Computer Networks

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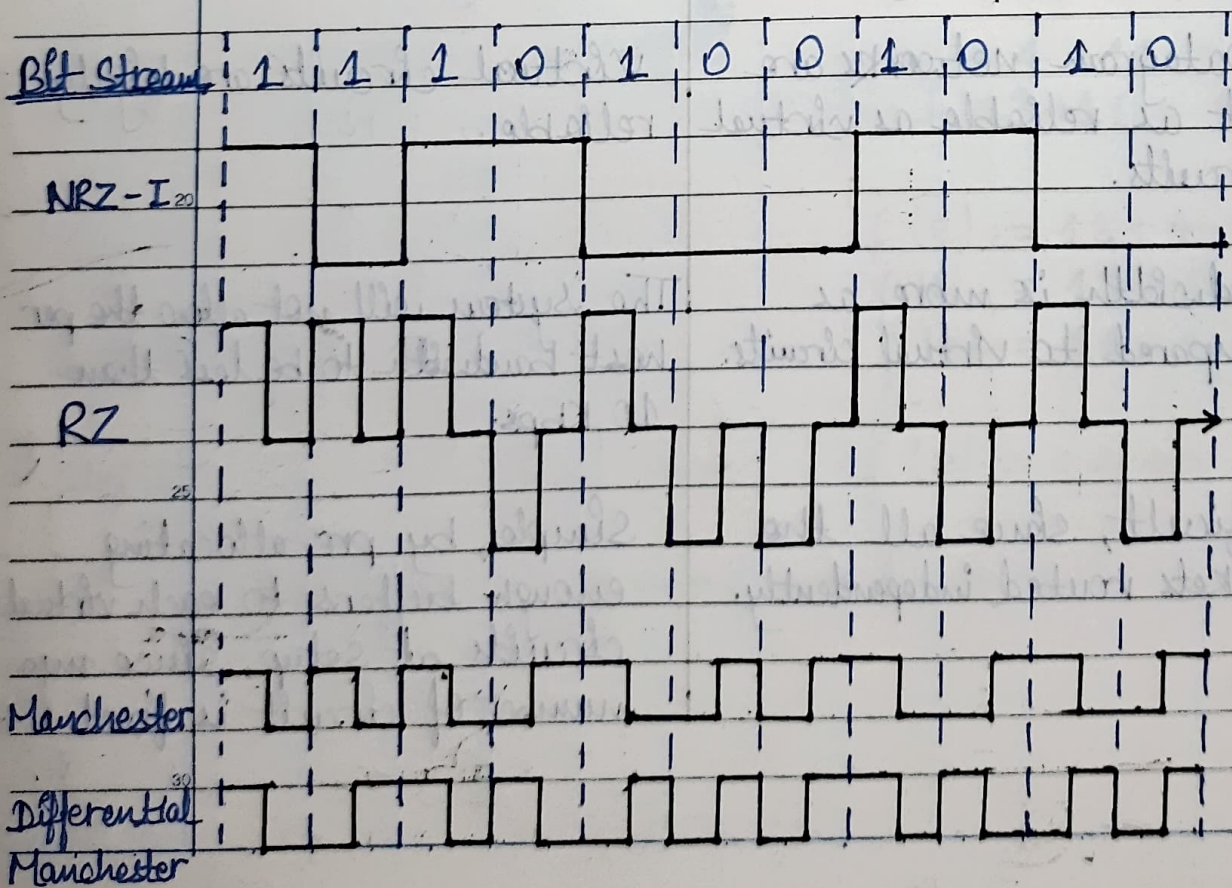
Question 1:

	Datagram Circuit	Virtual Circuit
① Router crash	No effect of failure except for packet lost during the crash.	All virtual circuits that passed through the failed router are terminated.
② Efficiency	Efficiency is high.	Efficiency is low.
③ Reliability	Datagram networks are not as reliable as virtual circuits.	Virtual circuits are highly reliable.
④ Bandwidth	Bandwidth is more as compared to virtual circuits.	The system will not allow the per host bandwidth to be less than 10 Kbps.
⑤ Congestion control	Difficult, since all the packets routed independently.	Simple, by pre-allocating enough buffers to each virtual circuits at setup, since max number of circuit is fixed.

	Packet Switching	Circuit Switching
Bandwidth Issues	There is no need to reserve the circuit even when it is not in use, means the system is more efficient and no wastage of bandwidth	A channel is always reserved even when the users are not communicating. A constantly reserved circuit results in wastage of network bandwidth
Fault Tolerance	During partial outages or other network problem time, packets can be routed and follow different paths.	A single outage can down the designated pathways for the communication

Question e.6.

Bit stream = 111101001010

| Bit Stream | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |

NRZ-I

RZ

Manchester

Differential Manchester

(b)　Design issues of the layered architecture of data communication in network are :—

(i) **Reliability :** It is a design issue of making a network, when it is made up of unreliable components.

(ii) **Addressing :** There are multiple processes running on one machine. Every layer needs a mechanism to identify senders and receivers.

(iii) **Error Control :** It is an important issue because physical communication circuits are not perfect.

(iv) **Flow control :** If there is a fast sender at one end sending data to a slow receiver, then there must be flow control mechanism to control the loss of data by slow receivers.

(v) **Routing :** When there are multiple paths between source and destination, only one route must be chosen. This decision is made on the basis of several routing algorithms, which chooses optimized route of the destination.

