**QUEUING THEORY ASSIGNMENT 4**

1. Consider the Easy Coach box office ticket window being manned by a single server. Customers arrive to purchase tickets according to Poisson input process with a mean rate of 30/hr. the time required to serve a customer has an ED with a mean of 90 seconds determine:

(a) Expected fraction of the day that the office ticket window will be in use.

(b) Expected number of customers in the queue

(c) Expected waiting time in the queue.

(d) Expected number of customers in the system.

(e) Expected waiting time in the system

(f) Expected number of customers in the queue from time to time.

(g) What is the probability that an arrival will have to wait in queue for service?

(h) What is the probability that exactly 2 customers are in the system

(i) What is the probability that an arrival will not have to wait in queue for service?

(j) What is the probability that there are 4 or more customers in the system?

(k) The company will install a second window when convinced that an arrival would have to wait for at least 12 minutes in queue for the ticket. By how much should the flow of arrivals be increased by to justify a second window?

1. Arrivals at an ATM booth are considered to be Poisson at an average time of 4 minutes  
   between one arrival and the next. The length of withdrawing cash is distributed exponentially, with a mean of 2 minutes. Determine:

(a) The expected fraction of the day that the ATM will not be in use.

(b) The expected number of Customers in the queue

(c) The expected waiting time in the queue.

(d) The expected number of customers in the system.

(e) The expected waiting time in the system

(f) What is the probability that an arrival will have to wait in the queue for service?

(g) What is the probability that an arrival will not have to wait in queue for service?

(h) The company will install a second ATM machine when convinced that an arrival would have to wait for at least 6 minutes in queue for the service. By how much should the flow of arrivals be increased by to justify a second machine?