

UNIVERSITY OF ESWATINI

Faculty of Science and Engineering

Department of Computer Science

MAIN EXAMINATION - JUNE 2019

**Title of Paper: NETWORKS AND CODING THEORY II / COMPUTER
NETWORKS II**

Course Number: CS438/CSC432

Time Allowed: 3 hours

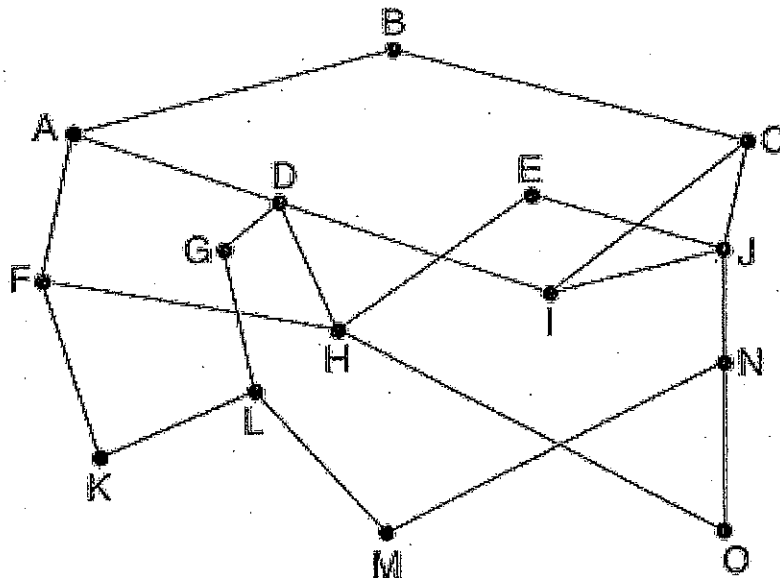
Instructions to candidates:

*This question paper consists of FIVE (5) questions. Answer any FOUR (4) questions
Marks are indicated in square brackets.
All questions carry equal marks (25 Marks Each).*

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THE INVIGILATOR.

QUESTION 1

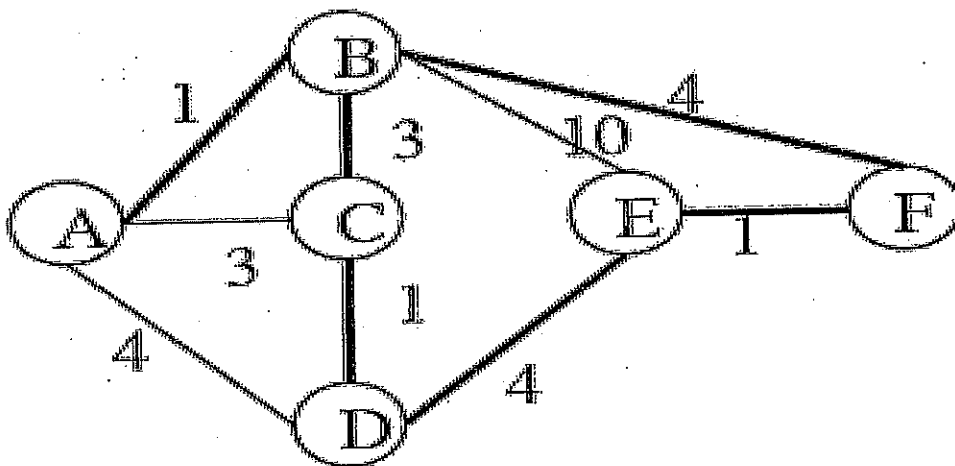
- a) State 4 functions of the router. What services are provided by the network layer? Why is it important for routers to know about all of the possible routes through a network topology? [6]
- b) Distinguish between store-and-forward packet switching and cut-through packet switching? [2]
- c) Explain the encapsulation and de-encapsulation processes at the network layer. Clearly outline the processes involved in both the sender and receiver side. [5]
- d) A TCP entity transmits 10,000 bytes of data in 2,000 byte segments (thus, including the TCP header, there will be 2,020 bytes of IP data for each segment). The IP entity is operating with a Maximum Transmission Unit (MTU) of 1024 bytes. Calculate how many packets and their sizes the IP entity will transmit and justify your answer. (You may ignore errors and assume that the standard IP header is used). [5]
- e) Looking at the network of below, how many packets are generated by a broadcast from B, using
- (i) reverse path forwarding?
 - (ii) the sink tree?



[7]

QUESTION 2

- a) What is routing? Distinguish between static and dynamic routing algorithms and list 2 examples of each type. [5]
- b) Distributed routing algorithms in communications systems are designed to provide a fault-tolerant computation of end-to-end paths in the event of link or router failure (or repair).
- Describe how this occurs, using as an example the distance-vector algorithm. [4]
 - Distance-vector routing is said to be slow to react to changes. Explain with some illustrations why this is the case, and outline why link-state protocols are therefore preferred in today's Internet. [9]
- c) Consider the network represented by the directed graph below. Show the operation of Dijkstra's (Link State) algorithm for computing the least cost path from E to all destinations. Also, explicitly list the shortest path routes from E to all destinations that are the result of the algorithm's computation. Show the distance table that would be computed by the distance vector algorithm in B. [7]



QUESTION 3

- a) What is congestion? Explain causes of congestion and also outline a few congestion prevention algorithms? [7]
- b) How many classes can an IP address fall into, and how do you determine which class it belongs to? [5]
- c) What are private and public IP addresses? [3]
- d) Given the IP network 196.100.2.0, how many subnets would result if the maximum number of hosts per subnet is 30? What is the subnet mask? [5]
- e) Distinguish between TCP and UDP, indicating where it is suitable to use one over the other. [5]

QUESTION 4

- a) What is a socket in TCP/IP? [2]
- b) Explain the difference between HTTP and HTTPS. [3]
- c) Describe how email works. In your description you should include how an end user gets to read the email using the appropriate client. [5]
- d) What are the functions of the following internet protocols?
 - ICMP
 - ARP
 - DHCP[3]
- e) What is the relationship between the **Internet** and **WWW**? [2]
- f) A large number of consecutive IP addresses are available starting at 198.16.0.0/16. Suppose that four organizations, A, B, C, and D, request 4000, 2000, 4000, and 8000 addresses, respectively, and in that order. For each of these, give the first IP address assigned, the last IP address assigned, and the mask in the w.x.y.z/s notation. [6]

- g) The only entries in a certain route table are (128.59.28.0/22, port 0), (128.59.28.0/23, port 1) and (128.59.28.0/24, port 2). These entries indicate CIDR network number, the prefix indication and the corresponding port to which a packet should be forwarded. If a packet arrives with a destination IP address equal to 128.59.29.18, which port will this router forward the packet to? [4]

QUESTION 5

- a) What are different ways of securing a computer network? [3]
- b) One way of securing a network is through the use of passwords. What can be considered as good passwords? [2]
- c) Explain briefly what is meant by confidentiality, integrity and authentication. [6]
- d) Compare and contrast symmetric key cryptography (typified by the use of the DES algorithm), with public key cryptography (typified by the use of the RSA algorithm). In your answer you should list the major features of these approaches, but not discuss the details of DES or RSA. [6]
- e) Briefly explain what a firewall is. [3]
- f) With the aid of appropriate examples explain how transposition and substitution ciphers work. [5]

End of Question Paper