(vi) **Scalability :** When network gets large, new problem arises. Thus scalability is important so that network continue to work well when it gets large.

Question 3 6

→ Data link layer in TCP/IP reference model handles flow control, error correction and detection.

→ Following are the different error detection methods :-

* Parity check
* Checksum
* Cyclic Redundancy check (CRC)

→ Following are the different error correction methods :-

* Hamming codes
* Binary convolution code
* Reed - Solomon code
* Low - Density Parity - check code

→ Original frame is $x^{12} + x^9 + x^7 + x^5 + x^2 + 1$

$$= 1 \cdot x^{12} + 0 \cdot x^{11} + 0 \cdot x^{10} + 1 \cdot x^9 + 0 \cdot x^8 + 1 \cdot x^7 + 0 \cdot x^6$$
$$+ 1 \cdot x^5 + 0 \cdot x^4 + 0 \cdot x^3 + 1 \cdot x^2 + 0 \cdot x^1 + 1 \cdot x^0$$
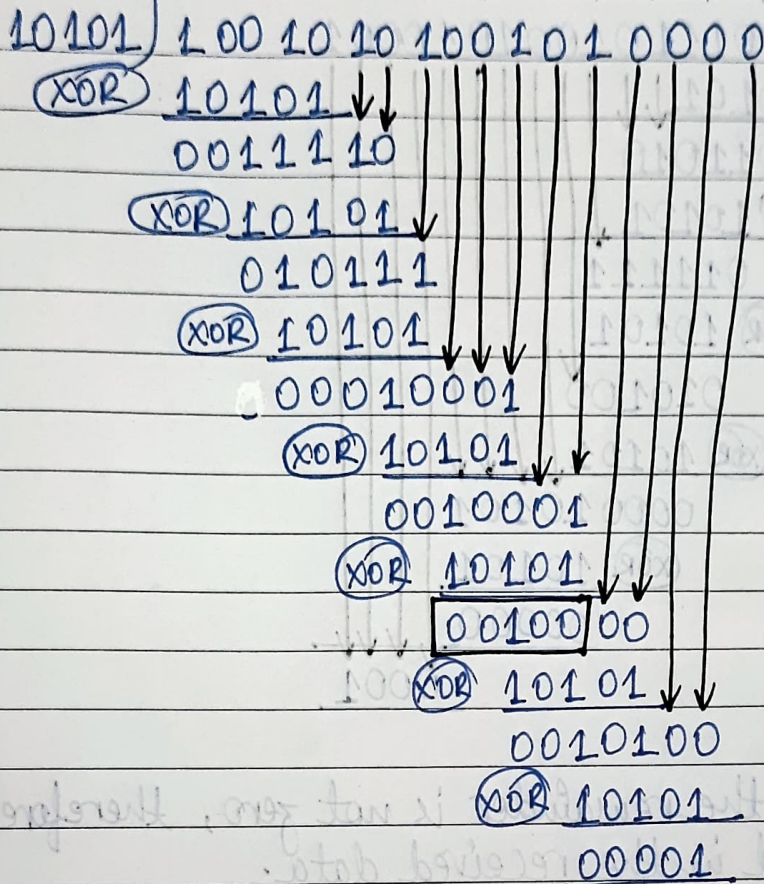$$= 1001010100101$$

→ Generator Polynomial is $x^4 + x^2 + 1$

$$= 1 \cdot x^4 + 0 \cdot x^3 + 1 \cdot x^2 + 0 \cdot x^1 + 1 \cdot x^0$$
$$= 10101$$

Redundant bit, $r = 4$

```
10101 ) 1 00 10 10 100 10 1 0 0000
  XOR  10101
       0011110
  XOR 10101
        010111
     XOR 10101
          00010001
       XOR 10101
            0010001
          XOR 10101
               0010000
            XOR 10101
                 0010100
              XOR 10101
                   00001
```

$\therefore$ CRC = 0001

$\therefore$ Transmitted Frame: 10010101001010001

Now, According to question, the fifth bit from left is inverted during transmission.

$\therefore$ Received data is:

10011101001010001

Now, we have to check if data has any error or not.

```
10101 ) 1001110100101010001
  XOR  10101
       0011010
  XOR  10101
       011111
  XOR  10101
       010100
  XOR  10101
       0000 10101
       XOR  10101
            00000
                  0001
```

Since, the remainder is not zero, therefore, ERROR is detected in the received data.

Question 46

(i) Go-Back-N

Go-Back-N protocol provides for pipelining of frame i.e., sending multiple frames before receiving the acknowledgement of first frame. The size of receiving window is 1 in this case.

(ii) Selective Repeat

This protocol also incorporates the concept of pipelining. Here, the receiver window is of size greater than 1. In this, only the errors or lost frames are re-transmitted, while the good frames are received and buffered.

→ Numerical

Bandwidth of line = 8 Mbps
and 1 bit takes 10 ms to make a round trip.
Data frames are 5000 bits in length.

Bandwidth delay product = 8 Mbps × 10 ms
$$= 8 × 10^6 \text{ bits/sec} × 10 × 10^{-3} \text{ sec}$$
$$= 80 × 10^3$$
$$= 80,000 \text{ bits}$$

The system can send 80,000 bits during the time it takes for the data to go from the sender to receiver.

∴ System can send only 5000 bits

$$\text{Utilization} = \frac{5000}{80000} × 100$$
$$= \frac{50}{8} \quad \frac{25}{4}$$
$$= 6.2 \%$$