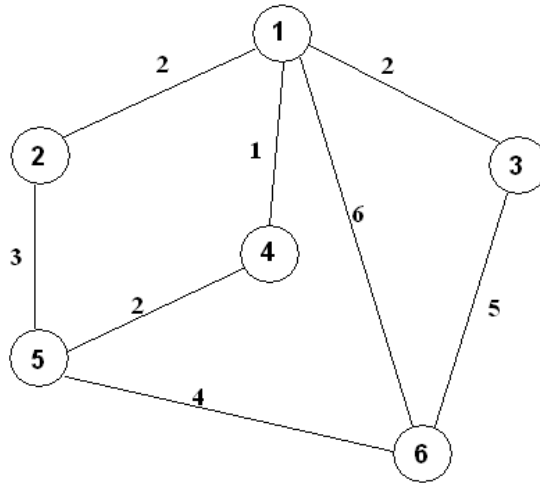


18-345 Introduction to Telecommunication Networks Quiz 4 Solution

Problem 1: Routing (5 points)



Use the Bellman Ford algorithm to find the shortest paths from all other nodes to node 3.

| | Node 1 | Node 2 | Node 4 | Node 5 | Node 6 |
|---------------|----------------|----------------------------------|----------------------------------|----------------------------------|----------------|
| Initial state | $(-1, \infty)$ | $(-1, \infty)$ | $(-1, \infty)$ | $(-1, \infty)$ | $(-1, \infty)$ |
| Iteration 1 | (3, 2) | (-1, ∞) | (-1, ∞) | (-1, ∞) | (3, 5) |
| Iteration 2 | (3, 2) | (1, 4) | (1, 3) | (6, 9) | (3, 5) |
| Iteration 3 | (3, 2) | (1, 4) | (1, 3) | (4, 5) | (3, 5) |
| Iteration 4 | | | | | |

Problem 2: IP address (5 point)

a. Convert the following IP address to its binary representation, and identify the address class of this IP address: **128.2.10.162**

10000000.00000010.00001010.10100010

Class B

b. A small organization has a class C address for seven networks each with 24 hosts. What is an appropriate subnet mask?

A Class C address has 8 bits for the host ID.
Minimum number of bits that the host ID requires =
Ceiling ($\log_2(24)$) = 5

The Subnet mask to be use is:

255.255.255.224

(11111111.11111111.11111111.11100000)

b. Perform CIDR aggregation on the following /24 IP address:
128.56.24.0/24; 128.56.25.0/24; 128.56.28.0/24; 128.56.32.0/24

..24.0/24 → *.*.00 011000.0/24

..25.0/24 → *.*.00 011001.0/24

..28.0/24 → *.*.00 011100.0/24

..32.0/24 → *.*.00 100000.0/24

The subnet mask has $8+8+2 = 18$ consecutive “1” followed by 14 “0”.
The aggregated address is 128.56.0.0/18

Problem 3: (6 points)

Compare link state routing & distance vector routing in terms of:

a. Speed of convergence

Link state generally converges much faster since they distribute topology information through flooding. The DV algorithm can converge slowly and have routing loops while the algorithm is converging. In addition, the DV algorithm also suffers from the count to infinity problem (i.e. bad news travels slowly).

b. Communication overhead

DV has lower message overhead. Link state protocols use flooding, which is expensive. In contrast, in distance vector algorithm, routers only exchange messages with their neighbors.

c. Support for advanced routing, e.g. multi-path or QoS routing

Link state provides better support for advanced routing as each router keeps track of the entire network topology. Hence, by using metrics such as delay, bandwidth etc. it can more easily find paths that satisfy specific requirements.

Problem 4: Wireless (4 points)

- a. Explain using examples, what is Hidden Terminal Problem in wireless communication and what is Exposed Terminal Problem. (Provide one example for each problem)

Hidden Terminal: Tx and interfering Tx can not hear each other. Packets from Tx and interfering Tx collide at Rx.

Exposed Terminal:

Although two Rx are far away, two Txs can hear each other. Carrier sense prevents two Txs from transmitting simultaneously.

(examples: slides 17,18 in Lecture 16)

- b. Why these problems do not exist in wired networks?

In wired network, signal attenuation in the propagation medium is much smaller than wireless medium. As a result, any hosts are able to detect collision (or can not transmit simultaneously) if they share the same medium.