

# ISE 327, EEE 051: Introduction to Computer Networks

## Recitation 11

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25 May 2011

### 1 Queuing Disciplines

Suppose a router has three input flows and one output. It receives the packets listed in Table 1 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) fair queuing
- (b) weighted fair queuing with flow 2 having twice as much share as flow 1, and flow 3 having 1.5 times as much share as flow 1. Note that ties are to be resolved in order flow 1, flow 2, flow 3.

Packet	Size	Flow
1	200	1
2	200	1
3	160	2
4	120	2
5	160	2
6	210	3
7	150	3
8	90	3

Table 1: Table for Exercise 1

## 2 Fair Queuing with Skew

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

flow A: 1, 3, 5, 6, 8, 9, 11

flow B: 1, 4, 7, 8, 9, 13, 15

flow C: 1, 2, 4, 6, 7, 12

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.

- (a) Suppose the router implements fair queuing. For each packet, give the wall clock time when it is transmitted by the router. Arrival time ties are to be resolved in order A, B, C. Note that wall clock time  $T = 2$  is FQ-clock time  $A_i = 1.333$ .
- (b) Suppose the router implements weighted fair queuing, where flows A and C are given an equal share of the capacity, and flow B is given twice the capacity of flow A. For each packet, give the wall clock time when it is transmitted.