ENE 3031 - Fall 2014
Homework 2
due Tuesday Sep/30

1. A tool crib has exponential interarrival and service times and serves a very large group of mechanics. The mean time between arrivals is 4 minutes. It takes 3 minutes on the average for a tool-crib attendant to service a mechanic. The attendant is paid $10 per hour and the mechanic is paid $15 per hour. Would it be advisable to have a second tool-crib attendant? (Show all your work and do not simply use the computer program)

2. A two-runaway (one runaway for landing, one runaway for taking off) airport is being designed for propeller-driven aircraft. The time to land an airplane is known to be exponentially distributed, with a mean of 1.5 minutes. If airplane arrivals are assumed to occur at random, what arrival rate can be tolerated if the average wait in the sky is not to exceed 3 minutes? (Show all your work and do not simply use the computer program)

3. A repair and inspection facility consists of two stations: a repair station with two technicians, and an inspection station with 1 inspector. Each repair technician works at the rate of 3 items per hour; the inspector can inspect 8 items per hour. Approximately 10% of all items fail inspection and are sent back to repair station (This percentage holds even for items that have been repaired two or more times.) If items arrive at the rate of 5 per hour, what is the long-run expected delay that items experience at each of the two stations, assuming a Poisson arrival process and exponentially distributed service time? What is the maximum arrival rate that the system can handle with out adding personnel?(Show all your work and do not simply use the computer program)

4. Patients arrive for a physical examination according to a Poisson process at the rate 1 per hour. The physical examination requires three stages, each one independently exponentially distributed, with a service time of 15 minutes. A patient must go through all three stages before the next patient is admitted to the treatment facility. Compute the average number of delayed patients, L_Q for this system. [Hint: The variance of the sum of independent random variables is the sum of the variance.] (You may use the excel program to get your answer).

5. Consider the usual single-server FIFO queue that will process exactly 10 customers. The arrival times and service times of the 10 customers are:

Customer	1	2	3	4	5	6	7	8	9	10
Arrival time	0	4	8	10	17	18	19	20	27	29
Service time	5	5	1	3	2	1	4	7	3	1

6. Use the basic Monte Carlo technique from class to integrate

$$I = \int_{-1}^{1} \frac{1}{\sqrt{2\pi}} \exp \frac{-x^2}{2} dx \tag{1}$$

(a) Use 100 independent $\text{Unif}(0,1)$ random variables to produce your answer. (You may use the excel program to get your answer).

(b) Can you think of any way to calculate an "exact" answer?