1. Given a data segment consisting of 1 0 0 1 1 1 0 1 1 1 0 1 0 0 1 1 0 1 0 1 0 0 1 0, calculate the optimal 2-dimensional parity. You must show your work (i.e., draw out the table!).

2. Calculate the correct CRC bits for the data segment: 1 0 1 1 1 0 0 0 1 0, with a generator G = 1 0 1 1.
3. Using the link-state routing protocol (Dijkstra), generate the table that node $u$ will end up with when the algorithm terminates. You must show all the steps of the algorithm from start to finish. Recall that we update the cost $D(v)$ for each neighbor as: $D(v) = \min(D(v), D(w) + C(w, v))$. 

![Diagram of a network with nodes U, W, X, Y, V, Z and edges with weights: U to W (5), U to V (2), V to W (1), V to Z (7), W to X (4), W to Y (8), X to Y (3), Y to Z (2).]
4. [20 points] Using the distance vector protocol (Bellman-Ford), generate all the routing tables, including intermediate steps until the algorithm terminates (hence, when no more updates are sent). Recall that the least costs are calculated by $D_v(y) = \min_v \{ c(x, v) + D_v(y) \}$ and to calculate the tables we find this for each node $y$ in the network.
5. [15 points] A network has been given the class C address: 128.32.54.0/24.

   (a) Assume a network has 3 subnets, with sizes 120, 30, 61. List the subnets as you would divide them. Recall that the first address in a subnet is the network number while the last address is the broadcast address.

   (b) Assume that two new subnetworks are attached with 10 and 8 nodes respectively. Can you allocate enough addresses from what you allocated in the previous part of the question? How would you allocate the rest of the addresses? (Note: If you cannot allocate enough addresses given your answer in the first part, just reallocate them accordingly here.)
6. [20 points] Assume two hosts, A and B, are on the same Ethernet segment and the propagation delay between them is 250 bit times. Recall that with CSMA/CD in Ethernet, an adapter must wait 96 bit times before it starts transmitting. Also, recall that the jam signal is 48 bits.

(a) Is it possible for A to fully transmit a frame without detecting that B has also started transmitting a frame? Recall that an Ethernet frame has an 18 byte header, 8 byte preamble, and a data segment that’s between 46 to 1500 bytes.

(b) If A and B start transmitting at time \( t = 0 \), and A rolls 0 while B rolls 1 after detecting the collision, what time will A begin retransmitting its frame? What time will B start transmitting assuming that A and B are transmitting maximum sized Ethernet frames? When will B finish?