Indian Institute of Technology Delhi
Department of Computer Science and Engineering
COL334/672: Computer Networks
Minor Examination, Diwali 2021

Full Marks: 55 **Time: 2 hours**

All parts of the same question must be answered together
Be precise in your answers, and state any assumptions made
If there are multiple ways to perform a computation, state which one you are using

Question 1 [6+3+2 = 11 marks]
Replace $$ mentioned in the question with the last two digits of your roll number
(a) You want to download a Web page from www.iitkgp.ac.in; however, the IP address of the IITKgp server is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that 5 DNS servers are visited before your host receives the IP address from DNS; the successive visits each incur an RTT of (100-$$) ms. Further suppose that the Web page associated with the link contains three small objects (each can be encapsulated in one TCP segment). The RTT between the local host and the IITKgp server is (5+$$) ms. Assuming zero transmission time for the objects and the TCP connection being a non-persistent one, how much time elapses from when you clicked on the link until you received the full webpage? Further assume that the GET request can be piggybacked with the client ACK during the handshake procedure.

(b) You are running a video application iTube which runs over UDP. In iTube, you want to play a small video file hosted in the same IITKgp machine. The DNS resource record fetched in Q1(a) has a TTL of 30 minutes, and iTube has made the request 15 minutes after the DNS resolution. If the video file is small enough to be encapsulated in one UDP segment, what would be the total time to receive the video file? Use the RTT values from Q1(a). State any other assumptions made.

(c) A new user Ram has joined BitTorrent, but does not have any data chunks. Without any chunks, he cannot become an uploader for any of the other peers. How then will Ram get the first chunk?

Question 2 [8 marks]
Consider a simplified TCP version, where the congestion window size is measured in the number of segments. In additive increase, the congestion window size increases by one segment in each RTT. In multiplicative decrease, the congestion window size decreases by ⅓ rd (round up to the nearest integer if needed), and transmission resumes from there. Suppose that two TCP connections, C1 and C2, share a single congested link of speed 50 segments per second, and when the data rate in the link exceeds the link's speed, all TCP connections experience data segment loss. Assume that at time t, both C1 and C2 are in the congestion avoidance phase, with a congestion window of 10 segments. If C1's RTT is 50 msec and C2's RTT is 100 msec, what are their congestion window sizes after 1000 msec? Please show all the steps through a chart if necessary.

Question 3 [3x5 = 15 marks]

(a) What challenge do NATs introduce to the end-to-end Internet with respect to overcoming failures?

(b) In network-assisted explicit congestion control, how is congestion in the network signaled to the sender? Explain.

(c) For each of the items below, say if it increases, decreases, or doesn't affect the number of entries in the networks core routing tables, and briefly explain why:

(i) An organization with a spare /8 address allocation decides to divide it up into /16 address blocks and sell some of this space to anyone that wants IP addresses.

(ii) An organization which had already had IP prex 15.81.128/17 manages to buy 15.81.0/17.

(d) You join a small startup which doesn't have any funding, so you took your implementation of a simple router and are running it on a Linux box, using it as a router for your servers (instead of paying a regular Cisco router, say). As your company scaled, you started seeing some clients that use IPv6. Your servers understand IPv6, but your router doesn't. Describe two ways in which you can extend your router to handle IPv6 traffic.

(e) You are working from home and get a call saying that the servers are running extremely slow and they believe the servers are under a DOS attack. You think this is your competitor's job and use your Phone to ssh into your Linux machine. You decide to add an access control rule to block unwanted traffic and allow only legitimate traffic through your router TCP's protocol # is 6 and UDP's is 17. What rules will you add to do the following: - Allow all TCP traffic from (128.112.0.0/16) - Ban all traffic from 66.220.0.0/16 - Allow UDP traffic to server 69.65.28.126:3333 Your entries should have the following format:
<source IP, destination IP, protocol number, src Port, dst Port, 0 or 1>
(where 0 means deny, 1 means allow)

Question 4 [2x3 = 6 marks]

(a) Mention one advantage of Link State routing over Distance Vector.

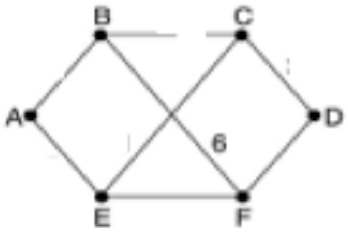
(b) Mention one advantage of Distance Vector routing over Link State.

(c) In Distance Vector routing, can count-to-infinity happen when a link is added to the network? Why or why not?

Question 5 [7 marks]

Consider the network given below, together with the link state information collected and

communicated by all nodes, and hence available to all nodes including A.

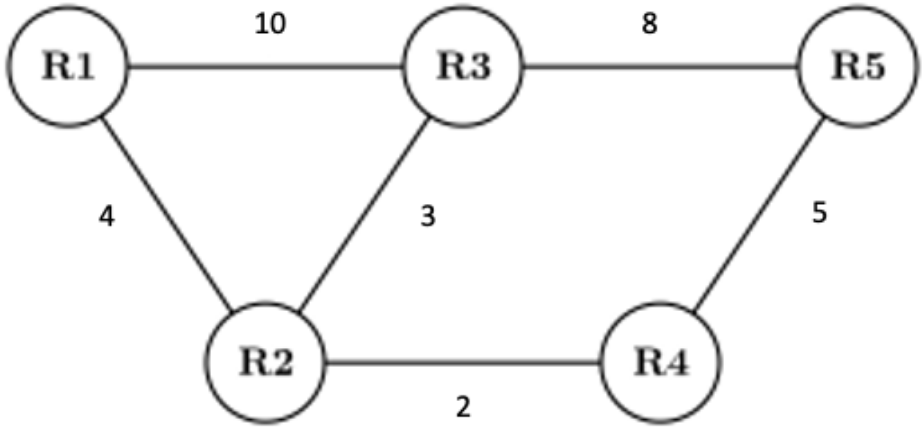


Link State Packets

A		B		C		D		E		F	
Seq.		Seq.		Seq.		Seq.		Seq.		Seq.	
Age		Age		Age		Age		Age		Age	
B	4	A	4	B	2	C	3	A	5	B	6
E	5	C	2	D	3	F	7	C	1	D	7
		F	6	E	1			F	8	E	8

Compute the shortest path tree rooted at A using Diskstra's algorithm. Show the intermediate steps. Use that to give the forwarding table at A.

Question 6 [4+4 = 8 marks]
Consider the network with link costs shown below



(a) Use the Bellman-Ford Algorithm to complete the table below. Each row in the table is the estimates at the ith iteration of the B-F algorithm for the estimate of distance & next hop to Router 5 for each of the routers R1-R4:

Iteration	R1	R2	R3	R4
1	∞	∞	8,R5	5,R5
2				
3				
4				
5				

(b) Now suppose the link between R3 and R5 fails. Using your final distance vector of part *a)* as your 0th iteration, how many iterations does it take for the B-F algorithm to converge to a new distance vector.

Iteration	R1	R2	R3	R4
0				
1				
2				