Solutions to Chapter 4 Problems

Q1.

Suppose there are three routers between a source host and a destination host. Ignoring fragmentation, an IP datagram sent from the source host to the destination host will travel over how many interfaces? How many forwarding tables will be indexed to move the datagram from the source to the destination?

(This question is taken from Kurose & Ross's book, Chapter 4 Review Problem 15)

Solution:

8 interfaces; 3 forwarding tables.

Q2.
Suppose Host A sends Host B a TCP segment encapsulated in an IP datagram. When Host B receives the datagram, how does the network layer in Host B know it should pass the segment (that is, the payload of the datagram) to TCP rather than to UDP or to something else?

(This question is taken from Kurose & Ross's book, Chapter 4, Review Problem 17)

Solution:

The 8-bit protocol field in the IP datagram contains information about which transport layer protocol the destination host should pass the segment to.

Q3.
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 at least 60 interfaces. Subnet 2 is to support at least 90 interfaces, and Subnet 3 is to support to at least 12 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints.

(This question is taken from Kurose & Ross's book, Chapter 4 Problem 13)

Solution:

223.1.17.0/26
223.1.17.128/25
223.1.17.192/28

Q4.
Use the whois service at the American Registry for Internet Numbers (http://www.arin.net/whois) to determine the IP address blocks for three universities. Can the whois services be used to determine with certainty the geographical location of a specific IP address? Use www.maxmind.com to determine the location of the Web servers at each of these universities.

(This question is taken from Kurose & Ross's book, Chapter 4 Problem 18)

Solution:
The IP address blocks of Polytechnic Institute of New York University are:

NetRange: 128.238.0.0 - 128.238.255.255
CIDR: 128.238.0.0/16

The IP address blocks Stanford University are:
NetRange: 171.64.0.0 - 171.67.255.255
CIDR: 171.64.0.0/14

The IP address blocks University of Washington are:
NetRange: 140.142.0.0 - 140.142.255.255
CIDR: 140.142.0.0/16

No, the whois services cannot be used to determine with certainty the geographical location of a specific IP address.

www.maxmind.com is used to determine the locations of the Web servers at Polytechnic Institute of New York University, Stanford University and University of Washington.

Locations of the Web server at Polytechnic Institute of New York University is

Hostname	Country Code	Country Name	Region	Region Name	City	Postal Code	Latitude	Longitude	ISP	Organization	Metro Code	Area Code
128.238.24.30	US	United States	NY	New York	Brooklyn	11201	40.6944	-73.9906	Polytechnic University	Polytechnic University	501	718

Locations of the Web server Stanford University is

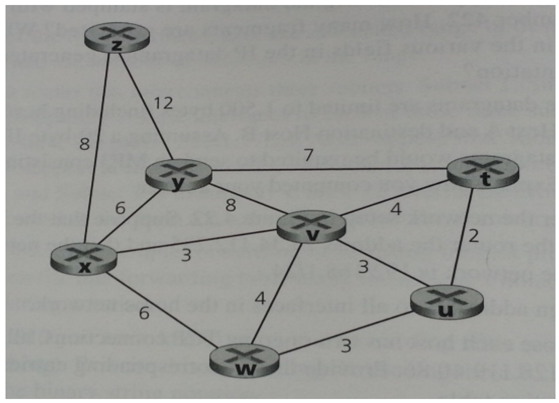
Hostname	Country Code	Country Name	Region	Region Name	City	Postal Code	Latitude	Longitude	ISP	Organization	Metro Code	Area Code
171.64.13.26	US	United States	CA	California	Stanford	94305	37.4178	-122.1720	Stanford University	Stanford University	807	650

Locations of the Web server at University of Massachusetts is

Hostname	Country Code	Country Name	Region	Region Name	City	Postal Code	Latitude	Longitude	ISP	Organization	Metro Code	Area Code
128.119.103.148	US	United States	MA	Massachusetts	Amherst	01003	42.3896	-72.4534	University of Massachusetts	University of Massachusetts	543	413

Q5.

Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from x to all network nodes. Show how the algorithm works by listing each steps in a table.



(This question is taken from Kurose & Ross's book, Chapter 4 Problem 26)

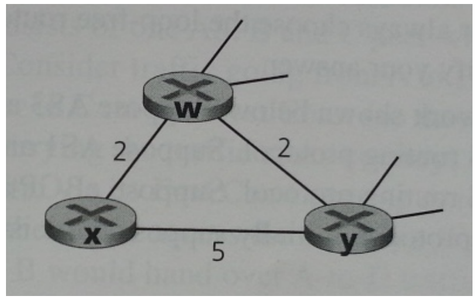
Solution:

Step	*N'*	*D(t),p(t)*	*D(u),p(u)*	*D(v),p(v)*	*D(w),p(w)*	*D(y),p(y)*	*D(z),p(z)*
0	x	∞	∞	3,x	6,x	6,x	8,x
1	xv	7,v	6,v	3,x	6,x	6,x	8,x
2	xvu	7,v	6,v	3,x	6,x	6,x	8,x
3	xvuw	7,v	6,v	3,x	6,x	6,x	8,x
4	xvuwy	7,v	6,v	3,x	6,x	6,x	8,x
5	xvuwyt	7,v	6,v	3,x	6,x	6,x	8,x
6	xvuwytz	7,v	6,v	3,x	6,x	6,x	8,x

Q6.

Consider the network fragment shown below, x has only two attached neighbors, w and y. w has a minimum-cost path to destination u (not shown) of 5, and y has a minimum-cost path to u of 6. The complete paths from w and y to u are not shown. All link costs in the network have strictly positive values.

a. Give x's distance vector for destinations w, y, and u.
b. Give a link-cost change for either c(x,w) or c(x,y) such that x will inform its neighbors of a new minimum-cost path to u as a result of executing the distance vector algorithm.



(This question is taken from Kurose & Ross's book, Chapter 4 Problem 30)

Solution:

a) Dx(w) = 2, Dx(y) = 4, Dx(u) = 7

b) First consider what happens if c(x,y) changes. If c(x,y) becomes larger or smaller (as long as c(x,y) >=1) , the least cost path from x to u will still have cost at least 7. Thus a change in c(x,y) (if c(x,y)>=1) will not cause x to inform its neighbors of any changes.
If c(x,y)= δ<1, then the least cost path now passes through y and has cost δ+6.

   Now consider if c(x,w) changes. If c(x,w) = $\varepsilon \leq 1$, then the least-cost path to u continues to pass through w and its cost changes to 5 + ε; x will inform its neighbors of this new cost. If c(x,w) = $\delta > 6$, then the least cost path now passes through y and has cost 11; again x will inform its neighbors of this new cost.