

Midsem

1. Short Answer Questions: Other than auto-graded questions, rest all require brief and to the point explanations. No marks for answers without explanation. This applies to the entire paper.

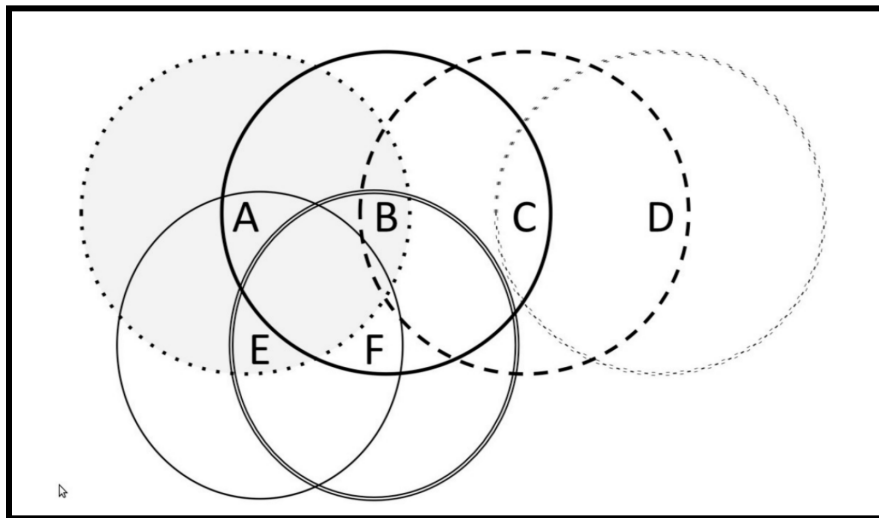
- a. **(1M)** A 1500 byte packet is sent from your home to a server. It is first sent over a 6 Mbps cable link. Once it has been received completely, it is then sent over a 100 Mbps ISP link. The propagation delay of the cable link is 1 ms and the propagation delay of the ISP link is 10 ms. How long does it take for the packet to reach the server in ms? Format X.xx (e.g. 26.75)
- b. **(1M)** What signal to noise ratio is needed to get a bit rate of 4 Mbps (mega bits per second) on a channel with 1MHz bandwidth? Format X (e.g. 10)
- c. **(1M)** The table below partially specifies a code. Determine the codeword corresponding to data 11 such that the code can be used to detect the presence of 1 or 2 errors in a codeword.

Data	Codeword
00	00 00 00
01	01 11 00
10	10 11 01
11	?

- d. **(1M)** Does 4B/5B encoding provide error detection capability? Explain.
- e. **(1M)** Fast Ethernet operates at 100Mbps (10 times faster than regular Ethernet). Supposing the maximum roundtrip propagation delay for Fast Ethernet is held the same as regular Ethernet i.e. 51.2us. What would be the minimum packet size used in Fast Ethernet in bytes? Format X (e.g. 22)
- f. **(1M)** Consider a TDMA system that has been allocated a total bandwidth of 10MHz that results in a total of 10Mbps data rate. The system employs a framing structure made up of 20 time-slots per frame. If a user is assigned one time-slot every other frame (i.e. one time slot every two frames), what data rate will he get? Express answer in kbps. Format X (e.g. 120)
- g. **(1M)** Why do protocols configured on top of Ethernet, need to specify the length of the packet as part of their header?
- h. **(1M)** Stop and wait protocol is being used on a link with a link speed of 4kbps and a one-way propagation delay of 20ms. For what range of frame

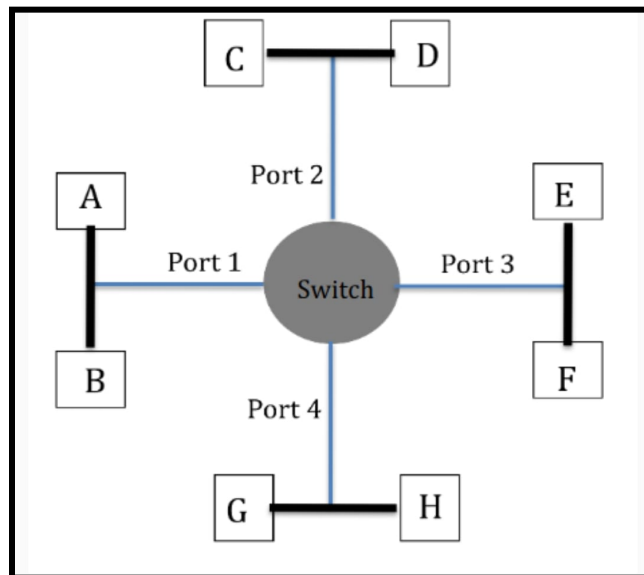
sizes does the protocol give an efficiency of at least 50 percent? Format symbol-bytes (e.g ≥ 100 or < 20)

