Pre-experiment and Post-experiment Quizzes

1. Consider a single machine where jobs arrive according to a Poisson stream with a rate of 10 jobs per hour. The processing time of a job consists of two phases. Each phase takes an exponential time with a mean of 1 minute.
    (i) Determine the distribution of the number of jobs in the system.
    (ii) Determine the mean number of jobs in the system and the mean production lead time (waiting time plus processing time).

2. Consider a machine where jobs are being processed. The mean production time is 4 minutes and the standard deviation is 3 minutes. The mean number of jobs arriving per hour is 10. Suppose that the interarrival times are exponentially distributed. Determine the mean waiting time of the jobs.

3. In a warehouse for small items orders arrive according to a Poisson stream with a rate of 6 orders per hour. An order is a list with the quantities of products requested by a customer. The orders are picked one at a time by one order picker. For a quarter of the orders the pick time is exponentially distributed with a mean of 10 minutes and for the other orders the pick time is exponentially distributed with a mean of 5 minutes.

4. In a record shop customers arrive according to a hyperexponential arrival process. The interarrival time is with probability 1/3 exponentially distributed with a mean of 1 minute and with probability 2/3 it is exponentially distributed with a mean of 3 minutes. The service times are exponentially distributed with a mean of 1 minute.
    (i) Calculate the distribution of the number of customers found in the record shop by an arriving customer.
    (ii) Calculate the mean number of customers in the record shop found on arrival.
    (iii) Determine the mean time a customer spends in the record shop.

5. Find and compare total system times for the following three M/G/1 queueing systems with the same arriving process of the rate 10 λ = 1 packets per ms:
    (i) Mean service time is 5 = x ms and service time has an exponential distribution with parameter 1/5.
    (ii) Mean service time is 5 ms and service time is a random variable uniformly distributed between 4ms and 6 ms.
    (iii) Service time is constant with mean 5ms.
    (iv) Mean service time is 5 ms and service time is an Erlang distributed random variable with n=5 and parameter 1.

6. Packets arrive at switching node according to a Poisson process with rate λ = 2 packets per millisecond. We regard the single outgoing link of the switching node as the only server. Packets service times (~x) are uniformly distributed, $0 <$ ~$x \leq 0.2$ milliseconds. The input buffer has a very big capacity so that there are no blocked packets. We model this system as an M/G/1 queueing system. Find

(i) Average number of customers in the system.
(ii) Average number of customers in the queue.
(iii) Average waiting time spent in the queue by a customer.
(iv) Average time spent in the system by a customer

7. Customers arrive according to a Poisson process at a parking lot near a small shopping center with a rate of 60 cars per hour. The mean parking time is 2.5 hours and the parking lot offers place to 150 cars. When the parking lot is full, an arriving customer has to park his car somewhere else. Find the fraction of customers finding all places occupied on arrival.