RE Exam.

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Munshinagar, Andheri(W), Mumbai-400058
COMPUTER DEPARTMENT
CE 51: Data Communication and Computer Networks,
B.Tech. III yr. (Sem. V)
End Semester Exam

Dt: 9/1/2023

Total:60 Marks

Instruction: *Keep your answers clear and concise, and state all of your assumptions carefully. Show all your work, Partial credit is possible for an answer, but only if you show possible intermediate steps in obtaining the answer.*

Answer ALL Questions:

Q.1
CO(1,2)

12

Q.1 (a) Assuming that the physical layer encodes .low. as the absence of an electrical signal and high. as the presence of an electrical signal, for which of the following encodings: i.) NRZ (Non-Return to Zero), ii) NRZI (Non-Return to Zero Inverted), iii) Manchester iv) 4-bit/5-bit, might the interface controller have difficulty in determining the end of the frame, and under what circumstances? Why not for the others? Draw necessary figure and explain. (8)

(b) Compared to TCP/IP reference model, the OSI Model has two additional layers. Where these layers in the stack are and what services do they provide? (4)

Q.2
CO(3)

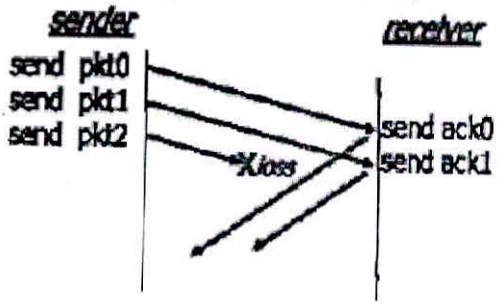
12

(a) Consider the sliding window protocol in Figure (a) and (b). (Note: In figure one can refer 'pkt' as 'frame', or as it is) (8)

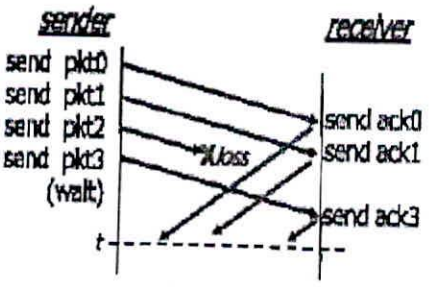
(i) Do these figures indicate that Go-Back-N is being used, Selective Repeat is being used, or there is not enough information to tell? Explain Your answer briefly for given figures (a) and (b).

(ii) Consider Figure (b) again. Suppose the sender and receiver windows are of size N = 5 and suppose the sequence number space goes from 0 to 15. Show the position of the sender and receiver windows over this sequence number space at time t (the Horizontal dashed line).

(iii) Suppose that it take 1 ms to send a packet, with a 10 ms one-way propagation delay between the sender and receiver. The Sliding windows size is again N = 4. What is the channel/link utilization?



(a)



(b)

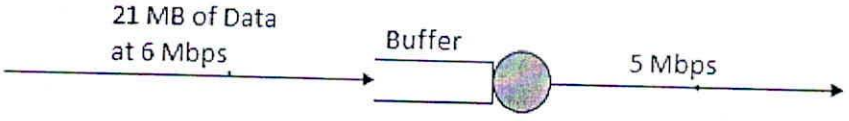
(iv) What is the one reason why Ethernet's exponential back-off might be better than randomizing retransmission attempts over a fixed-length time interval?

(b) Suppose you are designing frame structure of protocol named *Cracker*. It uses a specific bit pattern (flag field pattern - 01111110) to delineate the beginning or end of the frame, However if the flag pattern itself occurs elsewhere in the information field of packet then the receiver incorrectly detect the end of the *Cracker* frame. As a possible solution forbid upper layer protocol from sending data containing the flag field bit pattern, but *Cracker* requirement of transparency obviates this possibility. Therefore suggest the technique you will use that makes receiver to correctly detect the end of the *Cracker* frame and how it will work. (4)

Q.3
CO(4) 12

(a) (i) Compare leaky bucket algorithm with Token bucket w.r.t (i) Data rate (ii) Congestion Management (iii) Application (iv) Queuing (8)

(ii) Computer A has to 'inject' 21 MB of data into the network. The data is generated and transmitted in bursts of 6 Mbps. The minimum sustainable transmission rate across routers in the network is 5 Mbps. If computer A's transmission is shaped using a leaky bucket (see figure below), what is the minimum size of the buffer to prevent any data loss?



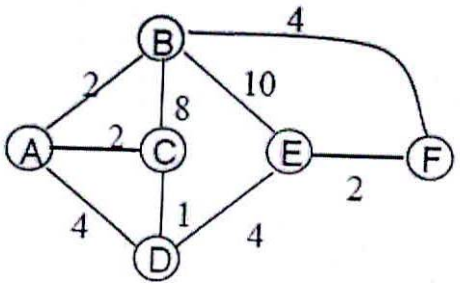
(b) Describe two changes that were made when designing IPv6 that speed up packet processing and forwarding compared to IPv4. Briefly explain How these changes speed up packet processing and forwarding. (4)

OR

Q.3
CO4 12

(a) Consider the network shown below (8)

(i) Show the operation of Dijkstra's (Link State) algorithm for computing the least cost path from E to all destinations.



