1.(30%) Let random variable X has a density function f(x), cumulative distribution function F(x), mean u, and variance v. Define Y=c+dX, where c and d are constants satisfying $-\infty < c < \infty$ and d>0.

(a) Select c and d so that Y has mean 0 and variance 1.

(b) What is the correlation coefficient between X and Y?

(c) If X is symmetrically distributed about u, is Y necessarily symmetrically distributed about its mean?

2.(20%) Kitty Oil Co. has decided to drill for oil in 10 different locations; the cost of frilling at each location is $10,000 (i.e. total cost is $10,000) The probability of finding oil in a given location is only 1/5. If oil is found at a given location, the amount of money the company will get selling oil (excluding the initial $10,000 drilling cost) from that location is an exponential random variable with mean $50,000.

(a) What is the expected profit of this company?

(b) What is the probability that the Kitty Oil Co. could obtain more than $10,000 profits, if the oil is found exactly in two locations.

3.(30%) Let $X_1$, and $X_2$ be a random sample of size 2 from the uniform distribution U(0,1). And $Y = X_1 + X_2$

(a) What is the joint probability density function of $X_1$ and $X_2$ ?

(b) What is the probability density function of Y? Please graph it.

(c) What is the smallest sample size needed for Y to be approximated by a normal distribution? Why?

4. (10%) Cars arrive at a toll booth at a mean rate of five cars every 10 minutes according to a Poisson process. Define X as the time that the toll collector has to wait before collecting the eighth toll.

(a) What is X distributed? What is the expected waiting time?

(b) Find the point at which the waiting time obtains its maximum.

5.(10%) What do the assumptions of the classical regression model really mean? What does a linear regression model mean? Under what circumstances could a non-linear model be transformed to linear? Please give an example.