

Assignment 4

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Download all latex-tikz codes from

https://github.com/sachinkarumanchi/probability_and_random_variables/blob/assignment4/Assignment4.tex

1 PROBLEM

Cars arrive at a service station according to Poisson's distribution with a mean rate of 5 per hour. The service time per car is exponential with a mean of 10 minutes. At a steady state, the average waiting time in the queue is

2 SOLUTION

From the question given,

$$\lambda = 5/\text{hr} \quad (2.0.1)$$

$$\mu = \frac{1}{10\text{min}} = 6/\text{hr} \quad (2.0.2)$$

Therefore,

$$\text{Utilization rate}(\rho) = \frac{\lambda}{\mu} = \frac{5}{6} \quad (2.0.3)$$

Average number(or)length in queue be L_q

$$L_q = \frac{\rho^2}{1 - \rho} \quad (2.0.4)$$

$$= \frac{\left(\frac{5}{6}\right)^2}{1 - \frac{5}{6}} \quad (2.0.5)$$

$$= \frac{25}{6} \quad (2.0.6)$$

Let the Average waiting time in queue be W_q

$$W_q = \frac{L_q}{\lambda} \quad (2.0.7)$$

$$= \frac{\frac{25}{6}}{5} \quad (2.0.8)$$

$$= \frac{5}{6}\text{hr} = 50\text{min} \quad (2.0.9)$$

The average waiting time in the queue is 50 min.