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CSC645 Computer Networks

Homework 3

1. Network Layer Functions

What are the two most important network-layer functions in a computer network? What is the difference between them?

The two functions are **routing** and **forwarding**. Routing is algorithmically determining what path a potential piece of data should take between networks, while forwarding is the actual process of sending data between nodes in a network.

2. Finding Subnets

Find all subnets in the following network. Write the IP address of those subnets in the subnet notation (i.e. a.b.c.d/x notation)

The addresses (in order) are:

Subnet A has the following addresses:

- 223.1.1.1
- 223.1.1.2
- 223.1.1.3 (Gateway)
- 223.1.1.4

Since this is a class C network (starts with 223), we can just assume the common /24 subnet for the last octet to represent a host address. So the address of subnet A would be 223.1.1.0/24.

Subnet B has the following addresses:

- 223.1.2.1
- 223.1.2.2
- 223.1.2.6 (Gateway)

This seems to also represent a host address, so using the same process, we end up with 223.1.2.0/24 for subnet B.

Subnet C has the following addresses:

- 223.1.3.1
- 223.1.3.2
- 223.1.3.27 (Gateway)

Using the same process, we end up with 223.1.3.0/24 for subnet C.

It's also fair to assume that since each network subnet has two outgoing addresses towards each other in a triangle shape, these are probably point-to-point links, which would require four addresses: two hosts, one network, and one broadcast. This means a /30 subnet for each of these.

As such, for the following addresses:

Network A-C interconnect:
- 223.1.7.0
- 223.1.7.1

Network B-C interconnect:

- 223.1.8.0
- 223.1.8.1

Network A-B interconnect:
- 223.1.9.1
- 223.1.9.2

We can assume the following subnets for these, given the four address assumption given:

- 223.1.7.0/30
- 223.1.8.0/30
- 223.1.9.0/30

3. Dijkstra's Algorithm

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 computing a table similar to what we use in the lecture notes. Also draw the resulting shortest-path tree from x to all nodes and the resulting forwarding table in x.

Node	Distance
x	0
y	6
z	8
v	3
t	7
u	6
w	6

4. Distance Vector Routing

*Consider the network in the figure. Distance vector routing is used, and the following vectors have just come in for router C: from B: **(5, 0, 8, 3, 6, 2)** from D: **(6, 7, 6, 0, 9, 10)** from E: **(7, 6, 3, 2, 0, 4)** The cost of the links from C to B, D, and E, are **6**, **3**, and **5**, respectively. What is C's new routing table? Give both the outgoing line to use and the cost.*

Let's assume that the routing vector is in order from networks A-F.

$C \to B = 6$

$C \to D = 3$

$C \to E = 5$

Now, let's calculate each cost:

$C \to A$:

- through B : $(C \to B) + (B \to A) = 6 + 5 = 11$
- through D : $(C \to D) + (D \to A) = 3 + 6 = 9$

- through $E : (C \to E) + (E \to A) = 5 + 7 = 12$

$C \to A = 9$, via D.

$C \to B$:

- through $B (C \to B) + (B \to B) = 6 + 0 = 6$
- through $D : (C \to D) + (D \to B) = 3 + 7 = 10$
- through $E : (C \to E) + (E \to B) = 5 + 6 = 11$

$C \to A = 6$, via B.

$C \to C = 0$, via the local interface.

$C \to D$:

- through $B : (C \to B) + (B \to D) = 6 + 3 = 9$
- through $D : (C \to D) + (D \to D) = 3 + 0 = 3$
- through $E : (C \to E) + (E \to D) = 5 + 2 = 7$

$C \to D = 3$, via D.

$C \to E$:

- through $B : (C \to B) + (B \to E) = 6 + 6 = 12$
- through $D : (C \to D) + (D \to E) = 3 + 9 = 12$
- through $E : (C \to E) + (E \to E) = 5 + 0 = 5$

$C \to E = 5$, via E.

$C \to F$:

- through $B : (C \to B) + (B \to F) = 6 + 2 = 8$
- through $D : (C \to D) + (D \to F) = 3 + 10 = 13$
- through $E : (C \to E) + (E \to F) = 5 + 4 = 9$

$C \to E = 8$, via B.

This is the routing table for these minimum distances:

Destination	**Outgoing Node**	**Cost**
C	n/a	0
A	D	9
B	B	6
D	D	3
E	E	5
F	B	8