CS 5/7-344

Computer Networks & Distributed Systems

Fall 2023

Mid-term Exam

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Exam instructions

You are allowed the following resources for this exam:

- One sheet of notes (A4 – both sides)

Please put away all laptops and cell phones. You must use your own resources for this exam – sharing of resources is **not** allowed.

WHEN YOU HAVE COMPLETED THE EXAM, PLEASE SUBMIT YOUR EXAM AND NOTE SHEET. PLEASE PUT YOUR NAME ON BOTH ITEMS.

For instructor use only

Student Name: _____

SMU ID: _____

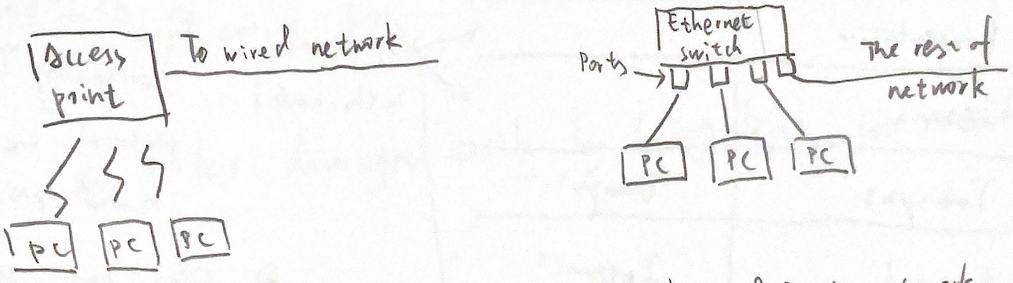
Problem	Points	Score
1	20	20
2	20	20
3	20	15
4	20	20
5	20	20
Total	100	95

TIME: 1 hour

1)

A. (10 points) Define **LAN**? Draw the **LAN** diagram for a small lab where you have **four** computers and **one** switch to connect with **Ethernet**.

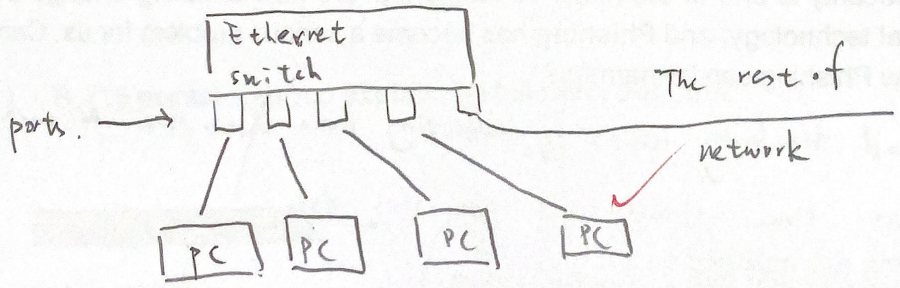
Sol: LAN: Local Area Networks.



The configuration on the left represents a wireless 802.11 network.

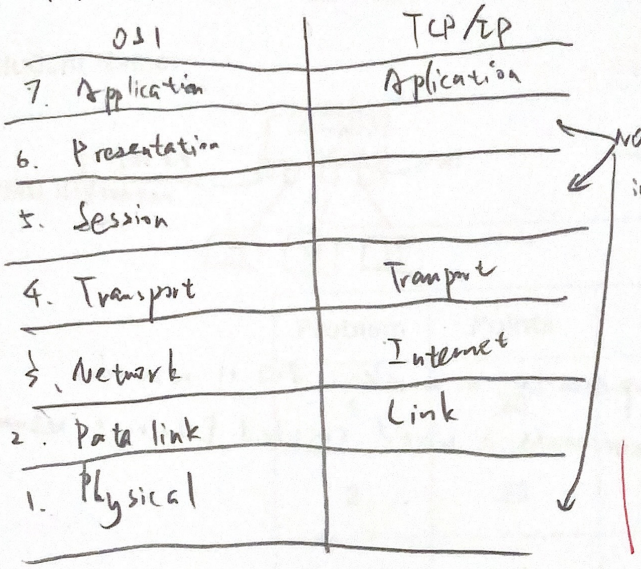
The configuration on the right represents a wired switched Ethernet network.

For the small lab:



B. (5 points) Write **two differences** between **OSI** and **TCP/IP** model.

Sol:



Difference:

① OSI Bad timing. competing TCP/IP protocols were already in widespread use.

② OSI has Presentation Session, Physical layers but those do not presence in the TCP/IP model See the figure left.

C. (5 points) Security is one of the major concerns that are now affecting a range of areas in Internet technology, and **Phishing** has become a serious problem for us. Can you explain how Phishing can be harmful?

Sol: ① Profilling and tracking users by collecting data about their network behavior over time. Phishing will get that data.

② Storing cookies in web browser, phishing can use that privacy information attack or stole money from user.

③ phishing can get the mobile service location, therefore it is quite danger for people who live alone.

Phishing messages masquerade as originating from a trustworthy party, for example, your bank, to try to trick you into revealing sensitive information for example, credit card numbers. Identity theft is becoming escalating problem as thieves collect enough information about a victim to obtain credit cards and other documents in the victim's name.

