COMSATS University Islamabad

Department of Computer Science

Mid-Term Examination BS(CS) SPRING-2024

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Course Title: *CSC340 Computer Networks* **Maximum Marks:** 50

Dated: 17-04-2024 **Time Allowed:** 90 Min

Name: _____ *Reg no.* _____

---CLO-1 ---

--(Summarize the fundamental concepts of computer networks)

Q (1) = (6+6+3=15 Marks)

Part A.

There is a user of Facebook who wants connectivity to the nearest Facebook server which has15 routers on the way. The entire length of optical fiber cable is 6543 Km between two host entities. The average processing delay at each router is 2 msec and there is no congestion on the link, The propagation delay is subject to refractive index of optical fiber equal to 1.5, The speed of light is universal constant of 3x10^8 m/sec. Calculate the end-to-end delay of data in one direction. Ignore transmission delays.

Part B.

Consider the car-caravan analogy and assume a propagation speed of 100 km/hour.

1. Suppose the caravan travels 175 km, beginning in front of one tollbooth, passing through a second tollbooth and finishing just after a third tollbooth. What is the end-to-end delay?
2. Repeat (a), now assuming that there are eight cars in the caravan instead of ten.

Part C.

In wireless system, user can be located anywhere in coverage area and the behavior of system is to reduce the user bandwidth to half after going away from tower for each 1 Km due to signal weakening. The bandwidth at the tower is 10 Mbits per second. How much time is required to transfer 1 GByte data at 2.9 Km location from tower.

---CLO-2 ---

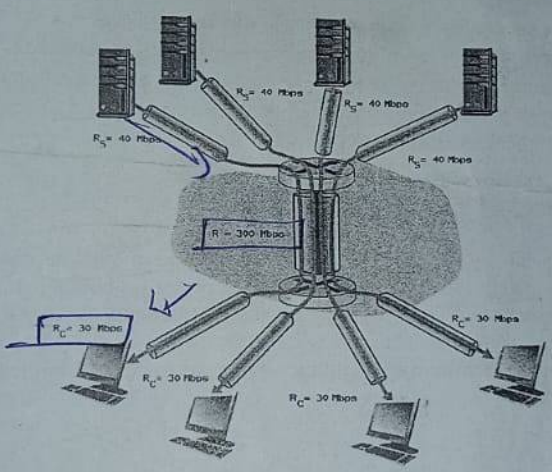
(Apply the concepts of computer networks to solve their related problems)

Q (2) = (7+7+6= 20 Marks)

Part A.

Consider the scenario shown below, with four different servers connected to four different clients over four three-hop paths. The four pairs share a common middle hop with a transmission capacity of R = 300 Mbps. The four links from the servers to the shared link have a transmission capacity of RS = 40 Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of RC = 30 Mbps.

1. What is the maximum achievable end-end throughput (in Mbps) for each of the four client-to-server pairs, assuming that the middle link is fairly shared?
2. Which link is the bottleneck link for each session?



Part B.

Suppose that the five measured SampleRTT values are 106 ms, 120 ms. Compute the EstimatedRTT after each of these SampleRTT values is obtained, using a value of $\alpha = 0.125$ and assuming that the value of EstimatedRTT was 100 ms just before the first of these five samples were obtained. Also compute the DevRTT after each sample is obtained, assuming a value of $\beta = 0.25$ and assuming the value of DevRTT was 5 ms just before the first of these five samples was obtained. Last, compute the TCP TimeoutInterval after each of these samples is obtained.

Part C.

Assign IP addresses for your new MAN (Metropolitan Area Network), which consists of 8 different buildings, each building will have 255 workstations. Your administrator tells you to only use as much of the 164.10.0.0 network as you need. Your administrator will assign the IP addresses to the serial interfaces

sing a different network. You will need to determine the following four items for each of the eight buildings·

1. Subnet masks
2. Network addresses.
3. Broadcast address for each subnet.
4. Valid host ranges on each subnet

---CLO-3---

(Analyze various protocols, algorithms, and their functions in a network)

Q (3) = (6+ 5+ 4= 15 Marks)

Part A.

Consider sending a 2600-byte datagram into a link that has an MTU of 700 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are the values in the various fields in the IP datagram(s) generated related to fragmentation?

Length	Id	More Fragment Flag	Offset
700		1	
700		1	
		0	
160		1	

Part B.

Host A and B are directly connected with a 100 Mbps link. There is one TCP connection between the two hosts, and Host A is sending to Host B an enormous file over this connection. Host A can send its application data into its TCP socket at a rate as high as 120 Mbps but Host B can read out of its TCP receive buffer at a maximum rate of 50 Mbps. Describe the effect of TCP flow control.

Part C.

Compare GBN, SR, and TCP (no delayed ACK). Assume that the timeout values for all three protocols are sufficiently long such that 5 consecutive data segments and their corresponding ACKs can be received (if not lost in the channel) by the receiving host (Host B) and the sending host (Host A) respectively. Suppose Host A sends 5 data segments to Host B, and the 2nd segment (sent from A) is lost. In the end, all 5 data segments have been correctly received by Host B

1. How many segments has Host A sent in total and how many ACKs has Host B sent in total? What are their sequence numbers? Answer this question for all three protocols.
2. If the timeout values for all three protocols are much longer than 5 RTT, then which protocol successfully delivers all five data segments in the shortest time interval?