

**UNIVERSITY OF SWAZILAND  
FACULTY OF SCIENCE  
DEPARTMENT OF ELECTRONIC ENGINEERING**

**MAIN EXAMINATION 2007/08**

- TITLE OF PAPER : COMPUTER NETWORKS & OPEN SYSTEMS  
INTERCONNECTIONS**
- COURSE CODE : ECO520**
- TIME ALLOWED : THREE (3) HOURS**
- INSTRUCTIONS : ANSWER ANY FOUR OUT OF THE FIVE QUESTIONS**
- EACH QUESTION CARRIES 25 MARKS**
- MARKS FOR DIFFERENT SECTIONS ARE SHOWN  
IN THE RIGHT-HAND MARGIN**

**THIS PAPER HAS 6 PAGES, INCLUDING THIS PAGE**

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**QUESTION ONE**

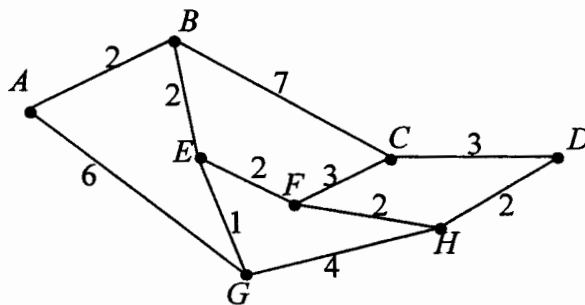
- (a) Identify the OSI reference model layers and briefly describe their principal functions.  
(14 marks)
- (b) Generate a polynomial codeword from the data sequence 1100, where the leading bit in the codeword represents the first sequence bit to enter the coder, for the generator polynomial  $x^3 + x + 1$   
(5 marks)
- (c) If a 50 byte IP packet (including all headers, etc.) is to be transmitted by Ethernet, how much padding of this is needed when put into an Ethernet frame  
(2 marks)
- (d) Differentiate between feedback-based flow control and rate-based flow control in the Data Link Layer's flow control mechanism  
(4 marks)

**QUESTION TWO**

- (a) Briefly explain how CSMA/CD handles medium access on a multipoint link  
(4 marks)
- (b) State the principal function of each of the following internet control protocols  
(i) ICMP (2 marks)  
(ii) RARP (2 marks)  
(iii) ARP (2 marks)
- (c) Television channels are 6 MHz wide. Assuming a noiseless channel, how many bits/s can be sent if 2 bits/sample digital signals are used?  
(3 marks)
- (d) Differentiate between a computer network and a distributed system  
(4 marks)
- (e) Give four typical characteristics that differentiate between LANs and WANs  
(4 marks)
- (f) Suppose a noisy channel has a signal-to-noise ratio of 30dB, and a bandwidth of 4 kHz. What is the maximum data rate possible for this channel?  
(4 marks)

### QUESTION THREE

- (a) Explain the two basic strategies that are used for dealing with errors in networks? (4 marks)
- (b) Briefly explain the principle of operation of the **Selective Repeat Protocol** (4 marks)
- (c) A channel has a bit rate of 4 kbps and a propagation delay of 20 ms. For what range of frame size does **stop-and-wait** give an efficiency of at least 50%? (5 marks)
- (d) By using Dijkstra's routing algorithm to the network of routers shown below, find the minimum distances and routes from node **A** to all other nodes. Also, sketch the graph of the resulting routes. (12 marks)



**QUESTION FOUR**

- (a) Using **CIDR** (Classless Inter-Domain Routing), an ISP called **ISP\_A** is allocated the prefix **203.85.0.0/16**. Allocate prefixes to five of its customers requiring **64, 64, 128, 1024** and **4096** host addresses. (10 marks)
- (b) Two hosts separated by 5 links, each with data rate of 10 kbps send a 5 kilobits file. Find the time to transfer the file between the two hosts using
- (i) message switching (2 marks)
  - (ii) packet switching, assuming that the file is segmented into 1 kilobit packets which are transmitted one after another (5 marks)
- (c) The IP network address **196.24.64.32** has a broadcast address of **196.24.64.63**. What is the network mask address? (3 marks)
- (d) A **56-kbps** slotted **ALOHA** channel is to be shared amongst a number of stations, each sending a 1 kilobit frame, on average one frame every 10 seconds. (Assume the sender can buffer frames to handle variations in successful sending versus this generation rate). What is the maximum number of stations this network can support (5 marks)

**QUESTION FIVE**

- (a) In the presence of pipelining, two types of sliding window data link protocols are used to deal with errors. Which are they?  
(2 marks)
- (b) With the help of sketches, briefly discuss the two network topologies that are commonly used in LANs for data transmission over short distances.  
(10 marks)
- (c) Find the link utilization for a 1000 m, 100Mbps fibre optic link when transmitting a 1500 byte frame using stop-and-wait protocol. Assume a propagation speed of  $2 \times 10^8$  m/s for a fibre cable.  
(5 marks)
- (d) Give any three attributes of the Open Shortest Path First (OSPF) routing protocol.  
(3 marks)
- (e) What is the fundamental difference between an interior gateway protocol and an exterior gateway protocol?  
(2 marks)
- (f) A bit string, 011110111110111110, needs to be transmitted at the data link layer. What is the string actually transmitted after bit stuffing?  
(3 marks)