Data Communication: Midterm Exam.

1. For the bit stream 10100001100000000110, sketch the waveforms for each of the following codes. Assume that the most recent preceding 1 bit for bipolar-AMI and HDB3 has a negative voltage and the signal level for the preceding bit for NRZI and Differential Manchester was high. Also, comment on the relative advantages of each scheme. (15)
   (a) NRZI (b) Differential Manchester (c) Bipolar-AMI (d) HDB3.

2. Suppose that a sender and a receiver use asynchronous transmission and agree not to any stop elements. Could this work? If so, explain any necessary conditions. (10)

3. (a) Explain in detail the reason why the forward error correction and the backward error control are usually used together in wireless data transmission, whereas the backward error control is mainly adopted in data transmission on a wired medium. (15)
   (b) In wireless transmission, exemplify the case for which only the forward error correction without the backward error control is required. (10)

4. Assume that a send window is *W*, the probability of error in frame transmission is denoted by *p*, and the signal propagation time normalized by a frame transmission time is denoted by *a*. Derive the utilization for Selective Reject scheme, under the assumption that an ACK/NAK frame is error-free and has negligible transmission time. (10)

5. Suppose that a select-reject ARQ is used where the size of a sensing window is W. Show that at least 2W sequence numbers are needed to differentiate between a duplicate and a new frame. (15)

6. Ten 19200-bps lines are multiplexed using statistical TDM. Ignore overhead bits in the TDM frame and assume that each line is busy 60% of the time. Assuming that we wish to limit average utilization of statistical TDM link to 0.8, what is the capacity required for this statistical TDM link? (10)

7. Answer the followings.
   (a) Describe two-level addressing of TCP/IP network (5)
   (b) Piggyback ACK (5)
   (c) Discrete Multitone (5)