3 Computer Systems Modelling (RJG)

Consider a M/M/1 queueing system with an arrival rate $\lambda > 0$ and a service rate $\mu > 0$ where $\rho = \lambda/\mu < 1$.

(a) Derive the distribution for N, the total number of customers present in the queueing system in equilibrium. [6 marks]

(b) Suppose that the queueing system is in equilibrium. For each of the following terms define the quantity and determine its value:

(i) utilization

(ii) throughput

(iii) mean number of customers present in the system

(iv) mean time spent by a customer in the system

[8 marks]

(c) Now suppose that the arrival rate and service rate are both scaled by a factor of $s > 0$. For each of the four quantities in part (b) determine their new values and explain your findings. [6 marks]