ECE 361 HW# 7, due May 21

Problem 1

a. If X is U[0,1], what is the CDF of Y=-X.
b. If X is U[-1,1], what is the pdf of Y=2X.
c. If X us U[-1,0], what is the CDF of Y=2X.
d. If X is exponential with mean 3, what is the CDF of Y=3X?
e. If X is exponential with a mean of 4, what is the CDF of Y=-X?
f. If X is random with a mean of -2 and variance of 9, what is the standard deviation of Y=-2X?
g. If X is exponential with a mean of 8, what is the CDF of Y= $\sqrt{X}$?
h. If X and Y are independent and identically distributed each with a mean of A and variance of V, what are (a) mean and variance of Z= X+Y (b) mean and variance of W=X-Y ?
i. If X is U[0,1], what is the pdf of Y=4log(1/X)?
j. If X is exponential with a mean of unity, what is the pdf of Y=exp(-X)?
k. If X and Y are i.i.d, each uniform in [0,2], what is the pdf of Z=X-Y?
l. If X and Y are i.i.d, each uniform in [0,1], what is the pdf of Z=|X-Y|?
m. If X and Y are i.i.d, each N(0,4), what are the densities of Z=X+Y and W=X-Y?
n. If X and Y are i.i.d, each N(2,3), what are the densities of Z=X+Y and W=X-Y?
o. If X is U[0,2], what is the pdf of Y=2-X?
p. If X is N(2,8) with a pdf f(x) and CDF of F(x), what is the variance of Y=F(x).
q. If X is Rayleigh distributed amplitude with an average power of 10, what is the pdf of Y=1-exp(-X^2/10)?
r. If X is N(0,4) and Y is N(0,9) and X and Y are independent, what is the prob {XY>0)?

Problem 2 X and Y have the joint pdf $f(x,y)=\begin{cases} cx, 0<x<y<1 \\ 0, elsewhere \end{cases}$

a. What is the value of c?
b. Obtain the marginal densities of X and Y? Are they independent?
c. What is P[X>Y/2]

Problem 3 The joint density of X and Y is

$$f(x,y)=k\sin(x+y), 0<x<\frac{\pi}{2}, 0<y<\frac{\pi}{2}$$

Obtain the value of k and determine f(x|y) and f(y|x).

Problem 4 The joint density of X and Y is

$$f(x,y)=\frac{k}{(a^2+x^2)(b^2+y^2)}, -\infty \le x \le \infty, -\infty \le y \le \infty, a>0, b>0$$

What is the value of k? Obtain the marginal pdfs and CDFs. Obtain the expression for the joint CDF.

Problem 5 X and Y are independent identically distributed random variables, each uniform in [0,10]. Obtain the densities of the max(X,Y) and min(X,Y).

Problem 6 Obtain the densities of the max(X,Y) and min(X,Y) if X is exponentially distributed with a mean of 4 and Y is Rayleigh distributed with a mean power of 8.

Problem 7 Data collected from a machine vision lab to see the efficiency of an object recognition system is given. The 200 data points given are collected as follows: Two receivers are mounted on the vehicle receiving the backscattered signal from the observation region. The first set of 100 points is from receiver # 1 and the second set of 100 points is from receiver # 2. In this experiment, the interest is to see how the performance of the receiver could be improved. To accomplish this, three algorithms are explored, namely the arithmetic mean, geometric mean and the maximum. The performance is characterized by the performance index

$$\eta = \frac{\text{mean}}{\text{standard deviation}} .$$

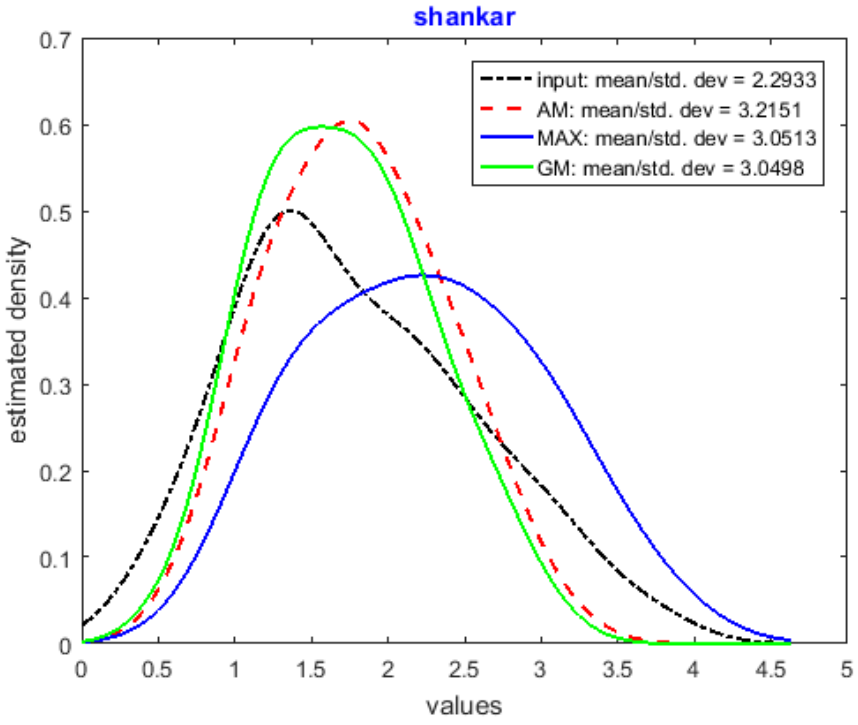
Obtain the performance indices for the raw data, arithmetic mean, geometric mean and the maximum.

If X and Y represent the two outputs,

$$V = \text{arithmetic mean} = \frac{X+Y}{2}$$
$$W = \text{geometric mean} = \sqrt{XY}$$
$$Z = \text{Maximum} = \max(X, Y)$$

The individual sets are given in the excel file, `HW7_data_shankar_Spring`

Sample results



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P. M. Shankar, May 12, 10:00 AM