ECE 158B Midterm, Spring 1997

1. (30 pts) Consider a Selective Repeat Protocol with a window size of 8. Recall that in the Selective Repeat Protocol with a window size of 8, the packets are labeled with sequence numbers modulo 16, i.e. from 0 to 15 inclusive. Assume that packets and acknowledgments with no errors arrive in the order they are transmitted. Suppose that at some point in time, the receiver is not buffering any packets. The receiver then receives a packet with a sequence number (SN) of 12, and delivers this packet to the upper layer. A packet with a request number (RN) of 13 was sent to the sender in response to this. A number of packets with errors are received (CRC check fails) by the receiver, which are discarded. Subsequently a packet with a sequence number of n is received by the receiver. For each of the cases below, describes the actions the receiver should take in response to receiving this packet.

   (a) $n = 2$

   (b) $n = 6$

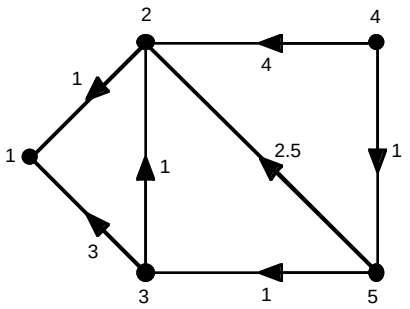
   (c) $n = 13$

2. (20 pts) A CRC with a generator polynomial of $g(D) = D^4 + D^2 + 1$ is used on a communications link. The sender wishes to transmit three information bits 100 ($s(D) = D^2$), and hence calculates the CRC polynomial as $c(D) = 1$ and transmits the codeword $x(D) = s(D)D^4 + c(D) = D^6 + 1$ (1000001). Suppose the receiver receives the string s, corresponding to the polynomial $y(D)$. For each of the cases below, determine whether or not an error can be detected.

   (a) $s = 0111110$ (i.e., $y(D) = D^5 + D^4 + D^3 + D^2 + D$)

   (b) $s = 0111111$ (i.e., $y(D) = D^5 + D^4 + D^3 + D^2 + D + 1$)

3. (20 pts) For the weighted directed graph shown, use the Bellman-Ford algorithm to find the *lengths* of the shortest paths from each node $n = 2, 3, 4, 5$ to the destination node 1. In addition, indicate the appropriate edges which lie on a shortest path to the destination node 1 directly on the graph below.



4. (30 pts) A variable rate server has capacity function $c(t)$, where

$$c(t) = \begin{cases} 1 & \text{, if } t < 1 \\ 0 & \text{, if } 1 \le t < 3 \\ 2 & \text{, if } 3 \le t \end{cases}$$

   Suppose the input traffic to the server has rate funtion $r_{in}(t)$, where $r_{in}(t) = \delta(t) + \delta(t-2)$. Plot the departure process $R_{out}(t)$, the backlog $B(t)$, and the virtual delay $D(t)$ versus t. Label your plots carefully.