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Subject - Computer Networks

Roll No - 20BAIT0302 . slot - D11 + D12 + D13

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Q 1a) Layered architecture

- The main aim of layered architecture is to divide the design into small pieces.
- Along with interaction between subsystems, it provides modularity & clear interface.
- Any modification in a layer will not affect other layers since ensures independence between layers by providing the services from lower to higher layer without defining how the services are implemented.
- The data is passed from the upper layer to lower layer through an interface.
- A layered architecture provides a clean cut interface so that minimum info is shared among different layers.
- It also ensures that the implementation of one layer can be easily replaced by another implementation.
- A set of layers & protocols is known as network architecture.
- Each layer of the layered architecture can be analyzed & tested individually.
- It ensures independence of layers so that implementation in one layer can be changed without affecting other layers.

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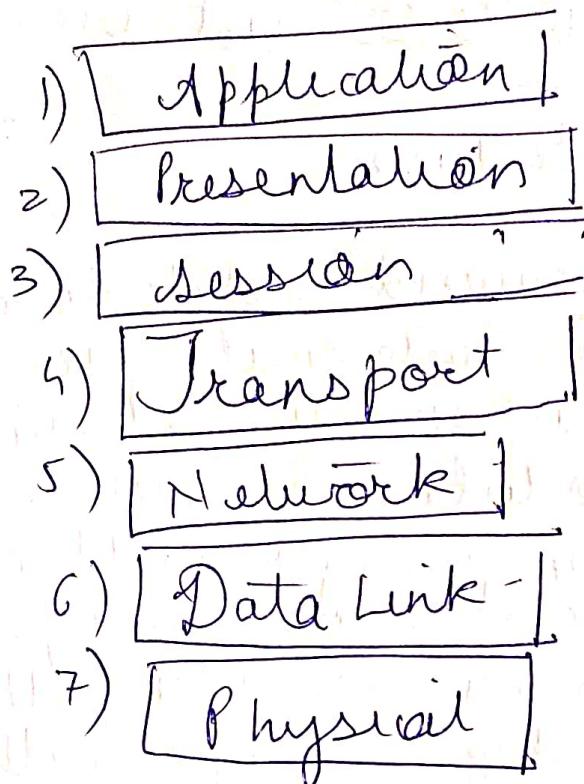
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- * Seven layers of the OSI model.



1) Physical Layer

- * Lowest layer.
- * Responsible for actual physical connection between devices
- * Contains information in the form of bits
- * Responsible for transferring data

2) Data Link Layer

- * Layer 2
- * Node to node delivery of message
- * Error free transmission of data

3) Network layer

- Transmission of data from one host to the other located in different networks.
- Takes care of selection of the shortest path to transmit the package (package routing)

4) Transport Layer

- Provides services to the application layer and takes services from the network layer.
- Data in this layer is called as segments.
- Responsible for end to end delivery of msg.

5) Session Layer

- Responsible for establishment of connection, maintenance of session, authentication & also ensures security.

6) Presentation Layer

- Also called transition layer.
- Data from application layer is entered here & manipulated as per required format.

7) Application Layer

- Top most layer of OSI model.
- Implemented by network application
- Works for application services to access the network & for displaying the received info to the user

Q2a)

Connection Oriented Service	Connectionless Service
<ul style="list-style-type: none">Designed and developed based on the telephone system	Based on postal system
<ul style="list-style-type: none">Creates a virtual path between the sender and the receiver	It does not create any virtual connection or path between sender and receiver
<ul style="list-style-type: none">Requires authentication before transmitting data packets to the receiver	Doesn't require authentication
<ul style="list-style-type: none">All data packets are received in the same order as those sent by the sender	Not all data packets are received in the same order as those sent by the sender.
<ul style="list-style-type: none">No congestion as it provides an end to end connection between sender and receiver during transmission of data	May be congestion due to not providing an end to end connection between source & receiver to transmit all all data packets.
<ul style="list-style-type: none">Requires higher bandwidth	Requires lower bandwidth
<ul style="list-style-type: none">More reliable connection service because it guarantees data packet transfer from one end to other end with a connection	Not reliable i.e. user doesn't guarantee data transfer.

