

Assignment #3

1. Question 1:

Develop algorithms for generating each of the codes shown in slide 29 of the Session 3 slide deck on Data Encoding and Transmission from NRZ-L.

Answer (Sample solution):

(a) NRZL

```
For i = 1 to input_length
  If input(i) is zero; output(i) = "+"
  Else output(i) = "-"
```

(b) NRZI

```
For i = 1 to input_length
  If input(i) is one {
    If output(i-1) is "+"; output(i) = "-"
    Else output = "+"
  } else output(i) = output(i-1)
```

(c) Bipolar AMI

```
For i = 1 to input_length
  If input(i) is one {
    If previous is "-"; output(i) = "+"; previous = "+"
    Else output(i) = "-"; previous = "-"
  } else output(i) = "neutral"
```

(d) Pseudo Ternary

```
For i = 1 to input_length
  If input(i) is zero {
    If previous = "-"; output(i) = "+"; previous = "+"
    Else output(i) = "-"; previous = "-"
  } else output(i) = "neutral"
```

(e) Manchester

```
For i = 1 to input_length
  If input(i) is zero; output(2*i-1) = "+"; output(2*i) = "-"
  Else output(2*i-1) = "-"; output(2*i) = "+"
```

(f) Diff Manchester

```
If output(i) is one; output(1) = "+"; output(2) = "-"
Else output(1) = "-"; output(2) = "+"
```

```
For i = 2 to input_length
  If input(i) is one; output(2*i-1) = output(2*i-2); output(2*i) = output(2*i-3)
  Else output(2*i-1) = output(2*i-3); output(2*i) = output(2*i-2)
```

2. Question 2:

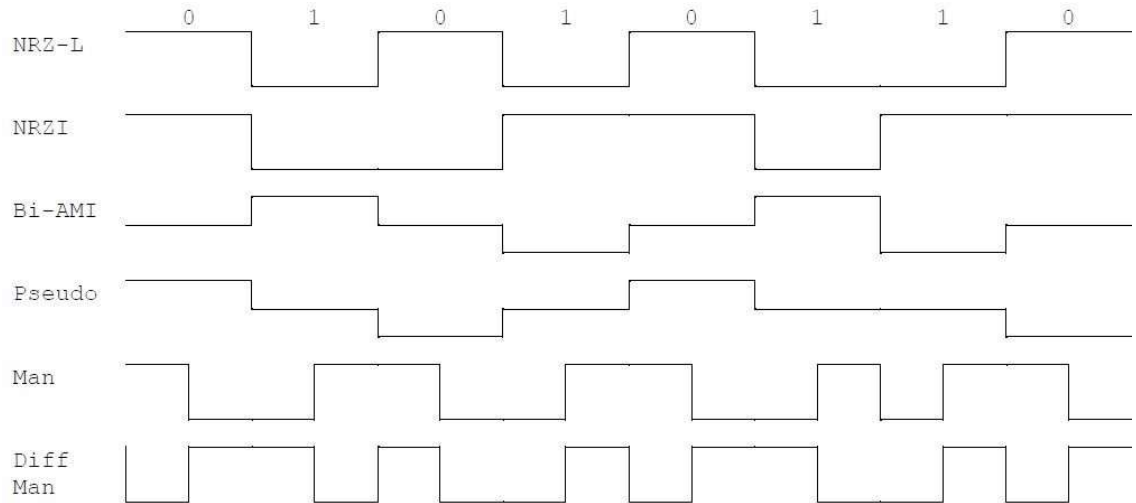
Enhanced NRZ (E-NRZ) is used for high-density recording on magnetic tape. It separates the NRZ-L data stream into 7-bit words, inverts bits 2, 3, 6, and 7, and adds a parity bit to each word. In this case, the parity bit is chosen to make the total number of 1s in the 8-bit word an odd count. Explain the advantages and disadvantages of E-NRZ over NRZ-L.

Answer: There are many possible answers for this.

3. **Question 3:**

For the bit stream 01010101, sketch the corresponding waveforms for NRZ-L, NRZI, Bipolar-AMI, Pseudoternary, Manchester, and Differential Manchester. Assume that the signal level for the preceding bit for NRZI was high; the most recent preceding 1 bit (AMI) has a negative voltage; and the most recent preceding 0 bit (pseudo ternary) has a negative voltage Solution:

Answer:



4. **Question 4:**

Consider a stream of binary data that consists of a long sequence of 1s followed by a zero followed by a long string of 1s and the same assumptions as in Problem 3 above. Draw the waveform for this sequence using:

- (a) NRZ-L
- (b) Bipolar-AMI
- (c) Pseudoternary

Answer:

