



SRM Institute of Science and Technology
Department of Mathematics
18MAB204T- Probability and Queueing Theory
Module – IV
Tutorial Sheet – I2

Questions

1	If $\lambda = 4$ per hour and $\mu = 12$ per hour in an $(M/M/1) : (4/FIFO)$ queueing system, find the probability that there is no customer in the system. If $\lambda = \mu$, what is the value of this probability.
2	If $\lambda = 3$, per hour, $\mu = 4$ per hour and maximum capacity $k=7$ in a $(M/M/1) : (k /FIFO)$ system, find the average number of customers in the system.
3	A petrol pump station has 4 pumps. The service times follow the exponential distribution with a mean of 6 min and cars arrive for service in a Poisson process at the rate of 30 cars per hour. What is the probability that an arrival would have to wait in line?
4	At a railway station, only one train is handled at a time. The railway yard is sufficient only for 2 trains to wait, while the other is given signal to leave the station. Trains arrive at the station at an average of 6 per hour. Assuming Poisson arrivals and exponential service distribution, find the probabilities for the number of trains in the system. Also find the average time of a new train coming into the yard. If handling rate is doubled, how will the above results get modified?
5	In a railway marshalling yard, goods train arrive at the rate of 30 trains per day and the inter arrival times follow an exponential distribution. The service time for each train is assumed to be exponential, with an average of 36 minutes. If the yard can admit 9 trains at a time, calculate the probability that the yard is empty and the average queue length.
6	Consider a single server queueing system with a Poisson input and exponential service time. Suppose the mean arrival rate is 3 calling units per hour, the expected service time is 0.25 hours and the maximum capacity of the system is two. Calculate the expected number in the system. Find the probability of 0, 1, 2 units in the system.
7	Patients arrive at a clinic according to Poisson distribution at a rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patient is exponential with mean rate of 20 per hour. (i) Find the effective arrival rate at the clinic. (ii) What is the probability that an arriving patient will not wait? (iii) What is the expected waiting time until a patient is discharged from the clinic?
8	A typist is attached to 5 officers for whom he performs typing job. He gets calls from the officers for whom he performs typing job. He gets calls from the officers at the rate of 4 per hour and takes on the average 10 minutes to attend to each call. If the arrival rate is Poisson and service time is exponential, find (i) the average waiting time for an arriving call (ii) the average number of waiting calls and (iii) the average time an arriving call spends in the system.