Total time: 50 minutes

Name: _____

WPI username: _____

# CS 3516 - Final Exam – Sample questions- A Term, 2018

Please write concisely, using only the space provided below. Extremely long answers to questions will be interpreted as guessing and will be penalized. Please specify the question/sub-question you are answering.

1. **Give a one sentence description of Dijkstra's algorithm used in Link State Routing. (1 point)**

   **Find the shortest path from a given node to all other nodes by developing paths by adding edges in order of increasing path lengths (1 point)**

2. **Assume that hosts A and B have a TCP connection established. Assume that the two hosts are separate by one router (i.e., they are one hop apart). Why does host A not directly use the MAC (LAN) address of host B when constructing its packets to send to host B?**

   **Host A has no way of knowing the MAC address of host B on the other side of a router. A router does not pass broadcast ARP frames. In any case, the MAC address of the router port connecting host A's LAN to host B's LAN must be used to forward an A-to-B packet through the router. If some other MAC address (e.g., that of host B) were used, routing would not take place. (2 points)**

3. **Using classful IP addressing, what is the network id part, host id part, and class of the following IP addresses? (6 points)**
   a. **2.5.9.1**
   b. **200.7.62.2**
   c. **166.88.7.153**

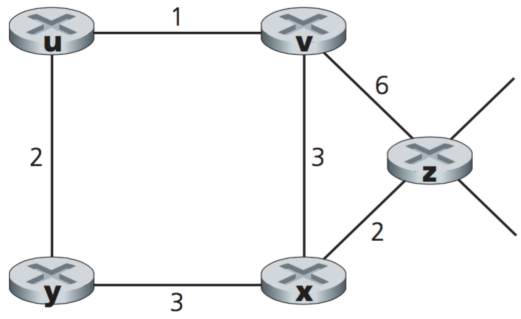
   a. **2.5.9.1 has a network id as 2 (0.5 point), host id as 5.9.1 (0.5 point). It is a Class A IP address (1 point);**
   b. **200.7.62.2 has a network id as 200.7.62 (0.5 point), and host id as 2 (0.5 point). It is a Class C IP address (1 point);**
   c. **166.88.7.153 has a network id as 166.88 (0.5 point) and host id as 7.153 (0.5 point). It is a Class B IP address (1 point);**

   **Note that Class A 1-126 (0 and 127 are reserved), with network id of 8 bits and host id 24 bits**
   **Class B 128-191, with network id of 16 bits and host id 16 bits**
   **Class C 192-223, with network id of 24 bits and host id 8 bits**
   **Class D 224-239, with no network id, and all bits are host id**
   **Class E 240-255, with no network id, and all bits are host id**

4. **Internet Routing and BGP:**
   **Understand slides 10-26 from the following link;**
   **https://users.wpi.edu/~yli15/courses/CS3516Fall18A/slides/CS3516-18-Internet-Routing.pdf**

5. **(6 points) (Sample Question) Consider the network shown below, and assume that each node initially knows the costs to each of its neighbors. Consider the distance-vector algorithm and show the changes of distance table entries at node z over steps. The distance table consists of the distance vectors of z and z's neighbors.**

Total time: 50 minutes




| | | Cost to u | v | x | y | z |
|---|---|---|---|---|---|---|
| From | v | ∞ | ∞ | ∞ | ∞ | ∞ |
| | x | ∞ | ∞ | ∞ | ∞ | ∞ |
| | z | ∞ | 6 | 2 | ∞ | 0 |

| | | Cost to u | v | x | y | z |
|---|---|---|---|---|---|---|
| From | v | 1 | 0 | 3 | ∞ | 6 |
| | x | ∞ | 3 | 0 | 3 | 2 |
| | z | 7 | 5 | 2 | 5 | 0 |

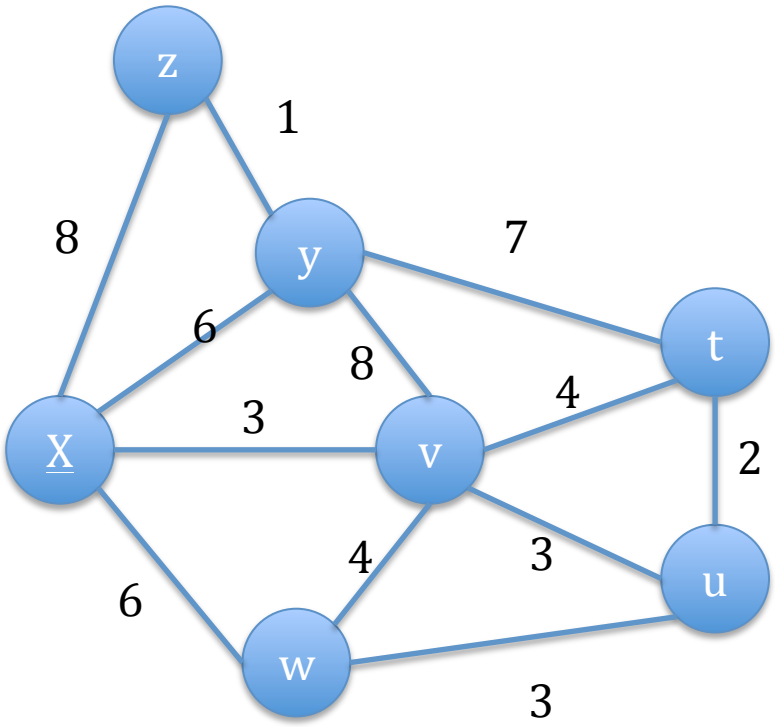
| | | Cost to u | v | x | y | z |
|---|---|---|---|---|---|---|
| From | v | 1 | 0 | 3 | 3 | 5 |
| | x | 4 | 3 | 0 | 3 | 2 |
| | z | 6 | 5 | 2 | 5 | 0 |

| | | Cost to u | v | x | y | z |
|---|---|---|---|---|---|---|
| From | v | 1 | 0 | 3 | 3 | 5 |
| | x | 4 | 3 | 0 | 3 | 2 |
| | z | 6 | 5 | 2 | 5 | 0 |

**[TA note 0.5 point for each row, Total 6 points]**

6. **(7 points) In the network below, use Dijkstra's algorithm to compute the shortest path from x to all the nodes. Show how the algorithm works by filling up the table. Where D(v) is the known shortest-path to node v from x, and p(v) is the predecessor of node (v) in the path to x (NOTE: The number of rows in the table below is more than what is needed to demonstrate the algorithm's workflow). (7 points)**

Total time: 50 minutes




| Step | Set 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) |
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| *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 | -- | 6,x | 6,x | 8,x |
| 2 | xvu | 7,v | -- | -- | 6,x | 6,x | 8,x |
| 3 | xvuw | 7,v | -- | -- | -- | 6,x | 8,x |
| 4 | xvuwy | 7,v | -- | -- | -- | -- | 7,y |
| 5 | xvuwyt | -- | -- | -- | -- | -- | 7,y |
| 6 | xvuwytz | -- | -- | -- | -- | -- | -- |

**[TA note 1 point for each row, total 7 points]**