(3)

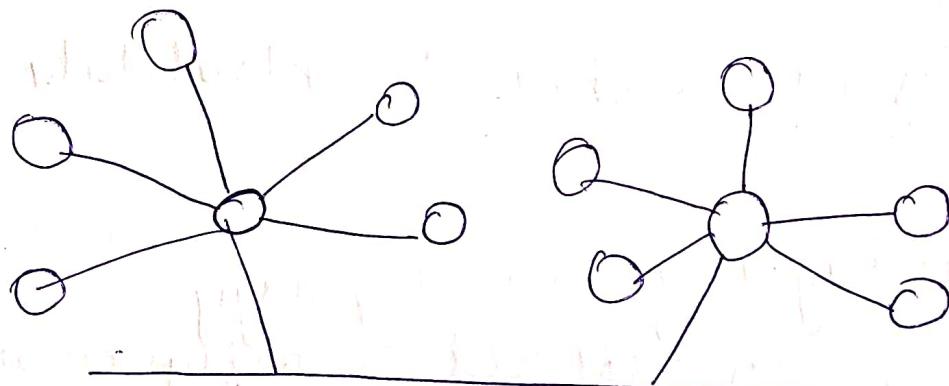
eg Transmission control
Protocol (TCP) is an
example of connection
oriented service

|
| a) Internet Protocol (IP)
| b) Internet control msg
| protocol (ICMP)

Q2 b). A tree topology is a special type of topology where many connected elements are arranged like the branches of a tree.

- Also known as Star bus Topology.
- Includes elements of both a bus & star topology.

Diagrams



Each node is a computer.

If the main cable (trunk) between 2 star topology networks fail, those networks would be unable to communicate with each other.

However, if computers on the same star topology would be able to communicate.

Advantages of Tree Topology

- Combination of bus & star Topology.
- Reliable
- Used in WAN.
- It is highly secure.
- Point to point wiring for individual signal segments
- Supported by several hardware and software vendors
- Provides easy maintenance & easy fault identification
- Other nodes not affected if one node gets damaged.
- Provides hierarchical & central data arrangement of nodes

Disadvantages of Tree topology

- Network is very difficult to configure as compared to others
- If bulk nodes are added, the maintenance will become complicated
- Treatment of the Topology is complex
- Require a larger no. of cables compared to star & ring topology.
- The length of the segment is limited & limited depends on type of cabling
- Slow network performance due to large no. of nodes

Q3

Generator polynomial: $n^3 + n^2 + 1$

$n^3 + n^2 + 1$ can be written as $n^3 + n^2 + 0 \cdot n + 1$

and is equivalent to 1101

message =

Message = 111011

As the length of the polynomial or divisor is 4. So 3 bits are appended

The diagram shows the division process:

- Divisor: 1101
- Dividend: 111011000
- Quotient: 1111
- Remainder: 1010 (circled in blue)

Arrows indicate the steps of subtraction and shifting.

