CSc8220: Assignment 4

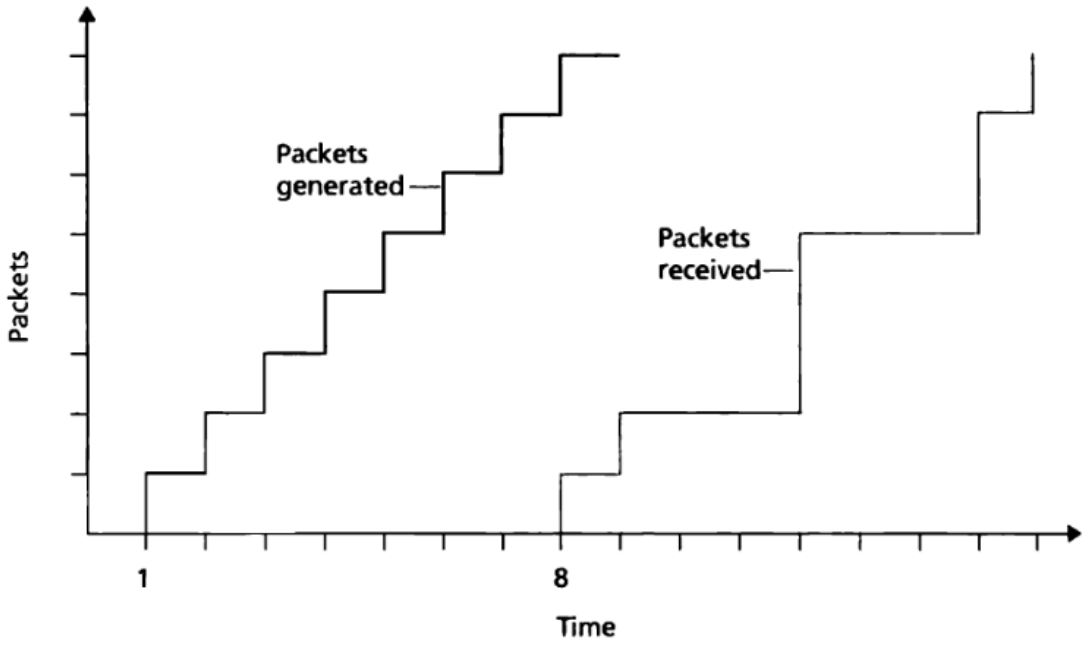
Due at 12:30pm, Apr. 24

1. Why it is hard to implement QoS on top of the TCP/IP model. Explain and compare the concepts of Integrated Services and Differentiated Services.

2. Suppose a student is thinking about a future Internet architecture. He has an idea to remove the IP layer and run TCP/UDP on top of Ethernet directly. Therefore, packets are addressed and forwarded by their MAC address. Routers use routing tables of MAC addresses to decide which packets should be forwarded to which interface.
    1) What is the impact of using a flat address on router design?
    2) Do we still need routing protocols like BGP and why?

3. Suppose a router's drop policy is to drop the highest-cost packet whenever queues are full, where it defines the "cost" of a packet to be the product of its size by the time remaining that it will spend in the queue. (Note that in calculating cost it is equivalent to use the sum of the sizes of the earlier packets in lieu of remaining time.)
    1) What advantages and disadvantages might such a policy offer, compared to tail drop?
    2) Give an example of a sequence of queued packets for which dropping the highest-cost packet differs from dropping the largest packet.
    3) Give an example where two packets exchange their relative cost ranks as time progresses.

4. In the figure below, the sender starts sending packetized video periodically at t = 1. The first packet arrives at the receiver at t = 8. Answer the following questions.



1) Calculate the delays (from sender to receiver, ignoring any playout delays) of packets 2 through 8? Note that each vertical and horizontal line segment in the figure has a length of 1, 2, or 3 time units.
2) If video playout starts as soon as the first packet arrives at the receiver at t = 8, which of the first eight packets sent will not arrive in time for playout?
3) If video playout starts at t = 9, which of the first eight packets sent will not arrive in time for playout?
4) What is the minimum playout delay at the receiver that results in all of the first eight packets arriving in time for their playout?
5) Someone says that since there are negligible losses within the US, the streaming multimedia applications donot need to have a playback buffer in US. What would be your response?

5. Max-min fairness
    1) Define max-min fairness;
    2) Given five flows A, B, C, C, E with respective bandwidth demands 1, 1, 2, 3, 3, being scheduled for a link with 9 bandwidth units available, what share will each flow receive?

6. Define the concept of Fair Queuing. What is the inherent source of unfairness in a first-in, first-out (FIFO) scheduling policy? Describe the mechanism used by Fair Queuing to avoid this problem.

7. Token Bucket Filter

    The transmission schedule (Table 1) for a given flow lists for each second the number of packets sent between that time and the following second. The flow must stay within the bounds of a token bucket filter. What bucket depth does the flow need for the following token rates? Assume the bucket is initially full.

a)2 packets per second

b)4 packets per second

Time (seconds)	Packets sent
0	7
1	4
2	2
3	0
4	7
5	2

Table . 1