



Terminal Examination – Semester Spring 2020

Course Title:	Data Communications and Computer Networks				Course Code:	CSC339	Credit Hours:	3(2,1)
Course Instructor/s:	Mr. Imran Raza, Dr. M. Hasanain Ch., Dr. Shahbaz Akhtar, Dr. Atif Saeed, Mr. Shuja				Program Name:	BS Computer Science, BS Software Engineering		
Semester:	5 th & 6 th	Batch:		Section:	All sections	Date:		
Time Allowed:	3 Hours				Maximum Marks:		100	
<u>Important Instructions / Guidelines:</u>								
<ul style="list-style-type: none">All questions are compulsory								

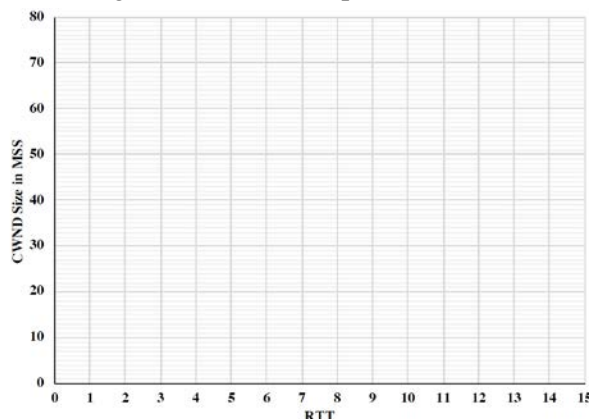
1. Suppose a new TCP congestion protocol TCPN is developed. It is similar to the congestion protocol we have discussed in the class but only has 2 phases: The Slow-Start phase and the Congestion-Avoidance phase. TCPN starts in the Slow-Start phase with CWND initially set to 1 (i.e., at RTT 0, CWND = 1), and ssthresh (slow-start threshold) set to 37. Its actions upon receiving each acknowledgement (Ack) in each of its phases are defined as follows. [15]

- Slow-start phase: for each Ack, $CWND += 2$
 - Congestion-Avoidance Phase: for each Ack, $CWND = CWND + 2 / CWND$
- When $CWND \geq ssthresh$, TCPN exits Slow-Start and enters the Congestion-Avoidance phase. On a packet loss, TCPN always goes back to the Slow-Start phase and adjusts as follows.
- $ssthresh = CWND / 4$
 - $CWND = 1$

Finally, when dividing, TCPN rounds numbers up to the nearest integer (e.g., $5/4 = 2$, $9/2 = 5$).

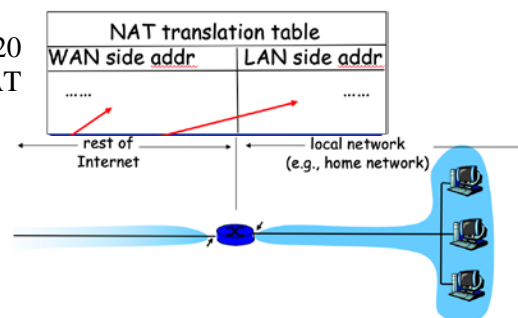
Based on the protocol described above, answer the following questions:

- Using TCPN, draw a CWND-size vs. RTT graph for the first 14 RTTs. Assume a packet loss is detected right after the 7th RTT has passed. Clearly label the CWND size value for each RTT. (10)
- Does TCPN ensure equal bandwidth sharing among multiple flows? Briefly explain why or why not. (2)
- Assume no loss happens and header size is negligible. Assume the MSS of your transport protocol to be 1500 bytes and RTT is fixed at 200 ms. Calculate the average throughput (in Mbps) using TCPN for the first 5 RTTs. Assume $1 \text{ Mbps} = 10^6 \text{ bps}$. (3)