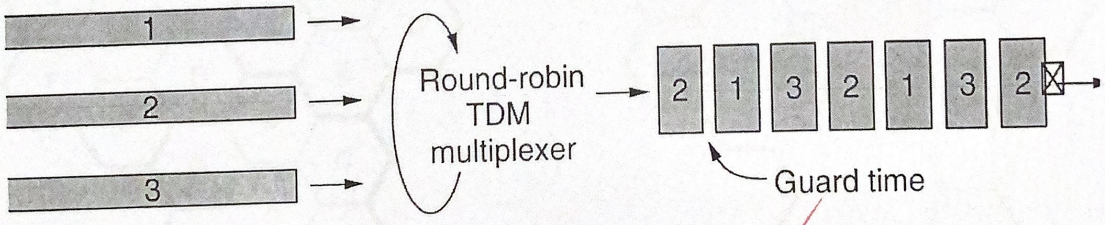
2)

A. (5 points) Write **two disadvantages** of **Fiber** Optics.

sol: ① Less familiar technology that requires specific engineering skills

② Fiber damaged easily by being bent too much.

B. (15 points) Can you **explain** the following diagram?



Time Division Multiplexing (**TDM**)

sol. Three separate data inputs are labeled as 1, 2, and 3. These represent different data sources that need to be transmitted over a single communication channel. Round-robin TDM multiplexer: This device takes the three data sources and combines them into a single data stream. It does this in a round-robin fashion, meaning it takes turns selecting from each source. As indicated in the image, the sequence it follows is 2, 1, 3. output sequence: The multiplexer's output is a combined data stream that sequences data from each source to get an equal opportunity to transmit its data. Guard Time: In between each set of data bits, there is a brief period called the guard time. This is a small interval used to prevent overlap or interference between data slots. It ensures that there's a clear separation between data from different sources. The diagram also indicates an unused slot at the end (represented by a crossed-out box) This could imply that there was no data available from any source at that time, or it could represent a damaged or lost slot.

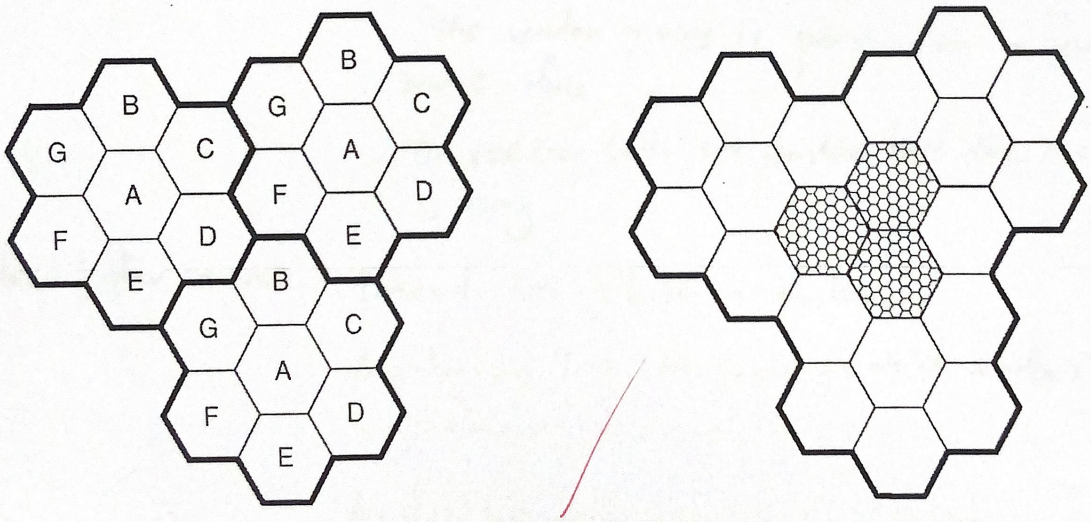
3)

A. (5 points) Write the **NRZ** (non-return to zero) form for the following bit stream.

10101110001

sol: 10111010001

B. (15 points) Can you **explain** the following **diagram**?



(a) (b)

(a) Frequencies are not reused in adjacent cells. (b) To add more users, smaller cells can be used.

sol: Cells A geographic region is divided up into cells ; allow for frequency reuse
At the center of each cell is a base station to which all the telephones in the cell transmit
The base station consist of a computer and transmitter/receiver connected to an
antenna. In a small system, all the base station are connected to a single device called
an MSC or MTSO. In a large one, several MSCs many be needed. all of which
are connected to a second-level MSC. and so on

4)

A. (5 points) Define **Error Control** and **Flow control**?

Sol: Error Control: Ensuring all frames are eventually delivered, to the network layer at the destination, in the proper order.

Ensuring reliable, connection-oriented service:

Requires acknowledgement frames and timers.

Flow Control: Controlling the sending of transmission frames at a faster pace than they can be accepted.

Feedback-based flow control: Receiver sends back information to the sender giving it permission to send more data, Or receiver tells the sender how the receiver is doing.

Rate-based flow control: Protocol has a built-in mechanism. Mechanism limits the rate at which senders may transmit data.

