ECE 358: Tutorial Set 4

Note: Class A is /8, Class B is /16, and Class C is /24.

Problem 1.
An organization with a class B address needs at least 950 subnets. Find the subnet mask and the configuration of each subnetwork.

Problem 2.
Find the prefix address and the host id for the following:
IP address: 120.14.122.16
Mask: 255.255.192.0

Problem 3
An organization has a C class network 200.1.1 and wants to form subnets for four departments, with hosts as follow:

A	72 hosts
B	35 hosts
C	20 hosts
D	18 hosts

There are 145 hosts in all

a) Give a possible arrangement of subnet masks to make this possible.
b) Suggest what the organization could do if department D grows to 34 hosts.

Problem 4.
You are the network administrator for the University of XYZ (UXYZ). The UXYZ has 10 departments, 3 of which need to accommodate approximately 5000 hosts each, while the rest (7) need about 600 hosts each. You have been given a single class B IP address

a) How would you use subnetting to meet the needs of all departments in IP addresses?
b) Suppose instead of a single class B address you could get a number of class C addresses, How many would you need? How would you use them?

Problem 5.
A company has three LANs with 500 nodes each. Explain how many of the IP addresses the company uses up if it selects:
a. Three class B networks.
b. One class B network with subnetting.
c. CIDR addressing.
Justify your answers by describing each addressing scheme.

Problem 6.
Consider sending a 1300-byte datagram into a link that has a MTU of 500 bytes. Which of the following is true?

1. Three fragments are created with offsets 0, 500/8 1000/8
2. Three fragments are created with offsets 0, 480/8 and 960/8.
3. Three fragments are created, with offsets 0, 460/8 and 920/8.
4. None of the above

Problem 7

Suppose an IP datagram is fragmented into 10 fragments, each with an independent loss probability of 1%. What is the probability of receiving the datagram correctly at the destination if (a) the datagram (each fragment) is transmitted once; (b) the datagram (each fragment) is transmitted twice?

Problem 8

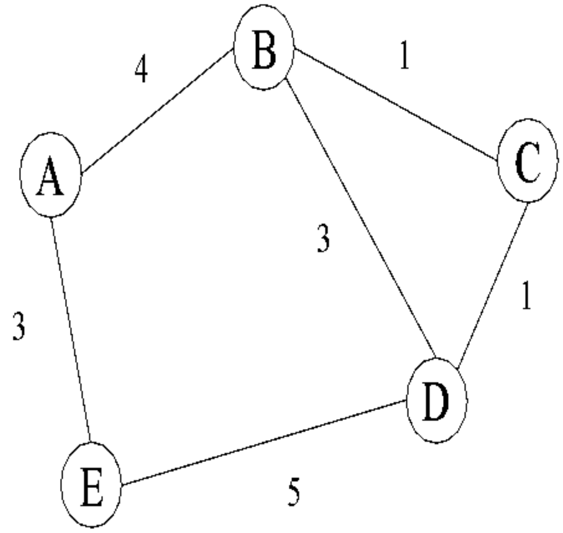
The table below is a routing table using CIDR. Address bytes are in hexadecimal. The notation "/12" in C4.50.0.0./12 denotes a netmask with 12 leading 1 bits, that is, FF.F0.0.0. Note that the last three entries cover every address and thus serve in lieu of a default route. State to which next hop the datagrams with the following destination address will be delivered:

a) C4.5E.13.87
b) C4.5E.22.09
c) C3.41.80.02
d) 5E.43.91.12
e) C4.6D.31.2E
f) C4.6B.31.2E

Net/Mask Length	Next hop
C4.50.0.0/12	A
C4.5E.10.0/20	B
C4.60.0.0/12	C
C4.68.0.0/14	D
80.0.0.0/1	E
40.0.0.0/2	F
00.0.0.0/2	G

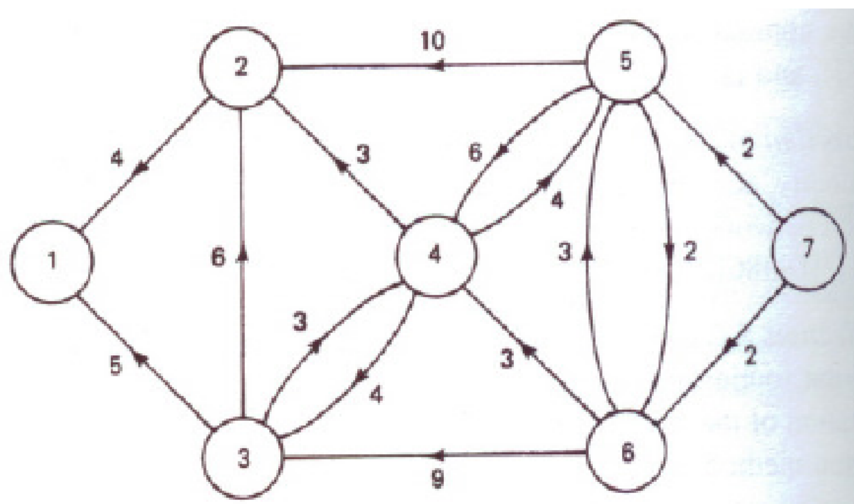
Problem 9

a) The nodes shown in the figure below have been running a shortest-path routing protocol (such as RIP or OSPF) long enough for the paths to have stabilized. Show the routing tables for nodes A and D. Use a separate row for every destination node, indicate the next node on the path.
b) Execute Dijkstra's shortest-path algorithm with node A as the source. Number the nodes in the figure in the order they are added to the shortest-path tree (starting with node A as number 1), and draw stars near the edges belonging to the final shortest-path tree.



Problem 10

Find the shortest path tree from every node to node 1 for the graph of the figure below using the Bellman-Ford and Dijkstra algorithms.



Problems P8, P9, P10, P11, P14, P16 are taken from Chapter 4 of an earlier version of the textbook. Reproduced below for your convenience.

P8: Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:

Destination Address Range	Link Interface
11100000 00000000 00000000 00000000 through 11100000 11111111 11111111 11111111	0
11100001 00000000 00000000 00000000 through 11100001 00000000 11111111 11111111	1
11100001 00000001 00000000 00000000 through 11100001 11111111 11111111 11111111	2
otherwise	3

a) Provide a forwarding table that has four entries, uses longest prefix matching, and forwards packets to the correct link interfaces.
b) Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses:

11001000 10010001 01010001 01010101
11100001 00000000 11000011 00111100
11100001 10000000 00010001 01110111

P9: Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table:

Prefix Match	Interface
00	0
01	1
10	2
11	3

For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

P10: Consider a datagram network using 8-bit host addresses. Suppose a router uses longest prefix matching and has the following forwarding table. For each of the four interfaces, give the associated range of destination host addresses and the number of addresses in the range.

Prefix Match	Interface
1	0
11	1
111	2
otherwise	3

P11: Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support up to 125 interfaces, and Subnets 2 and 3 are each required to support up to 60 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.

P14: Consider a subnet with prefix 101.101.101.64/26. Give an example of one IP address (of form xxx.xxx.xxx.xxx) that can be assigned to this network. Suppose an ISP owns the block of addresses of the form 101.101.128/17. Suppose it wants to create four subnets from this block, with each block having the same number of IP addresses. What are the prefixes (of form a.b.c.d/x) for the four subnets?

P16: Consider sending a 3,000-byte datagram into a link that has an MTU of 500 bytes. Suppose the original datagram is stamped with the identification number 422. How many fragments are generated? What are their characteristics?