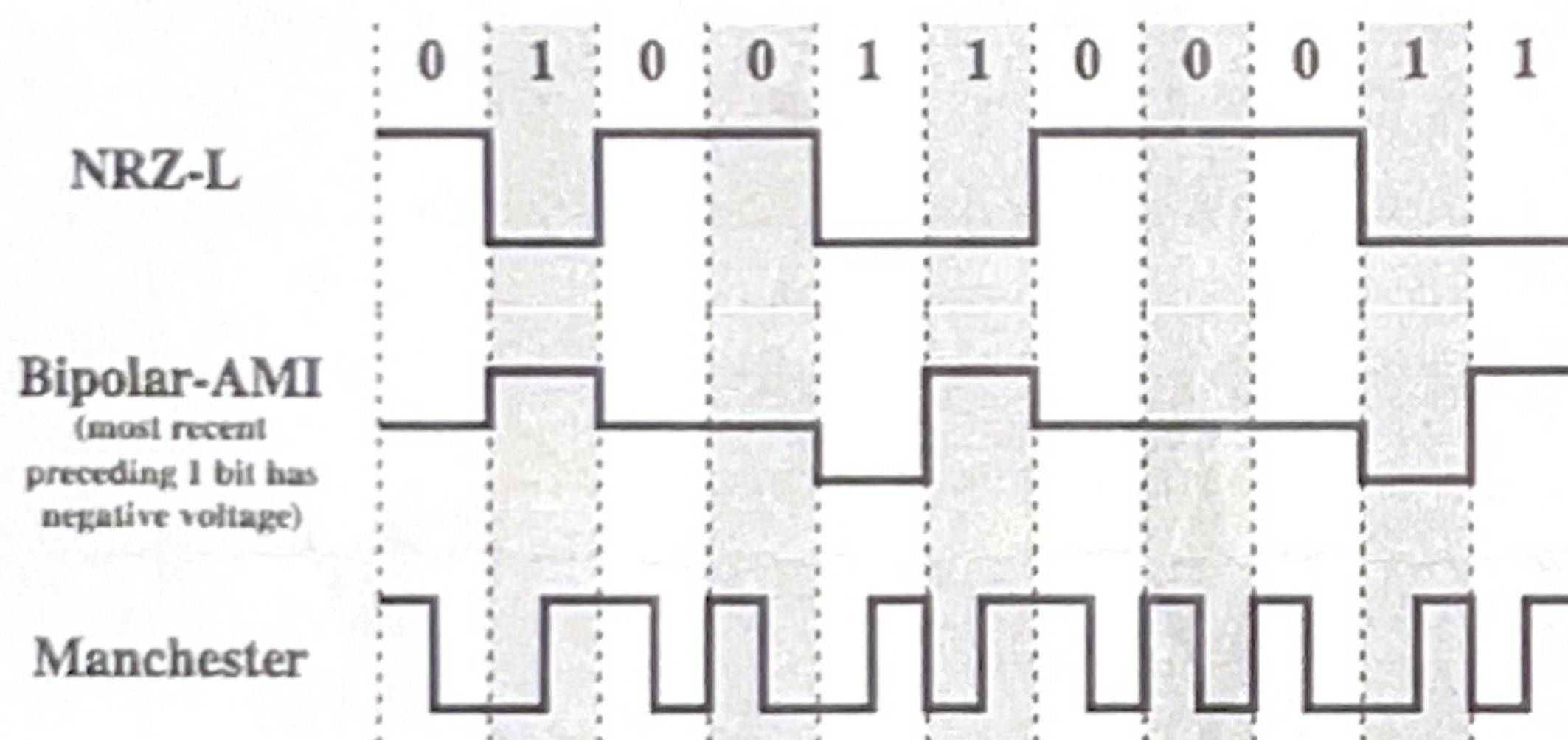


1. Please depict the TCP/IP protocol architecture, and explain the function of each layer. (5%, 10%)
2. Please explain the following transmission-related terminologies: (10%)
 - (1) *Attenuation* (2%) (2) *Attenuation distortion* (2%)
 - (3) *Delay distortion* (3%) (4) *Crosstalk* (3%)
3. Please refer to the following figure and compare the following encoding schemes: NRZ-L, Bipolar-AMI, and Manchester, in aspects of *signal spectrum*, *clocking*, *error detection*, and *cost*. (10%)



4. The drawback of the *Bipolar-AMI* code is that a long string of zeros may result in loss of synchronization. The *B8ZS* coding scheme is based on *Bipolar AMI* and overcomes the problem. *B8ZS* is amended with the following rules:

If an octet of all zeros occurs and the last voltage pulse preceding this octet was positive, then the eight zeros of the octet are encoded as 000+–0–+

If an octet of all zeros occurs and the last voltage pulse preceding this octet was negative, then the eight zeros of the octet are encoded as 000–+0+–

Please depict the signal pattern of *B8ZS* for the bit series of 1100000000110000010, and explain why *B8ZS* has overcome the problem of synchronization with *no DC component*. (5%, 5%)

5. Given L as the number of bits in a frame, R as the data rate of the link (bps), d as the length of the link (meters), and V as the velocity of propagation (m/s).
- (1) Please explain the protocol of *Stop-and-Wait* flow control (5%)
 - (2) Please calculate the maximum potential utilization of a point-to-point link using *Stop-and-Wait* flow control in *error-free* condition. (5%)
 - (3) Consider the probability P that a single frame is in error and assume that ACKs and NAKs are never in error. Please derive the equation of link utilization for *Stop-and-wait ARQ*. (5%)
6. Please explain (3%, 3%) and compare (4%) the following error control protocols: *Go-Back-N ARQ*, *Selective-Reject ARQ*.
7. Given the following parameters: frame transmission time = t , propagation time = a , window size = W , the probability that a single frame is in error = P . Assume that ACKs and NAKs are never in error. Please derive the equation of link utilization for *Selective-Reject ARQ*. (10%)
8. (1) Please explain *Circuit Switching* and *Packet Switching* respectively. (4%)
- (2) Please explain and compare (at least two aspects) two transmission techniques for packet switching networks: Virtual Circuit, Datagram. (4%, 2%)
9. Please give example(s) to discuss the impact of the packet size in the packet switching network from the following two aspects: *end-to-end delay*, *overhead*. (10%)