Therefore CRC = 111

The transmitted code $m_5 m_4 m_3 m_2 m_1 m_0 c_1 c_0$ is

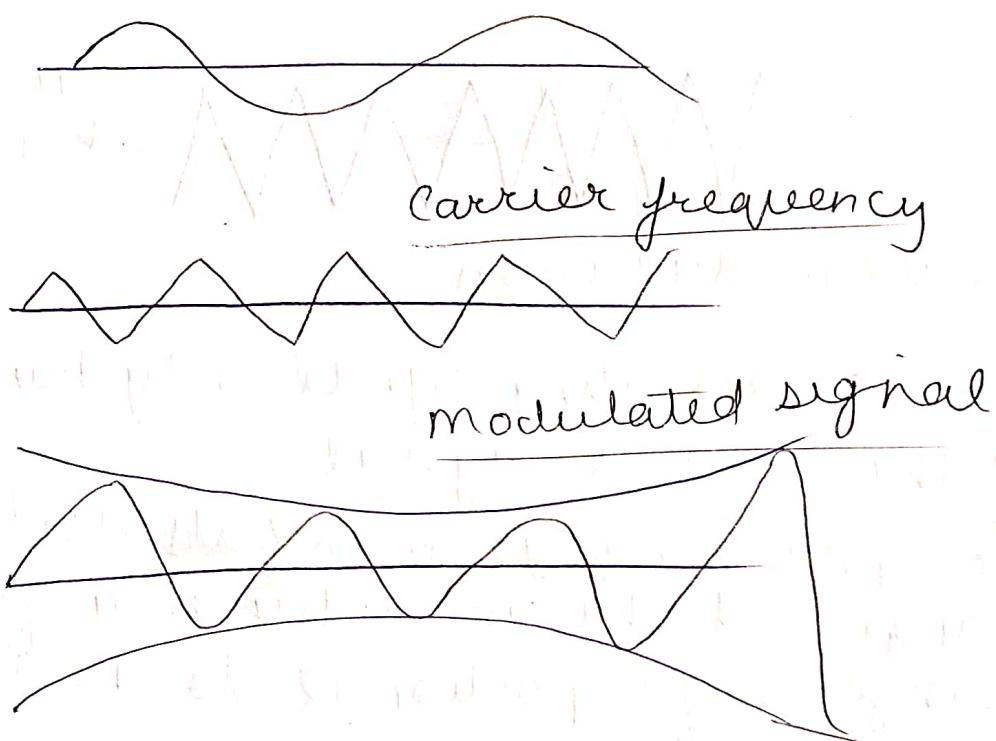
111011111

Q) The different types of analog modulation are:

(i) Amplitude Modulation.

- A carrier signal is modulated only in amplitude value.
- The modulating signal is the envelope of the carrier.
- Since both sides of carrier freq., the spectrum is identical we can discard one & half thus requiring a smaller bandwidth for transmission.

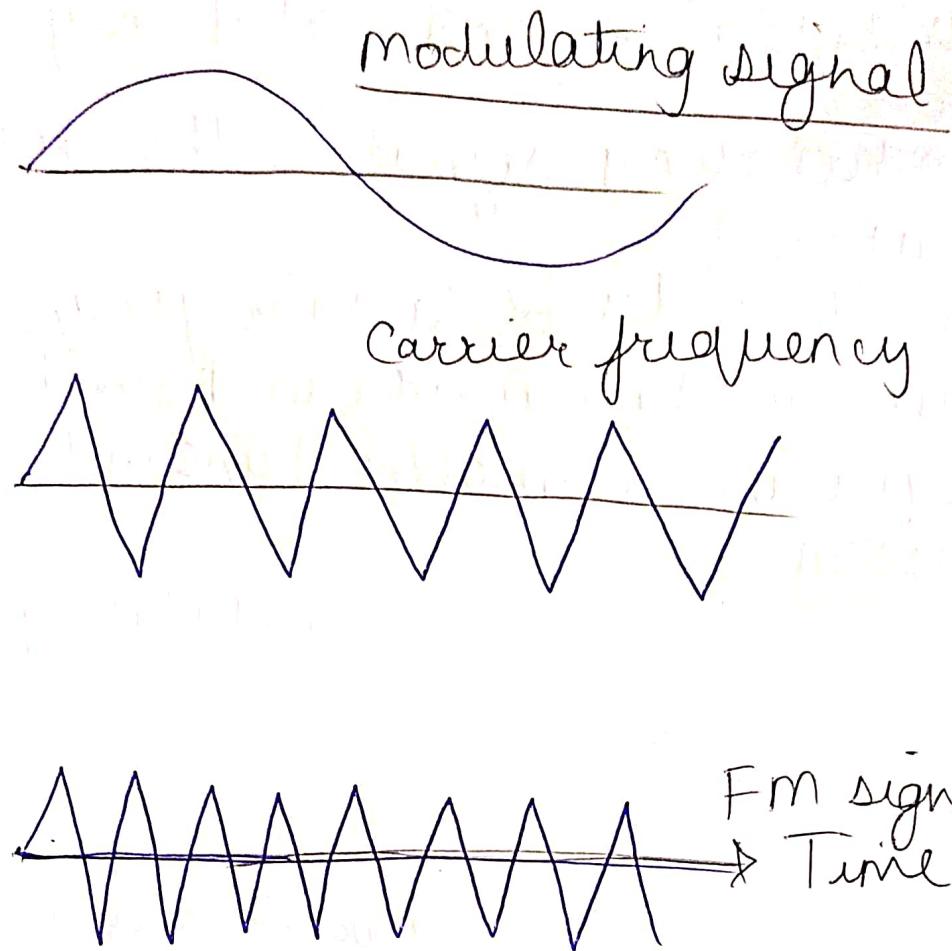
Modulating signal



(ii) Frequency modulation (FM)

- The modulating signal changes the frequency of the carrier signals.
- The Bandwidth of FM is high.
- It is approx 10x the signal frequency.