(ii) What are distance vectors in nodes E, D, and C? In one or two sentences, explain how the least cost path from E to A was determined by E based on these three distance vectors. (*Hint: you do not have to run the distance vector algorithm; you should be able to compute distance vectors by inspection)*

(iii) Let us focus again on node E and distance vector routing. Suppose all distance vectors have been computed in all nodes and now suppose that the link from E to B goes down. Approximately how many distance vector messages will be sent by node E as a result of this link going down? Explain your answer.

(b) Assume a datagram of size 5000 bytes crosses 5 different networks segments on its way from sender to receiver. The smallest MTU of all network segments is 820 bytes. (4)

(i) In how many datagrams does the original datagram have to be fragmented in

(ii) At which point in the network does the fragmentation occur?

(iii) Show the length, ID, frag flag, and offset fields of the IP header of each fragment.

(iv) At which location are the IP fragments reassembled? Explain Your answer.

Q.4
CO4

12

(a) (i) Referring to following figure answer following question and justify them. (8)

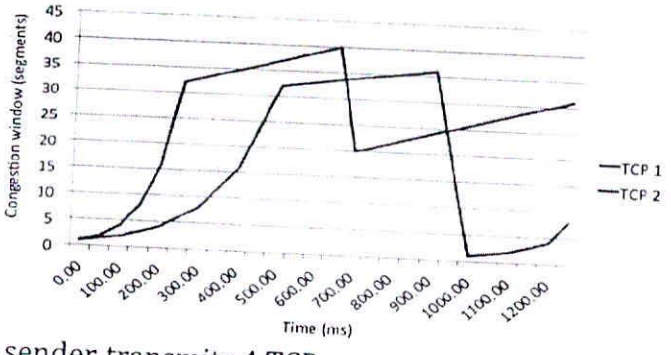
a) For the *TCP 1 and TCP 2* transmission, identify the time intervals when TCP Slow start is operating respectively

b) For the *TCP 1* transmission, identify time intervals when congestion avoidance is Operating

c) For the *TCP 2* transmission is the segment loss detected by triple duplicate ACK or by timeout?

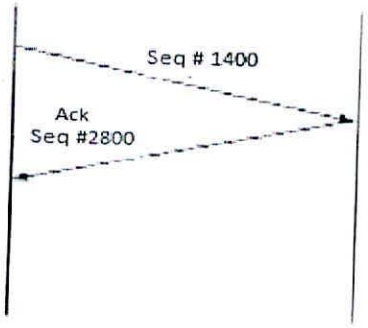
d) What is the initial value of ssthresh?

e) In general, explain the purpose of the receiver-advertised window in TCP.



f) Assume a TCP sender transmits 4 TCP segments with respective sequence

numbers 1400, 2800, 4200, 5600. 7000. The sender receives four acknowledgements with the following sequence numbers, 2800, 2800, 2800 and 2801. Complete following figure to show what TCP segments are exchanged between sender and receiver.



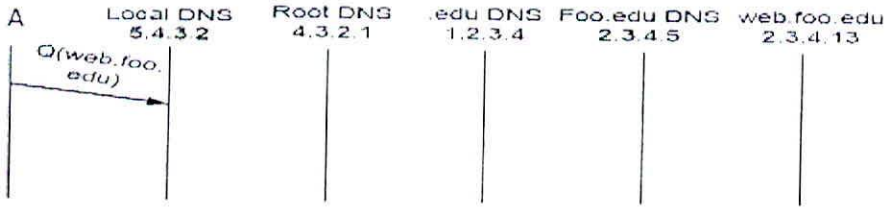
(b) (i) Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110. a) How much data is in the first segment? Suppose that the first segment is lost but the second segment arrives at B. In the acknowledgment that Host B sends to Host A, what will be the acknowledgment number?. (4)

(ii) Does UDP require a mechanism to estimate the RTT between sender and receiver? Briefly explain your answer?

Q.5
CO4
12

(a) (i) Suppose that Wallace wants to send an email message to Grommit. What is the scope of SMTP to operate between them? This will involve four entities: Wallace's Mail client (for Email composition and sending), Wallace's Outgoing mail server, Grommit's incoming mail server, and Grommit's mail client (for Email retrieval and viewing). Between which of these four entities does the SMTP and IMAP Protocols operate? Simply Draw schematic view for this (8)

(ii) The diagram below shows a DNS query from a host A to its local DNS server. The IP addresses of all hosts are shown in the diagram. The label "Q(web.foo.edu)" specifies the query string. Complete the diagram showing all packets sent to resolve the name and continuing through the opening of a TCP connection to the web site and the first GET request. All arrows that represent DNS queries should have a label of the form "Q(a.b.edu)"and replies should have a label of the form "R(b.edu=2.3.7.11)". TCP connection packets should be labeled with the appropriate flags and HTTP packets with the request type. Assume that the local DNS server performs recursive processing and has nothing in its cache, while the others perform iterative processing.



a) List all the mappings in the local DNS server's cache after the query has been processed.

b) List the mappings in the local server's cache if the .edu server did recursive processing rather than iterative.

(b) Further suppose that the web.foo.edu page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT_0 denote the RTT between the local host and the *web.foo.edu* server containing the object. (4)

(i) Assuming zero transmission time of the object, how much time elapses from when the client clicks on the link until the client receives the object?

Now for following questions (ii-iv) assume the HTML File references seven very small objects on the same server. Neglecting Transmission times, how much time elapses with

(ii) Non-persistent HTTP with no parallel TCP connections?

(iii)Non-persistent HTTP with the browser configured for 5 parallel connections?

(iv)Persistent HTTP?