1994 Paper 7 Question 3

Computer Systems Modelling

Consider a system with two independent server devices, which have FIFO queues, and two distinct customers. All service times are exponentially distributed but the service time distributions for the customers and devices differ; that is, there are four distinct service rates, one for each customer at each device.

(a) Draw the state diagram of a Markov chain representing the system. [8 marks]

(b) If all the service rates are equal then the system corresponds to our notion of a balanced system. Show that under these conditions the utilisation of each device is given by
$$U = \frac{N}{N + K - 1}$$
where N is the number of customers and K is the number of devices.

[6 marks]

(c) Show that this expression also holds in a system with three indistinguishable customers and two devices with identically exponentially distributed service times. [6 marks]