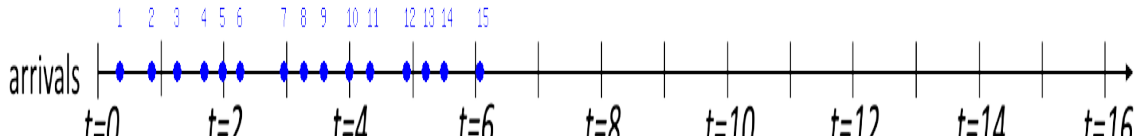
CS5222 Computer Networks and Internets

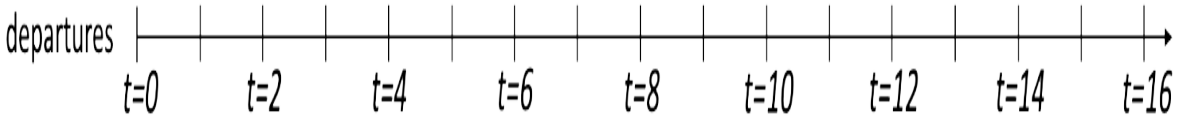
Tutorial 8 (week 9)

1. Consider the arrival of 15 packets to an output link at a router in some interval of time, as indicated by the figure below. We'll consider time to be "slotted", with a slot beginning at t = 0, 1, 2, 3, etc. At the beginning of each time slot, the packet scheduler will choose one packet, among those queued (if any), for transmission according to the packet scheduling discipline (that you will select below). Each packet requires exactly one slot time to transmit, and so a packet selected for transmission at time t, will complete its transmission at t+1, at which time another packet will be selected for transmission, among those queued. You can see the assignment of packets to classes 1,2, and 3 below.



Packets (#; time): 1; 0,35, 2; 0,85, 3; 1,25, 4; 1,68, 5; 1,97, 6; 2,24, 7; 2,93, 8; 3,24, 9; 3,55, 10; 3,95, 11; 4,28, 12; 4,86, 13; 5,16, 14; 5,44, 15; 6

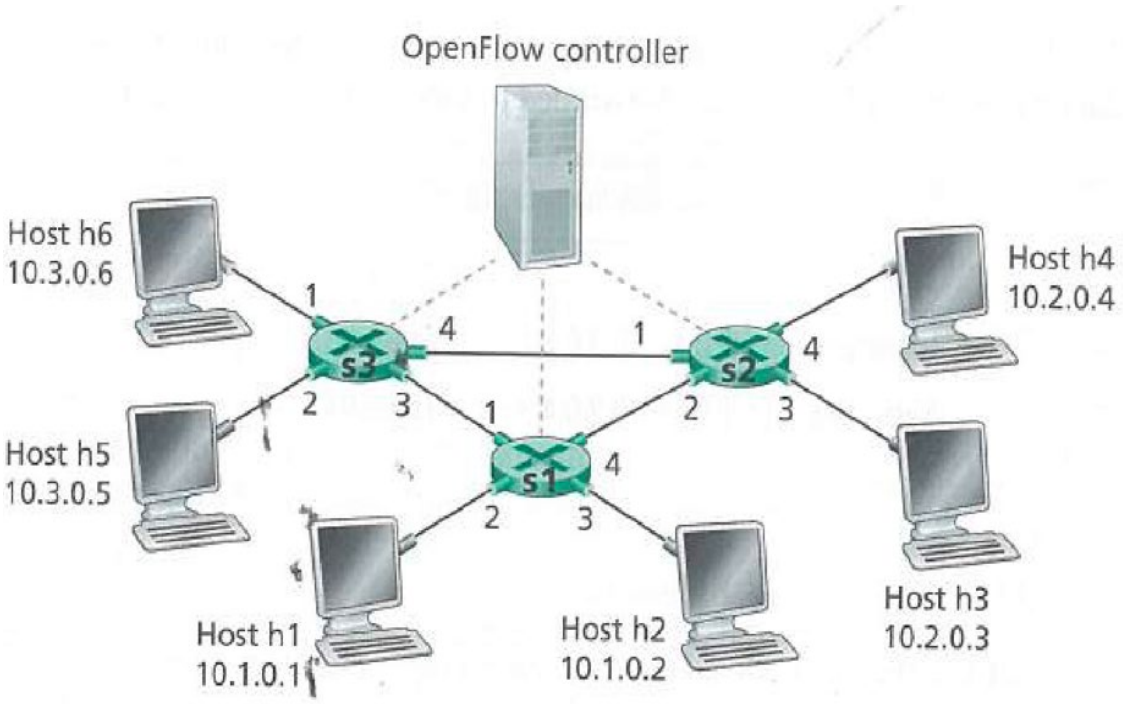
Packets (#; class): 1; 2 , 2; 2 , 3; 2 , 4; 2 , 5; 2 , 6; 2 , 7; 2 , 8; 1 , 9; 1 , 10; 1 , 11; 2 , 12; 2 , 13; 2 , 14; 2 , 15; 3



   a. Schedule the transmissions using a **priority** policy, where class 1 has the highest priority and class 3 the lowest priority.

   b. Schedule the transmissions using a **round-robin** policy.

2. Consider the **SDN OpenFlow** network shown below.



a. Give the flow tables at packet switch s2 to achieve the following behavior:
   i. Any datagram arriving on port 1 from hosts h5 or h6 that are destined to hosts h1 or h2 should be forwarded over output port 2.
   ii. Any datagram arriving on port 2 from hosts h1 or h2 that are destined to hosts h5 or h6 should be forwarded over output port 1.
   iii. Hosts h3 and h4 should be able to send datagrams to each other.
   iv. Any datagrams arriving from host h3 and destined for h1, h2, h5, or h6 should be forwarded in clockwise direction in the network.

b. Give the flow table entries at s1 and s3 such that any arriving datagrams with a source address of h3 or h4 are routed to the destination hosts specified in the destination address field in the IP datagram.

c. Give a flow table for s2 that implements the following firewall behavior:
   i. Only traffic arriving from hosts h1 and h6 should be delivered to hosts h3 or h4. Arriving traffic from hosts h2 and h5 is blocked.
   ii. Only TCP traffic is allowed to be delivered to hosts h3 or h4. (All UDP traffic is blocked.)

3. Consider the following network of routers. With the indicated link costs, use the link state algorithm (**Dijkstra's algorithm**) to compute the least cost path from x to all other nodes. Format your answer as a table.