

# 1995 Paper 8 Question 11

## Computer Systems Modelling

Given that in a balanced system with  $K$  devices and  $N$  customers, the utilisation of each device is given by

$$U = \frac{N}{N + K - 1}$$

derive a formula for the response time in terms of throughput, the number of devices and the average service demand at each device. [6 marks]

A system consists of three types of devices,  $A$ ,  $B$  and  $C$ . Customers require service at each type of device but do not care at which particular device they are served. The numbers of each type of device and average service requirements per customer are

	number of devices	average service demand
$A$	48	48 ms
$B$	24	24 ms
$C$	18	18 ms

so that, for example, a customer requires on average 48 ms of service at a type  $A$  device.

Give bounds for the system response time at a throughput of 500 customers per second when a scheduling policy ensures that

- (a) no device is more than 1.5 times as busy as the average for devices of the same type
- (b) no device is more than 1.8 times as busy as the average for devices of the same type

[9 marks]

What can you say about response time if no limit on utilisation skew across devices of the same type is guaranteed? [5 marks]