Minia University
Faculty of Engineering
Computers and Systems Engineering department

Course: Computer Networks	Code: CSE 413	Date: 11/01/2020	Final Exam	Max. Degree: 90	Time: 3 Hrs.

- **Answer the following questions.**

Question 1:- **(20 Marks)**

A) Packet Switching and Circuit Switching,

1) Describe the difference between a packet switched network and a circuit switched network, and indicate when it is more advantageous to use each.

2) Calculate how long it takes to send a 1Mb file over a 1.5Mbps link with

1. A circuit switched network that uses 24 different frequency slots and a 500msec connection establishment time.
2. A 10-hop packet switched network where each link is a 1.5Mbps link. Assume no congestion and no packet segmentation.

B) How many links are there in a network with N computers when they are:

1. In a mesh topology.
2. In a star topology.
3. Partially connected, with each computer connected to three others

C) What is the difference between a hub and a switch? What effect does this have on the "collision domain"? When MUST you use a switch instead of a hub?

D) What is the difference between a switch and a router? What effect does this have on the number of times they must forward a message? When MUST you use a router instead of a switch?

Question 2:- ***(20 Marks)***

A) Assume a TCP host is expecting sequence number 2847. Describe what the TCP host does in each of the following scenarios:

1. The last packet received was already acknowledged. A new packet arrives with sequence number 2847 and 253 bytes of data in the message payload.
2. The last packet received not yet been acknowledged. A new packet arrives with sequence number 2847 and 253 bytes of data in the message payload.
3. The last packet received was just acknowledged. A new packet arrives with sequence number 3100 and 177 bytes of data in the message payload.
4. The last packet received had sequence number 3100 and 177 bytes of data in the message payload. A new packet arrives with sequence number 2847 and 253 bytes of data in the message payload.

B) Compare and contrast the properties of a centralized and a distributed routing algorithm. Give an example of a routing protocol that takes a centralized and a decentralized approach.

C) Compare and contrast static and dynamic routing algorithms.

D) Consider the following network shown in figure 1. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from *x* to all network nodes.

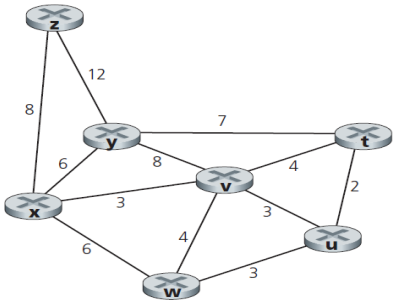

Figure **1.**

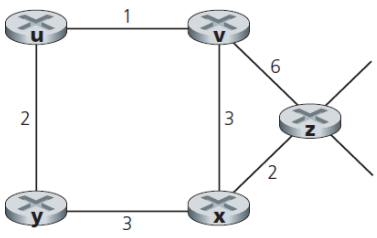

Figure 2.

Question 3: *(20 Marks)*

A) Consider the network shown in figure 2, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the distance table entries at node *z*.

B) If you had a completely reliable communication layer, your reliable transport layer would not need to do much: it would simply send each packet and, upon reception, deliver it to the application layer.

1. What reliability mechanisms would you need to add if your channel introduced bit errors?
2. What reliability mechanisms would you need to add if your channel also lost packets?

C) This elementary problem begins to explore propagation delay and transmission delay, two central concepts in data networking. Consider two hosts, A and B, connected by a single link of rate *R* bps. Suppose that the two hosts are separated by *m* meters, and suppose the propagation speed along the link is *S* meters/sec. Host A is to send a packet of size *L* bits to Host B.

1. Express the propagation delay, *d*prop, in terms of *m* and *s*.
2. Determine the transmission time of the packet, *d*trans, in terms of *L* and *R*.
3. Ignoring processing and queuing delays, obtain an expression for the end-to-end delay.
4. Suppose Host A begins to transmit the packet at time $t = 0$. At time $t = d\text{trans}$, where is the last bit of the packet?
5. Suppose *d*prop is greater than *d*trans. At time $t = d\text{trans}$, where is the first bit of the packet?
6. Suppose *d*prop is less than *d*trans. At time $t = d\text{trans}$, where is the first bit of the packet?
7. Suppose $S = 2.5x10^8$, $L = 120$ bits, and $R = 56$ kbps. Find the distance m *so* that *d*prop equals *d*trans.

D) What are some of the physical media that Ethernet can run over?

Question 4: **(20 Marks)**

A) Consider a router that interconnects three subnets: A, B, and C. Suppose all of the interfaces in each of these subnets are required to have the prefix 98.22.80.0/22. Suppose subnet A is required to support 500 interfaces, and subnets B and C are each required to support 250 interfaces. Provide network addresses for A, B and C (in the form a.b.c.d/x) that satisfy these constraints.

B) What is the 32-bit binary equivalent to the IP address 53.25.31.189 ?

C) Alice sends a message to Bob which is 4500 bytes long, and is broken into segments of 1200 bytes each. Alice chooses a random start value of 2400 for her sequence numbers.

1. How many segments will the message be broken into?
2. Give the start and end bytes of each segment
3. Give the ACK numbers which Bob will use to indicate that each segment was received uncorrupted
4. Suppose Bob chooses a random start of 852 for the sequence numbers (of his ACKs), and that he only sends headers (and no data) back to Alice. What will be the ACK numbers used by Alice in response to these ACKs?
5. Draw a brief Message Sequence Chart for the interaction.

D) Consider a router that interconnects three subnets: A, B, and C. Suppose all of the interfaces in each of these subnets are required to have the prefix 71.5.88.0/22. Suppose subnet A is required to support 500 interfaces, and subnets B and C are each required to support 250 interfaces. Provide network addresses for A,B and C (in the form a.b.c.d/x) that satisfy these constraints.

Question 5: **(20 Marks)**

A) Suppose 6 host machines and 1 router are connected by a company network consisting of 3 subnets. The configuration is given in the following table:

Subnets	Host IP address	Router IP address
66.25.48.0/22	66.25.48.1	66.25.48.44
66.25.52.0/23	66.25.52.1	66.25.52.22
66.25.56.0/23	66.25.52.2	66.25.56.11
	66.25.53.1	
	66.25.56.1	
	66.25.56.3	

1. Draw a diagram to represent this configuration.
2. Draw the forwarding table for the host machine with IP address 66.25.52.2
3. Draw the forwarding table for the router
4. Suppose an additional host machine is connected to the company network. For each of the following IP addresses, either give the subnet to which this IP address belongs, or state that it is not a valid IP address for any of the subnets.

- 66.25.50.1
- 66.25.58.1

B) When you design a new application-layer protocol you have to define 4 items. What are they?

C) What is the difference between persistent and non-persistent HTTP? Which version of HTTP supports both?

D) Suppose Client A initiates a Telnet session with Server S. At about the same time, Client B also initiates a Telnet session with Server S. Provide possible source and destination port numbers for

1. The segments sent from A to S.
2. The segments sent from B to S.
3. The segments sent from S to A.
4. The segments sent from S to B.
5. If A and B are different hosts, is it possible that the source port number in the segments from A to S is the same as that from B to S?
6. How about if they are the same host?

Best wishes