

Queuing, Congestion, Wireless

1 Queuing (No Skew) (16 points)

Packet	Size	Flow
1	120	1
2	80	1
3	100	1
4	110	1
5	150	2
6	220	2
7	180	3
8	60	3

Suppose a router has three input flows and one output. It receives the packets listed in the table above all at about the same time, in the order listed, during a period in which the output port is busy but all queues are otherwise empty. Give the order in which the packets are transmitted, assuming

- (a) (8 points) fair queuing
- (b) (8 points) weighted fair queuing, with flow 1 having weight 1.5, flow 2 having weight 2, and flow 3 having weight 1

Assume all ties are resolved in the order 1, 2, 3.

2 Queuing (With Skew)[†] (8 points)

Consider a router that is managing three flows, on which packets of constant size arrive at the following wall clock times:

- flow A: 2, 3, 4
- flow B: 1, 4
- flow C: 1, 2, 4

All three flows share the same outbound link, on which the router can transmit one packet per time unit. Assume that there is an infinite amount of buffer space.

Suppose the router implements fair queuing. Arrival time ties are to be resolved in order A, B, C.

For each packet, give the wall clock time when it is transmitted by the router.

Note: Wall clock time $T = 2$ is Fair Queuing clock time $A_i = 1.5$.

3 Queuing Effects (12 points)

Two users, one using Telnet and one sending files with FTP, both send their traffic out via router R. Both Telnet and FTP are protocols which run on top of TCP. This means that their data packets are placed inside TCP packets when sent out.

The outbound link from R is slow enough that both users keep packets in R's queue at all times. Discuss the relative performance seen by the Telnet user if R's queuing policy for these two flows is

- (a) (4 points) round-robin service
- (b) (4 points) fair queuing
- (c) (4 points) modified fair queuing, where we count the cost only of data bytes, and not IP or TCP headers

Consider outbound traffic only. Assume Telnet packets have 1 byte of data, FTP packets have 512 bytes of data, and all packets have 40 bytes of headers.

4 Random Early Detection (RED) (10 points)

Consider a RED gateway with $\text{MaxP} = 0.04$, and with an average queue length halfway between the two thresholds.

- (a) (5 points) Find the drop probability P_{count} for $\text{count} = 1$ and $\text{count} = 25$.
- (b) (5 points) Calculate the probability that none of the first 25 packets are dropped. Note that this is $(1 - P_1) \times \dots \times (1 - P_{25})$.

Round your answers to the nearest 0.0001.

5 802.11 Beacon Frames (6 points)

Explain the role of beacon frames in 802.11

6 802.11 Transmission (10 points)

Suppose an 802.11b station is configured to always reserve the channel with the RTS/CTS sequence. Suppose this station suddenly wants to transmit 1,000 bytes of data, and all other stations are idle at this time. As a function of SIFS and DIFS, and ignoring propagation delay, and assuming no bit errors, calculate the time required to transmit the frame and receive the acknowledgement.

What to turn in

Turn in your submission for the above assignment including:

- Names of all students in the group and the total number of hours spent on the assignment
 - If this information is missing I will deduct 5%
- Date of submission
- All work, including calculations and graphs as appropriate

Turn in the above via email to ise327@gmail.com, in person before the above date (or in my drawer in the Engineering School office, or via fax to 04-665-3661).

Note: Do not send work submissions to my personal email – use the course email (ise327@gmail.com).