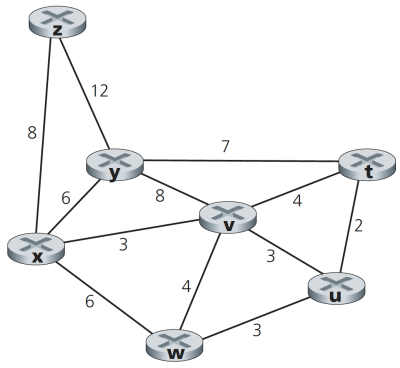
CS 4316/5313: Computer Networks

Homework 4

(24 pts)

1.



Consider the network shown above. Using Dijkstra's algorithm, and showing your work using a table, do the following:

a. Compute the shortest path from t to all network nodes.
b. Compute the shortest path from u to all network nodes.
c. Compute the shortest path from v to all network nodes.
d. Compute the shortest path from w to all network nodes.
e. Compute the shortest path from y to all network nodes.
f. Compute the shortest path from z to all network nodes.

2. Compare and contrast the properties of a centralized routing algorithm and a distributed routing algorithm. Describe the main role of the communication layer, the network-wide state management layer, and the network-control application layer in an SDN controller.

3. Suppose you are interested in detecting the number of hosts behind a NAT. You observe that the IP layer stamps an identification number sequentially on each IP packet. The identification number of the first IP packet generated by a host is a random number, and subsequent packets are sequentially assigned. Assume all packets from the hosts behind the NAT are sent to the outside world.

a. Based on this observation, and assuming you can sniff all packets sent by the NAT to the outside, outline a simple technique that detects the number of unique hosts behind the NAT. Justify your answer.
b. If identification numbers are randomly rather than sequentially assigned, would your technique still work? Justify your answer.

4. Describe all the protocol steps involved when you power on your PC, connect to Ethernet, and download a Web page. Assume there is nothing in the DNS or browser caches when you power on the PC. Include all relevant protocols from link layer to transport and application layers.

5. What are the three different approaches (classes) of Multiple Access Channel (MAC) protocols? Describe the properties and differences between ALOHA, Slotted ALOHA, CSMA/CD, and CSMA/CA. Is CSMA/CA with RTS/CTS better than pure CSMA/CA? Explain.

6. Show (give an example other than the one in lecture) that two-dimensional parity checks can correct and detect a single bit error. Show (give an example of) a double-bit error that can be detected but not corrected.

7. What is a Buffer Overflow? Consider the following code snippet, do you recognize any potential vulnerability? Discuss the potential risk posed by this vulnerability and suggest a method for fixing it.

```
void Echo()
{
  char buff[4];

  cout << "Some input: ";

  gets(buff);

  puts(buff);
}
```

8. Explain the difference between ARP poisoning and DNS poisoning. Explain how ARP poisoning can lead to a TCP session hijacking attack.

9. How many types of DOS attacks are there? Explain how SYN cookies can prevent the SYN flooding attack.