1.a) For each of the following networks, discuss consequences if connection fails

1. Five devices arranged in a mesh technology

→ In mesh topology every device has a dedicated point to point link to every other device and it is robust. If one link becomes unstable, it does not incapacitate the entire system. So, if one connection fails, the other connections or devices will be still working. Thus if only any one connection fails, there is no effect on network and they can still communicate

2. Five devices arranged in star topology

→ Star runs to a central device like a switch, so if the switch itself fails then the whole network will be disconnected. Thus each device has dedicated point to point link to Hub. If any link goes down & connection fails so the reconfigure and sort out problem area.

3. Five devices arranged in bus topology.

→ In Bus topology, a backbone wire is connected with device and further taps and drop lines link the clients. If any link goes down so signals won't pass on and get back to origin which will create noise on both sides. And if the backbone wire is broken so the whole communication will be disabled.

4. Five devices arranged in ring topology.

→ Ring is like bus except it connect back bone onto itself so if one device fails they all fail. The exception is if

there is a redundant inside ring like that used in FDDI (fibre ring) then if both get disconnected from one device then they all do.

2. a) A system has n-layer protocal hierarchy. Applications generate messages of length M Bytes. At each of the layers, an h bytes header is added. How does information pass from one layer to next layer? List the design issue for it layering approach.

⇒ A system contains n-layers protocal hierarchy and h bytes of data are added at each layer so total number of header bytes is (n-1)*h

Each message generated by application is m-bytes long so add m with total number of header bytes is. Total message size is {(n-1)*h} + M Divide the total number of header file bytes by total number of message of message size to calculate fraction of bandwidth wasted {(n-1)*h} / [{(n-1)*h} + M]

A number of design issues exist for the layer to layer approach of computer networks. Some of the main design issue are as follows:

1) Reliability
Network channels and components may be unreliable, resulting in loss of bits while data transfer. So, an important design issue is to make sure that the information transferred is not distorted.

2) Scalability
Networks are continuously evolving. The sizes are continually increasing leading to congestion. Also when new technologies are

are applied to the added components, it may lead to an incompatibility issues. Hence, the design should be done so that the networks are scalable and can accommodate such additions and alterations.

3) Addressing
At a particular time, innumerable messages are being transferred between large numbers of computers. So, a naming or addressing system should exist so that each layer can identify the sender and receivers of each message.

4) Error control
Unreliable channels introduce a number of errors in the data streams that are communicated. So, the layers need to agree upon common error detection and error correction methods so as to protect data packets while they are transferred.

5) Flow control
If the rate at which data is produced by the sender is higher than the rate at which data is received by the receiver, there are chances of overflowing the receiver. So, a proper flow control mechanism needs to be implemented.

6) Resource Allocation
Computer networks provide services in the form of network resources to the end users. The main design issue is to allocate and deallocate resources to processes. The allocation / deallocation should occur so that minimal interference among the hosts occurs & there is optimal usage of the resources.

7) Statistical Multiplexing
It is not feasible to allocate a dedicated path for each message which it is being transferred from the source to the destination. So, the data channel needs to be multiplexed, so as to allocate a fraction of the bandwidth or time to each host.

8) Routing
There may be multiple paths from the source to the destination. Routing involves choosing an optimal path among all possible paths, in terms of cost and time. There are several routing algorithms that are used in network systems.

9) Security
A major factor of data communication is to defend it against threats like eavesdropping & surreptitious alteration of messages. So, there should be adequate mechanisms to prevent unauthorized access to data through authentication and by cryptography.

3. a) Wireless networks are easy to install, which makes them inexpensive since installation costs usually is negligible. Nevertheless, they also have some disadvantages. Discuss two of them and justify your answer.

→ The computer networks that are wireless means the computers are not connected with wires, are called wireless networks.
These networks help reduce cost of cables which are otherwise used to connect the nodes.
They make use of radio communication where radio waves are used to connect devices like laptops to the internet.

Disadvantages

1) Security issue
Security is a major concern in any form of communication. Wireless networks involves the risk of modification and eavesdropping. So they make use of certain encryption techniques for security. There are also authentication mechanism in place for the same. But it has been found some of the encrytion techniques can be easily compromised.

2) Reliability
Since wireless networks work with radio wave communication, the signal is affected by much interference It is also subjected to certain propagation effects. The movement of the user also creates instability in the signals. These disturbances to the signal may becomes difficult to handle for the network administrator.

3.b) Sender A wants to sends some data to Sender B. Consider that at data link layer, error detecting CRC with generator 10101 is used at DLL protocol layer. Assume CRC bits follow data bits in any transmission media.
i) Compute transmitted bit sequence for data bit sequence 011010101 that Sender A sends to receiver B
ii) Receiver B receives strings of bit as 110011001100. Is it acceptable, if so what is the data bit sequence?

→ i) Transmitted bit sequence:

Data bit sequence : 01101101

Generator : 10101

Step 1: Append 4 zeroes to the data bit sequence:

Dividend = Data word + 4 zeros

= | 01101101 | 0000 |

Step 2: Carry out division:

```
         11110111
10101 ) 011011010000
      ⊕ 10101
        11000
      ⊕ 10101
        011011
      ⊕ 10101
         01110 0
       ⊕ 10101
         010011
       ⊕ 10101
          0011000
        ⊕ 10101
           011010
         ⊕ 10101
            011110
          ⊕ 10101
             01011
```

Step 3: Code word:

Codeword = Dividend + Remainder

= | 01101101 | 1011 |

ii) Received word: 110011001100

Carry out the division as follows:

```
          11111100
10101 ) 110011001100
      ⊕ 10101
        011001
      ⊕  10101
         011000
      ⊕   10101
          011010
      ⊕    10101
           011111
      ⊕     10101
            010101
      ⊕      10101
             000000
```

Since the remainder is 0, the received codeword is ~~are~~ acceptable and does not contain errors, so it is acceptable.

Received codeword = | 11001100 | 1100 |