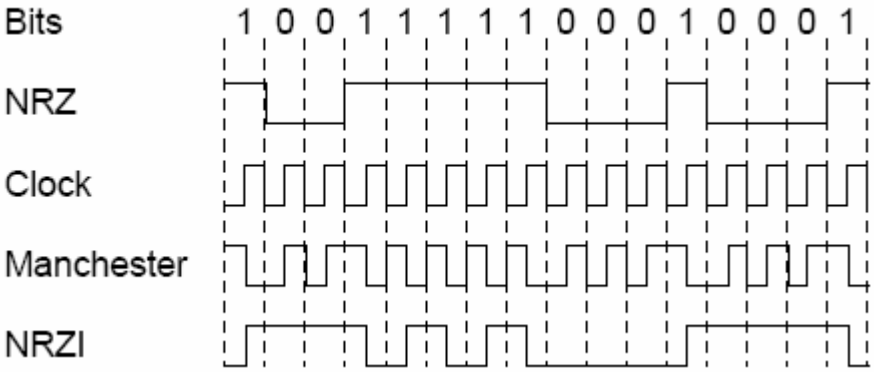
Solutions to Homework#1

1.



5. The stuffed bits (zeros) are in bold:
1101 0111 11**0**0 1011 111**0** 1010 1111 1**0**11 0

18. (a) We take the message 11001001, append 000 to it, and divide by 1001. The remainder is 011; what we transmit is the original message with this remainder appended, or 1100 1001 011.

(b) Inverting the first bit gives 0100 1001 011; dividing by 1001 ($x^3 + 1$) gives a quotient of 0100 0001 and a remainder of 10.

33. In the following, ACK[N] means that all packets with sequence number *less* than N have been received.

1. The sender sends DATA[0], DATA[1], DATA[2]. All arrive.

2. The receiver sends ACK[3] in response, but this is slow. The receive window is now DATA[3]..DATA[5].

3. The sender times out and resends DATA[0], DATA[1], DATA[2]. For convenience, assume DATA[1] and DATA[2] are lost. The receiver accepts DATA[0] as DATA[5], because they have the same transmitted sequence number.

4. The sender finally receives ACK[3], and now sends DATA[3]-DATA[5]. The receiver, however, believes DATA[5] has already been received, when DATA[0] arrived, above, and throws DATA[5] away as a "duplicate". The protocol now continues to proceed normally, with one bad block in the received stream.

43. (a) Assuming 48 bits of jam signal was still used, the minimum packet size would be 4640+48 bits = 586 bytes.

(b) This packet size is considerably larger than many higher-level packet sizes, resulting in considerable wasted bandwidth.

(c) The minimum packet size could be smaller if maximum collision domain diameter were reduced, and if sundry other tolerances were tightened up.

WSU-exercise:

Because interference range is larger than communication range.