

## COMP9334 Revision Problems for Week 5

There are three questions.

### **Question 1**

Customers arrive at a grocery store's checkout counter according to Poisson process with rate 1 per minute. Each customer carries a number of items that is uniformly distributed between 1 and 40. The store has 2 checkout counter, each capable of processing items at a rate of 15 per minute. To reduce customer waiting time in queue, the store manager considers dedicating one of the two counters to customers with  $x$  items or less and dedicating the other counter to customers with more than  $x$  items. Write a small computer program to find the value of  $x$  that minimises the average customer waiting time.

(This question is taken from Bertsekas and Gallager, "Data Networks", Question 3.29)

### **Question 2**

A computer system receives requests from a Poisson process at a rate of 10 requests/s. Assume that 30% of the requests are of type  $a$  and the remaining are of type  $b$ .

For request type  $a$ , its average service time is 0.1 seconds and the coefficient of variation of its service time is 1.5.

For request type  $b$ , its average service time is 0.08 seconds and the coefficient of variation of its service time is 1.2.

Compute the average response time for each type of request under the following scenarios:

1. Requests of types  $a$  and  $b$  have equal priorities
2. Requests of type  $b$  have non-preemptive priority over requests of type  $a$
3. Requests of type  $b$  have preemptive priority over requests of type  $a$

(This question is taken from Q5 in Chapter 11 of Mensace et al, "Performance by Design")

### **Question 3**

A communication line capable of transmitting at a rate of 50 kbits/s will be used to accommodate 10 sessions each generating Poisson traffic at a rate of 150 packets/minute. Packet lengths are distributed as follows: 10% of the packet are 100 bits long and the rest are 1500 bits long. Find the mean queue length and how long a packet has to wait before it starts its transmission on the communication line. You can assume that there is sufficient buffer space to store the queueing packets.