No feedback from receiver is necessary.

B. (15 points) Can you explain the following **two cases**, **network_layer_ready** and **frame_arrival**, with a few sentences?

```
switch(event) {
   case network_layer_ready:        /* the network layer has a packet to send */
          /* Accept, save, and transmit a new frame. */
          from_network_layer(&buffer[next_frame_to_send]); /* fetch new packet */
          nbuffered = nbuffered + 1;       /* expand the sender's window */
          send_data(next_frame_to_send, frame_expected, buffer);  /* transmit the frame */
          inc(next_frame_to_send);         /* advance sender's upper window edge */
          break;

  case frame_arrival:     /* a data or control frame has arrived */
          from_physical_layer(&r);         /* get incoming frame from physical layer */

          if (r.seq == frame_expected) {
                 /* Frames are accepted only in order. */
                 to_network_layer(&r.info);       /* pass packet to network layer */
                 inc(frame_expected);    /* advance lower edge of receiver's window */
          }
```

Sol: ① network_layer_ready:

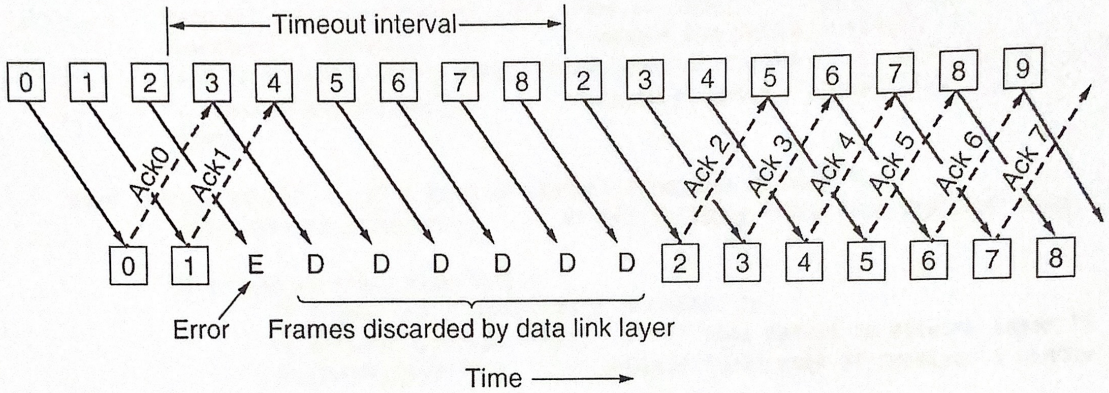
When the event is network_layer_ready, it will fetch new packet from network layer first and then add 1 to the sender's window. and then use the "send_data" function to transit the frame. When this finish use "inc" function to advance sender's upper window edge.

② frame_arrival:

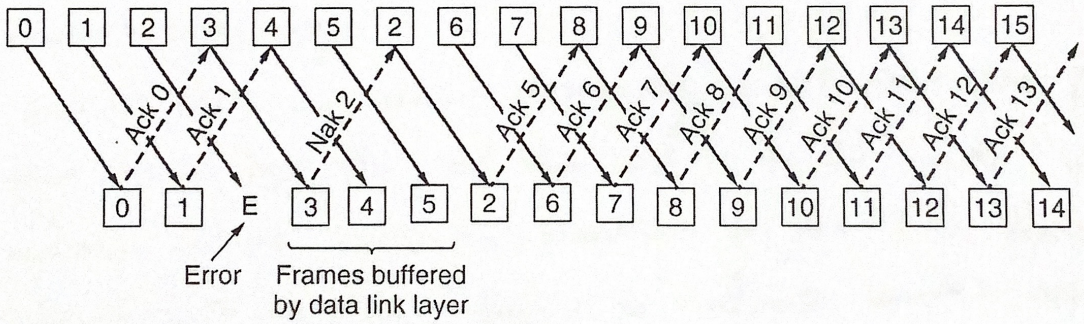
When the event is frame_arrival, it will get incoming frame from physical layer first. And then to check whether the frame is expected. if it is expected. it will pass packet to network layer. And then advance lower edge of receive's window.

5)

A. (20 points) Briefly explain **go-back-n** and **selective repeat** based on the following diagram.



(a)



(b)

(a) go-back-n (b) selective repeat

sol: In go-back-n, if a frame in the middle of a long stream is damaged or lost, the receiver just discards all subsequent frames, sending no acknowledgments for the discarded frames. This strategy corresponds to a receive window of size 1. In other words, the data link layer refuses to accept any frame except the next one it must give to the network layer. If the sender's window fills up before the time runs out, the pipeline will begin to empty. Eventually, the sender will time out and retransmit all unacknowledged frames in order, starting with the damaged or lost one. This approach can waste a lot of bandwidth if the error rate is high.

In the alternative strategy, the damaged or lost one. When it is used, a bad frame that is received is discarded, but any good frames received after it are accepted and buffered. When the sender times out, only the oldest unacknowledged frame is retransmitted. If that frame arrives correctly, the receiver can deliver to the network layer, in sequence, all the frames it has buffered. Selective repeat corresponds to a receiver window larger than 1.