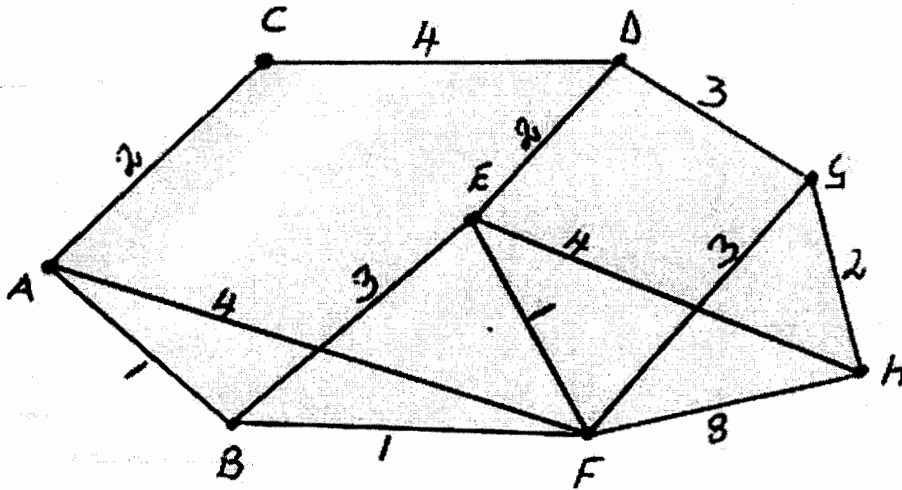
QUESTION 1 (Compulsory)

a) 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.

[5]

b) Apply Dijkstra's routing algorithm to the network of routers shown below



[6]

- c) Given the IP address **192.168.4.65/26**, what is the:
- i. The total number of bits used for the network address
 - ii. The total number of bits used for the host address.
 - iii. Broadcast address

[4]

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

[4]

e) Describe the three-way handshake of TCP.

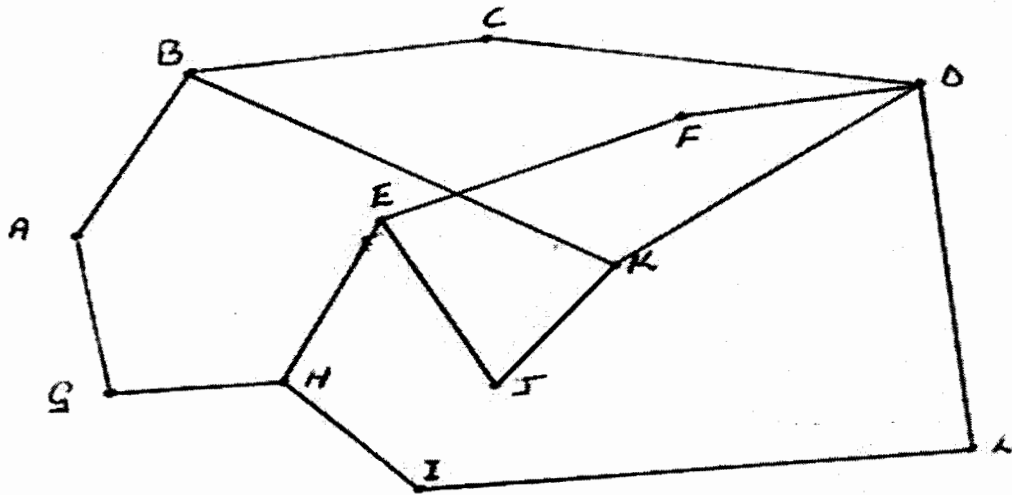
[3]

f) The Domain Name System (DNS) provides an important service in the resolution of Internet names and addresses. Explain the difference between a name and an address, giving examples of each.

[3]

QUESTION 2

- a) How is the IPv4 header checksum calculated? [3]
- b) What is a socket in TCP/IP? [3]
- c) Into how many classes can an IP address fall into, and how do you determine which class it belongs to? [4]
- d) Compute a multicast spanning tree for router J in the subnet below for a group with members at routers B, C, D, F, I, K and J. [4]



- e) Using the subnet diagram in (d), how many packets are generated by a broadcast from A using [6]
- (i) reverse path forwarding?
 - (ii) sink tree?
- f) What causes congestion in data networks? [6]

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 the RSA encryption method. [6]
- d) How does public key cryptography differ from private key cryptography? [3]

- e) What is a socket in TCP/IP? [3]
- f) Describe the following routing strategies: [5]
- (i) Fixed routing
 - (ii) Adaptive routing
 - (iii) Random routing

QUESTION 4

- a) Describe how machine A with IP address 192.168.10.20 sends a packet to machine B with IP address 192.168.10.25, and how machine A sends a packet to machine C with IP address 196.24.64.55. Assume that all networks use the default network masks. [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? [5]
- 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. The protocols used are SMTP and POP3. [5]
- d) Write the pseudo code for a network program that acts as a server and is coded using sockets. [4]
- e) Describe the leaky bucket method of congestion control. [5]

QUESTION 5

- a) Describe the sequence of events that occur when a user on a PC in the Computer Science lab accesses the url <http://www.iee.org>. [5]
- b) What is the function of ARP? [4]
- c) Describe how you would use a firewall to make an organizations' network secure. [4]
- d) Calculate the number of fragments which are sent when an IP datagram with payload of 3000 bytes is sent from a computer on network A via two routers to a destination computer C. The MTU of network A is 4000 bytes. The MTU of network B is 512 bytes and for network C the MTU is 1500 bytes. Your answer should specify the number and size the of the IP datagrams sent on each of the LANs. [5]

e) An Ethernet protocol analyser observes the following frame:

```
00e0 f726 3fe9 0800 2086 354b 0800 4500
0026 ab49 4000 ff11 f700 8b85 d96e 8b85
e902 99d0 043f 0012 7228 6865 6c6c 6f68
656c 6c6f
```

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

- (i) Ethernet Destination Address
- (ii) Destination IP 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).

You should assume the packet starts with a Medium Access Control (MAC) header.

[7]