Practice Problems:

1. In reactive routing techniques (not done in class), a node x tries to find a path to another node y only when x receives a packet with a destination address y. Can you propose a scheme using flooding to find a path from one node x to y when x has to send a packet to y? Is this a good approach to find a path every time a packet is to be sent? If yes, justify why. If no, suggest how your basic scheme can be improved on.
2. With respect to distance vector routing, answer the following questions:
    a. Consider a network with 125 nodes. If each node sends its table to its neighbor every 30 seconds, what is the maximum time that can be taken for a link break to be known to all nodes?
    b. Draw any graph with at least 10 nodes, at least degree 3 for each node, and diameter at least 5 (note that it is "at least", so easy to draw by simply adding more nodes and edges). Give arbitrary weights.
    c. Consider the pseudocode shown in class for processing a routing table. What changes will be needed in the code (write the full pseudocode again if (i) only partial tables with only the changes since the last period are sent normally, with full table sent only once every k periods for some constant k, (ii) if non-existent routes are immediately deleted from the table?
    d. Show with an example (show the starting tables, and exact sequence of message send, receive, and processing) how a routing loop can form in a distance vector routing with a 4 node cycle (and no cycle of length 3 or 2 in the network) even if split horizon is applied. What if poisoned reverse is applied? State any assumptions you make clearly.
3. With respect to link state routing, answer the following questions:
    a. How are stale LSA's detected?
    b. Suppose a node sends the full neighbor list only once, and then sends a LSA only if there are any changes. Will this work? Justify.
    c. Can you design the message format for a LSA?
4. Suppose that an organization gets the IP network 144.16.192.0/23. It wants to break it up into 1 subnet of size 256 addresses, 1 subnet of size 128 addresses, and 2 subnets of size 64 addresses. Call the subnets Subnet 1 to Subnet 4 respectively. For each subnet, show the subnet address using / notation. Show briefly your calculations to get the addresses (no marks without this).
5. Consider a router with 4 network interfaces (all Ethernet) named eth0, eth1, eth2, and eth3. The routing table of the router has the following entries:

Destination	Next Hop	Cost	Interface
144.16.203.0/24	144.16.203.2	10	eth0

144.16.203.64/26	144.16.203.69	20	eth1
144.16.203.176/27	144.16.203.170	5	eth2
0.0.0.0/0	144.16.230.7	10	eth3

Suppose that an IP packet comes with destination IP 144.16.203.88. Clearly explain step by step how is the packet forwarded to its next hop, starting from how the next hop is found from the routing table till how the packet reaches the IP layer of that next hop.

6. An organization X has the subnets 144.16.192.128/27, 144.16.192.160/27, and 144.16.192.192/27. The main router of X, named R is connected to two other external routers, S and T. S connects to an organization Y with subnets 144.16.203.0/24, 144.16.203.2/24, and 144.16.3/24. T is connected to the ISP. Show the routing table entries at R, S, and T. try to minimize the number in each.

7. Suppose that data is to be transmitted in an IP based network from the node A (IP address 150.100.10.20) to the node C (IP address 198.40.50.60). There is only one router B (with two network interfaces, one with IP address 150.100.10.2 on A's subnet and the other with IP address 198.40.50.2 on C's subnet) on the route between A and C. The link from A to B has an MTU of 1000 bytes, and the link from B to C has an MTU of 600 bytes. Each node knows only the MTU of the next link. The IP layer in A wants to send 1700 bytes of data (not including header) to C. Clearly show all header fields (**except** Version, Checksum, Type of Service, and Protocol) of all IP packets **received at C** for this transfer. **Show ONLY a single table**, with the rows representing the relevant header fields, and the columns representing the packets received at C. Mark the rows and columns with proper names, then just show the header field values of the packets. Assume that at A, identification field for IP starts with the last 4 digits of your roll no, default TTL is (20 + (last 2 digits of your roll no.)%10), and there are no IP options sent. Also assume that no packets are lost and all packets arrive in order.