The total bandwidth can be determined by using $B_{FM} = 2(d+B)B$.

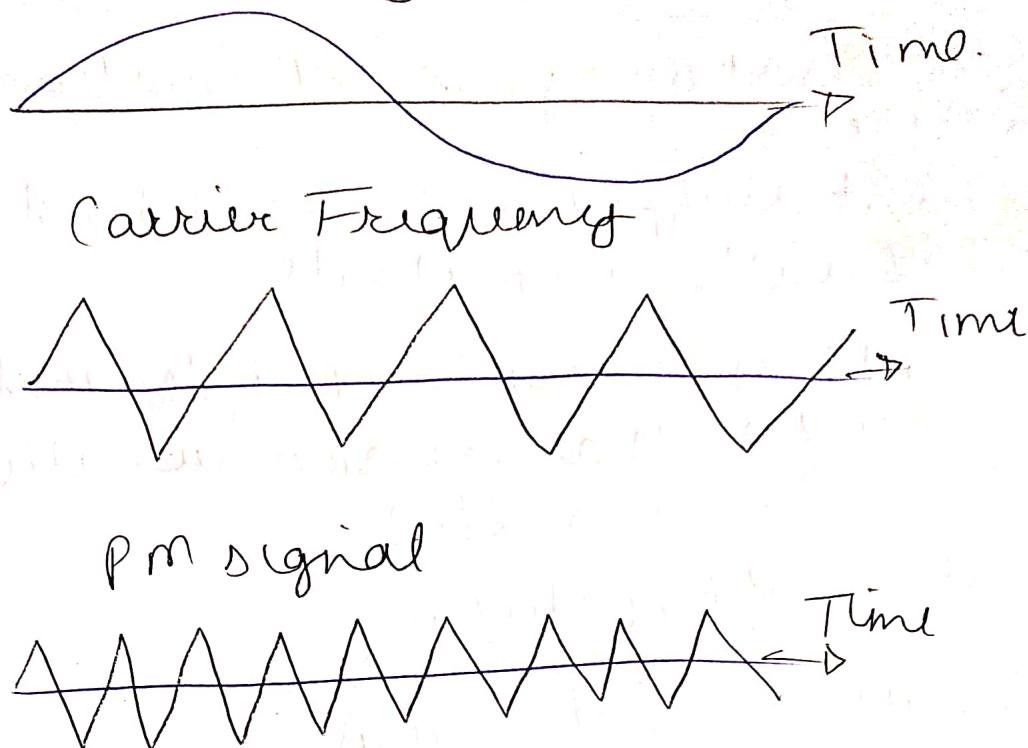


(iii) Phase modulation

- The modulating signal only changes the phase of the carrier signal
- The phase change manifests itself as a frequency change but the instantaneous frequency change is proportional to the derivative of the amplitude
- The bandwidth of the amplitude is higher than that of AM

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modulating signal



The need of conversion of analog pulse in computer networking while transmitter and receiver device in network understand only digital data because analogue signals is infinite in nature.

- Digital deals with discrete or finite signals or finite.
- ADC converts analog signals into quantifiable data which makes it easier to process and store as well as make it more accurate & reliable by minimizing errors.

Q5 Bit stuffing:

- It is insertion of non information bits into data.
- Note that stuffed bits should not be confused with overhead bits.
- Overhead bits are non data bits that are necessary for transmission (usually part of headers, checksums, etc)

Application of Bit stuffing.

- Run length limited coding
- Rate-match two single channels to each other
- Synchronise several channels before multiplexing

Disadvantages of Bit stuffing.

- Since the code rate is unpredictable, it depends on the data being transmitted.

e.g 01111011110111110.

If we take the flag as "0111110" then the output string at the sender is

"011111001110111100111110100111110"

It is desuffed at the receiver and the actual message is received by it.