

QUEUEING THEORY

PART-A

1. For (M/M/1 : (∞ / FIFO) model, write down the little's formula.
2. For (M/M/c) : (N/ FIFO) model, write down the formula for (a) average number of customers in the queue.(b) Average waiting time in the system.
3. In a given M/M/1, queue, the arrival rate $\lambda = 7$ customers/ hour and service rate $\mu = 10$ customers/ hour. Find $P (X \geq 5)$ where X is the number of customers in the system.
4. What is the effective arrival rate for M/M/1/N queuing system
5. In the usual notation of an M/M/1 queuing system if $\lambda = 12$ per hour and $\mu = 24$ per hour .find average the number of customers in the system.
6. Write pollaczck –khintchine formula and explain the notations.
7. What are the basic characteristics of queuing process?
8. Obtain the steady state probabilities of on (M/M/1); (N/ FIFO) queuing System.
9. In a given (M/M/1 : (∞ / FCFS) $\rho=0.6$ what is the probabilities that the queue contain 5 or more customer
10. What is the effective arrival rate for (M/M/1 : (A/ FCFS) queuing model when $\lambda = 2$ and $\mu = 5$

PART'B'

1. Obtain the steady state probabilities for (M/M/1) : (N/ FCFS) queuing Model.
2. A petrol pump station has 2 pumps . The service times follow the Exponential distribution with mean of 4 min and cars arrive for service is Poisson process at the rate of cars per hour . Find the probabilities that a customer has to wait for service . What is the probabilities that pumps remain ideal.

3. In a given (M/M/1) queuing System the ag arrival is 4 customer per minute $\rho=0.7$ what are (i)) mean number of customer L_q in the queue
(ii) mean number of customer standing in the queue(iii) Probabilities that the server is ideal (iv) mean waiting time W_6 in the system.
4. There are three typists in an office .Each typist type on any of 6 letter per hr. If letters arrive for being typed at the rate of 15 letters per hr.
(i)What fraction of time all the typist will be busy?
(ii)What is the average number of letters waiting to be typed?
(iii) What is the average time of letter has to spend waiting and for being typed?
5. A 2person barber shop has 5 chair to accommodate the waiting customer potential customer who arrive when all 5 chairs are foll. Leave without entering the barber shop customers arrive at the average rate 4 per hr. and spend on average of 12 min in the barber's chair. compute P_0, P_1, P_7 and L_g
6. In the railway marshalling yard goods trains arrive at a rate of 30 trains per day. Assume that the int distribution er arrival time follows the Exponential distribution and the service time distribution is also Exponential with an average 36 minutes . Calculate the following
 - a. The mean square size
 - b. The probabilities that the queue size exceeds 10 if the input of trains increase to an average of 33 per day , what will be the change in the above quantities?
7. Arrival rate of telephone calls at telephone booth are according to Poisson distribution with an average time of 12 min. between two consecutive calls arrival. The length of telephone call is assumed to be exponentially distributed with mean.4 min
 - a. Determine the probabilities that person arriving at booth will have to wait.
 - b. Find the average queue length that is formed from time to time
 - c. The telephone company will install second booth when convinced that an arrival would expect to have wait at least 5 min for the phone find their increase in follows of arrival which will justify second booth.

- d. What is the probabilities that an arrival will be wait for more then 15 min before thje phone is free.
8. Patients arrive at clinic according to Poisson distribution at a rate of 30 patients per hr. The waiting room does not accommodate more than 14patients .Examine time per patient is exponential with mean rate of 20 per hr.
- what is the probabilities that an arriving patient will not wait?
 - What is the effective arrival rate
9. Automatic car W has facility operator with only one boy .Cars arrive according to Poisson distribution with mean of 4 cars per hr and may wait in the facilities parking Lot if the boy is busy . If the service time for all cars is content and equal to 10 min .Determine L_s , L_q , W_s and W_q .
10. Derive pollaccek–khinchine formula for the average number of customer in the M/M/I queuing system

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