

Computer Networks (CS3001)

Date: December 20th 2024

Course Instructor(s)

Dr. Umar Aftab & Ms. Sumaira Mustafa

Final Term Exam (Subjective)

Total Time (Min): 130

Total Marks: 102

Total Questions: 05

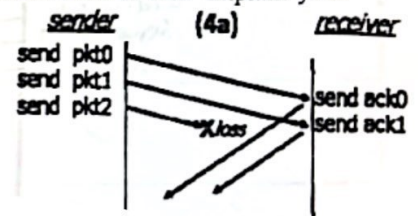
	Q1(Obj) CLO#2	Q2 CLO#2	Q3 CLO#3	Q4 CLO#3	Q5 CLO#2	Total
Total Marks	40	18	17	15	12	102
Marks Obtained						

Can the questions.

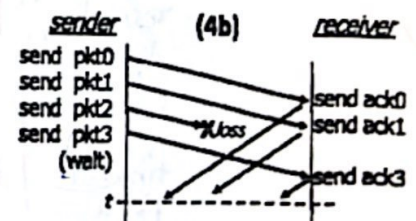
CLO #2: Describe utilization of network protocol concepts vis-a-vis OSI and TCP/IP stack.

Q2: Answer the following questions. [18 Marks]

- A. Consider the sliding window protocol in Figure (4a) to the right. Does this figure 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. [3 Marks]



- B. Consider the sliding window protocol Figure (4b) to the right. Does this figure 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. [3 Marks]



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- C. Consider Figure (4b) again and use the answer of part B. Suppose the sender and receiver windows are of size $N = 4$ and have sent four packets as in figure 4b. Suppose the sequence number space goes from 0 to 15. Show how the sliding window of the sender and receiver will grow over these sequence numbers at time t (the horizontal dashed line) in figure 4b. [3 Marks]

Sender Side Window:

0 1 2 3 4 5 6 7 8 9 10 11 12 ... → ~~0 1 2 3~~ → 0 1 2 3 4 5

Receiver Side Window:

~~0 1 2 3~~ → 0 1 2 3 → 0 1 2 3 4 → 0 1 2 3 4 5 (105)

- D. Suppose that it takes 1 ms to send a packet, with a 10 ms one-way propagation delay between the sender and receiver. The sliding window's size is again $N = 4$. What is the channel/link utilization? [4 Marks]

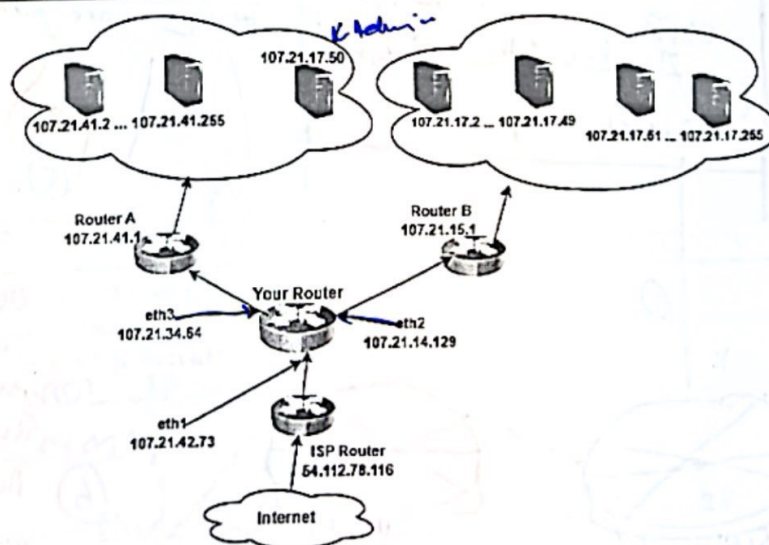
- E. Refer to Figure 4b above and the answer from part B. Suppose ACK0 and ACK3 are lost while propagating from the receiver to the sender, and packet pkt2 is lost during its propagation from the sender to the receiver. At time t , list all possible future events at the sender resulting from the ACKs currently in transit (including the lost ACKs and packet). For each event, specify the corresponding action taken by the sender. Draw a diagram (only) to explain how the loss of ACKs affects both the sender's and receiver's behavior. [5 Marks]

CLO #3: Demonstrate various classical routing and switching protocol via simulators.