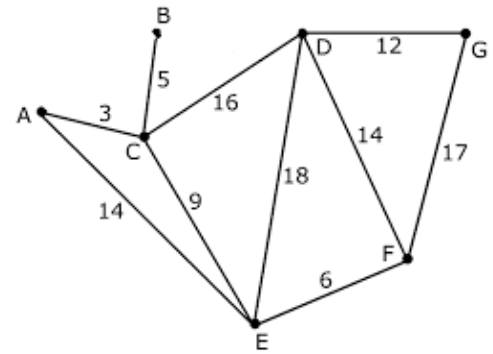


2. Consider the given network setup, suppose that the ISP assigns the router the address 12.14.102.215 and that the network address of the home network is 172.16. 0.0/16. [10]

- Assign addresses to all interfaces in the home network. (3)
- Suppose each host has six ongoing TCP connections, all to port 20 at host 118.109.20.96. Provide all corresponding entries in the NAT translation table. (7)



3. Consider the network shown below: [15]
- Show the operation of Bellman Ford's (Distance Vector) algorithm for computing the least cost path from **F** to all destinations. Only compute the table of **F**. (5)
 - Identify the path with the "count to infinity" problem and discuss its impact on the convergence of the algorithm in case of a change in the link cost. Why? Will it be resolved on its own? Assume that the poison reverse is not in use. (5)
 - Define Spanning Tree formally? Build a Minimum Spanning Tree (MST) using Reverse Path Forwarding (RPF) at node **F** to all nodes in the given network. (5)



4. Suppose Datagrams are limited to 1000 bytes (including header) between Host A and Router X. The MTU is 500 bytes (including header) between Router X and Router Y and the MTU is 1000 bytes (including header) between Router Y and Destination B. Assume an IP-header of size 20 bytes. In total, how many datagrams reach the destination B if the Host A is required to send an MP3 file of 8 million bytes? Explain neatly with the help of a figure the various fragments that are generated, their sizes, and all the key fields of the datagram like fragmentation offset, identifier, and flags (DF, MF). [10]

The network connection is as follows:

Host A → Router X → Router Y → Host B

5. Consider the Random Early Detection (RED) algorithm with MinThreshold = 100, MaxThreshold = 200, maximum buffer size = 250 and maxP = 0.1. Draw the curve that gives the packet drop probabilities for all values of average queue lengths. Suppose that a packet arrives when the average queue length is 140, what is the minimum probability that it will be dropped? What is the minimum probability that it will be dropped if the average queue length is 95? [10]
6. Consider a network comprising three nodes A (at Lahore), node B (at Karachi), and node C (at Multan) connected to the internet. The Web Server is in Peshawar and the DNS Server is in Quetta. [10]
- Node A in Lahore opens www.google.com in the browser. Do we need the DNS Server to open the website?
 - Before HTTP data can be sent or received from node A to the Web Server, what must be established first?
 - How does the webserver in Peshawar differentiate between the connections, if all three nodes (A at Lahore, B at Karachi, and C at Multan) opens www.google.com in their respective browser?
 - If the DNS Server in Quetta goes down while transferring data between the web server and the host, will the communication be disrupted between the Web Server and nodes?
 - How does the Web Server differentiate between the communications if node C in Multan opens two instances of www.google.com website?
7. If the 11-bit hamming codeword received by the receiver is 10010100101. Assuming the even parity state whether the received codeword is correct or wrong. If wrong, then locate the bit having the error. [10]
8. Calculate CSMA/CD Efficiency for nodes attached to 9.5km long coaxial cable with a 100Mbps transmission rate and 820-bit packet. [10]
- Assume 2.3×10^8 m/s transmission speed in a coaxial cable.
 - Consider the transmission time as 8.2×10^{-5}
9. Develop a subnetting scheme for the network requirements given below. [10]
- Would you prefer using VLSM or FLSM for the given scenario? (2)
 - Identify the total number of required subnets? (2)
 - What is the subnet mask of each subnet? (3)
 - List down the subnet ids and host address range of all the subnets. (3)

IP address 206.178.1.0/24	
Segment	Hosts
Computer Science	112
Management Sciences	62
Media Studies	32
WAN Link 1	2
WAN Link 2	2
WAN Link 3	3