Lab Three
Computational Probability and Statistics
CIS 2033, Section 002

Due: 9:00 AM, Friday, October 17, 2014

Question 1 Let X be a continuous random variable, plot the probability density function $f(x)$ if

- X is an exponential distribution, $X \sim Exp(\lambda), \lambda = 0.5, 1, 2$;
- X is a normal distribution, $X \sim N(\mu, \sigma^2)$, where (μ, σ^2) are from $\{(-1, 1), (0, 1), (1, 1), (0, 4), (0, 16)\}$.

For each of those two cases, you have to plot multiple curves, one for each of the probability density functions when the parameter is fixed. For example, for the exponential distribution, you have to plot the probability density functions for $Exp(0.5), Exp(1), Exp(2)$. Please use **different colors** (e.g., red, blue, black) for those curves and put those curves in **one** figure. Please analyze those curves in this figure and draw a conclusion for **how does the curve changes when we increase (or decrease) the parameter value**. You have to submit

1. MATLAB codes, which should be put in script files (.m);
2. Two figures, which should be in eps format (.eps);
3. Two observations (conclusions), which should be in a plain text file (.txt).

Question 2 Let X be a continuous random variable, plot the distribution function $F(X)$ if

- $X \sim Exp(2)$;
- $X \sim N(0, 1)$.

For each of those distributions, you have to plot a figure, showing the distribution function. You also have to compute the **median**, $q_{0.5}$, and add a special point $(q_{0.5}, 0.5)$ in this figure. Please use the "Asterisk" $(*)$ as the marker and red color for this special point.
You have to submit

1. MATLAB codes, which should be in script files (.m);
2. Two figures, which should be in eps format (.eps).

Question 3 Let X be a continuous random variable, generate 10^5 samples if

- $X \sim Exp(2)$;
- $X \sim N(0, 2)$.

You can use the MATLAB function *random* to generate datapoints from a given distribution. Please check the *help* or *doc* command in order to use the *random* function correctly. Please plot those samples by using *hist* function. You can check its usage by using *help hist* or *doc hist*. You have to submit

1. MATLAB codes, which should be in script files (.m);
2. Two figures, which should be in eps format (.eps).

Question 4 Suppose we only have a random number generator, which has a $U(0, 1)$ distribution. But we want to generate a sequence of random numbers with a non-uniform distribution (e.g., $Exp(2), Par(2)$). Now, please

- first use the random number generator to generate 10^5 uniformly ($U(0, 1)$) distributed samples;
- then transform those samples to datapoints, which should have a $Exp(2)$, or $Par(2)$ distribution;
- finally plot those transformed samples by using the *hist* function.

You have to submit

1. MATLAB codes, which should be in script files (.m);
2. Two figures, which should be in eps format (.eps).