Q3: Answer the following questions. [17 Marks]

- A. A website hosted on a single server becomes extremely popular, prompting the administrators to replace it with two sets of 200 servers (400 servers-total), connected to the Internet via two routers, **Router A** and **Router B**, for fault tolerance. These routers connect to the Internet via a router under your management (**Your Router**). Router A manages IP addresses in the range **107.21.41.2 - 107.21.41.255**, and Router B manages IP addresses in the range **107.21.17.2 - 107.21.17.255**. Subsequently, the administrators move the server with IP address **107.21.17.50** from the network behind Router B to the network behind Router A, without changing the server's IP address. Add default route for ISP. Reference network topology is explained in the Figure below. Perform static routing and write the routing table entries for **Your Router** to ensure correct packet routing between the Internet and the 400 servers, using the minimum number of table entries. Additionally, specify any modifications required in the routing table of **Your Router** after implementing the subsequent changes. [5 Marks]

Destination Network	Subnet Mask	Next Hop	Description (1 line Only)
107.21.41.0/16	255.255.255.0	107.21.42.73	
107.21.17.0/16	255.255.255.0	107.21.15.1	
107.21.17.50	255.255.255.0	107.21.15.1	



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B. Draw the architecture diagram of the SDN (Software-Defined Networking) controller including its components, control, and data plane. [6 Marks]

forwarding

C. Recall how the key components of the SDN interact with: the data plane (switches/routers) and the application layer applications. Assume a scenario where a switch in the SDN network fails. Explain by referring the above diagram (part B), how the SDN controller would detect and handle this failure using its distributed state management and communication layer. [6 Marks]

CLO #3: Demonstrate various classical routing and switching protocol via simulators.

Q4: Consider the below-given diagram as a corporate network. Answer the following questions. [15 Marks]

A. While considering the network prefix (no. of network bits) /24. Provide details against every subnet according to the provided format. [06 Marks]

Network ID _____, Broadcast ID _____

Subnet	Network ID	Broadcast ID	Useable IP Range
① 223.1.1.0	223.1.1.0	223.1.1.255	223.1.1.1 - 223.1.1.254
② 223.1.9.0	223.1.9.0	223.1.9.255	223.1.9.1 - 223.1.9.254
③ 223.1.7.0	223.1.7.0	223.1.7.255	223.1.7.1 - 223.1.7.254
④ 223.1.8.0	223.1.8.0	223.1.8.255	223.1.8.1 - 223.1.8.254
⑤ 223.1.2.0	223.1.2.0	223.1.2.255	223.1.2.1 - 223.1.2.254
⑥ 223.1.3.0	223.1.3.0	223.1.3.255	223.1.3.1 - 223.1.3.254

B. Considering the diagram draw the IPv4 datagram format. [06 Marks]

C. How many subnets are there? 6 [03 Marks]

CLO #2: Describe utilization of network protocol concepts vis-a-vis OSI and TCP/IP stack.

Q5: Answer the following questions. [12 Marks]

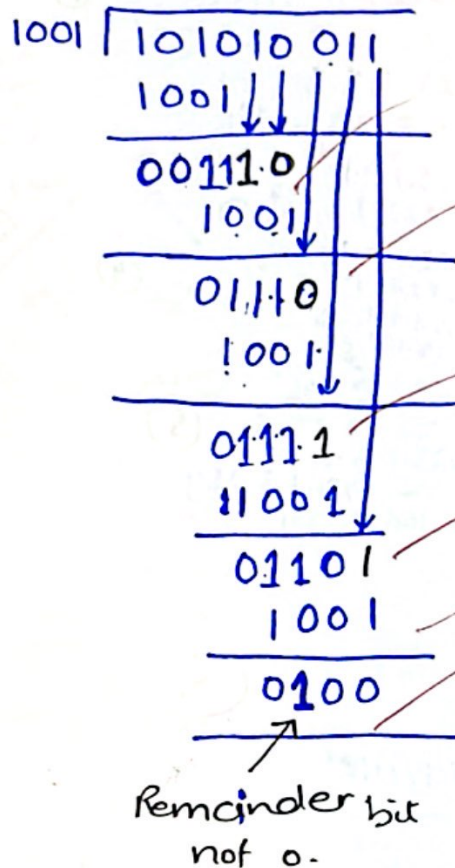
A. Consider the number 1010101010111, where the last bit is the parity bit. Detect the single-bit errors using even parity checking (if any). [2 Marks]

data | P
101010101011 | 1

There is no single bit error in the data as no of 1's including parity is even.

- B. Consider a scenario where 9 bits are received as $d=101010$ and $r=011$. Additionally, the generator $G = 1001$ is provided. Verify whether the data transmitted by the sender was received correctly using CRC. [10 Marks]

$$d = \underline{101010} \quad r = \underline{011}$$



Concept:

→ In CRC - the redundant bits are combined with the data bits and the generator $G = 1001$ is used as divisor.

→ we start doing XOR operations of the bits until we get a remainder.

∴ The receiver did not correctly get the received data as all bits of remainder have to be 0 but one of them is 1.

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