- i. **(1M)** What information is contained in the forwarding table of a switch that employs virtual circuit switching?
2. **(4M)** Draw a timeline of the sliding window protocol where frames with sequence number 3 and 5 (first copies only) are lost. Assume $SWS=RWS=4$ and the packet sequence number starts from 0. Use a time-out of $2 \times RTT$ and assume that cumulative ACKs are employed. Also that the sender retransmits a frame on receiving the first duplicate ACK asking for it. Draw the timeline till the lost packets are successfully acked. State any other assumptions being made, they have to be reasonable to be considered. Provide brief explanation.
 3. Consider the wireless topology made of 6 nodes. Circles around each node represent the transmission range. This question is autograded. You need to get the entire set correct, this shows understanding. No partial credit, so be careful in your answer..



- a. **(1M)** If node A wants to transmit a frame to node B, list the potential hidden terminals for this transfer? Select all that apply.
 - C
 - D
 - E
 - F
- b. **(1M)** If node A wants to transmit a frame to node B, list the potential exposed terminals for this transfer?
 - C
 - D
 - E

- F
 - c. **(1M)** If nodeB wants to transmit a frame to nodeC, list the potential hidden terminals for this transfer? Select all that apply.
 - A
 - D
 - E
 - F
 - d. **(1M)** If nodeA wants to transmit a frame to nodeB, list the potential exposed terminals for this transfer?
 - A
 - D
 - E
 - F
 - e. **(1M)** What is the solution to the exposed node problem?
4. Consider the following extended LAN. Each LAN segment has 2 hosts. Assume at the very beginning, all forwarding tables at the switch are empty. The switch then uses learning to build the table. For each step in this sequence of transmissions, list which all ports the Ethernet frame is forwarded on by the switch. Note that after each of the transmissions, the switch remembers state from earlier transmissions.



- a. **(0.5M)** A sends to E
- 1
 - 2
 - 3
 - 4
 - Drop

- b. **(0.5M)** A sends to B
 - 1
 - 2
 - 3
 - 4
 - Drop
 - c. **(0.5M)** G sends to E
 - 1
 - 2
 - 3
 - 4
 - Drop
 - d. **(0.5M)** E sends to A
 - 1
 - 2
 - 3
 - 4
 - Drop
 - e. **(0.5M)** E sends to B
 - 1
 - 2
 - 3
 - 4
 - Drop
 - f. **(0.5M)** H sends to G
 - 1
 - 2
 - 3
 - 4
 - Drop
5. Consider three switches S1, S2 and S3. S1 needs to serve four groups: Red, Blue, Green and Yellow. S2 needs to serve two groups Red and Blue. S3 needs to serve two groups Red and Yellow. It is intended to hook up the three switches so as to form four VLANs corresponding to the four colors. Note that hosts belonging to a given color should be able to communicate with hosts belonging to the same color on other switches.
- In the answers below, specify clearly the number of ports needed on each switch to facilitate this interconnection and what color will be assigned to them.

- a. **(2M)** How would you interconnect the switches if no VLAN trunking can be employed? Choose a configuration that results in the least number of overall ports across all switches. Draw any figures neatly.
 - b. **(2M)** How would you interconnect the switches if VLAN trunking can be employed?
6. **(5M)** Given the below extended LAN, run the spanning tree protocol. Note that the LANs are labeled A to I. Use the notation bridge-LAN to identify a port. Ignore the host labelling, that is not relevant for this question. Answer the following with suitable explanation.
 - a. Which ports are designated ports for a given LAN?
 - b. Which ports are root ports?
 - c. Which ports are finally disabled.

