COLLEGE OF ENGINEERING
COMPUTER SCIENCE
VIRGINIA TECH

**Machine Learning I**

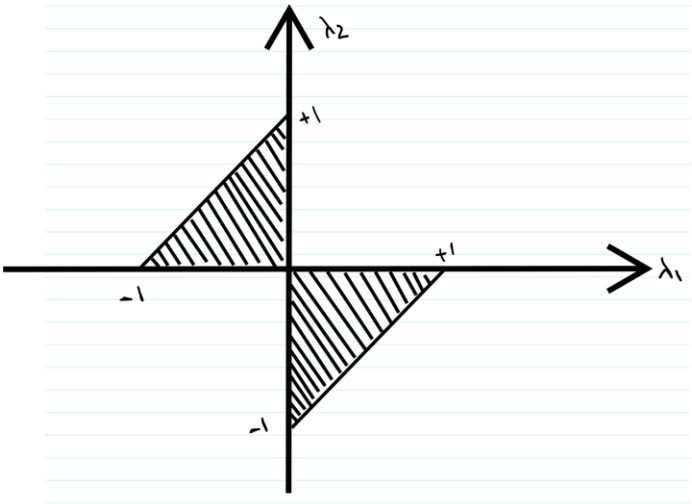
**CS 5805**

**Homework # 4**

1. Consider the following joint density function for the random variable X and Y with the following distribution:

$$f_{X,Y}(\lambda_1,\lambda_2)=\begin{cases} c \;;\; -1<\lambda_1<1 \; and \; -1<\lambda_2<1 \\ \\ 0 \quad ; \quad Else \end{cases}$$

a. Find the constant c.
b. Find the marginal density $f_X(\lambda_1)$ and $f_Y(\lambda_2)$
c. Graph the marginal density function for random variable X and Y and show that the area under each curve is unity.
d. What is E[X]? what is E[Y]?
e. Find and graph $f_{X|Y}(\lambda_1|\lambda_2)$ . What is $f_{X|Y}(\lambda_1|\lambda_2)$ when $\lambda_2$ = 0.5.
f. Find and graph $f_{Y|X}(\lambda_2|\lambda_1)$. What is $f_{Y|X}(\lambda_2|\lambda_1)$. when $\lambda_1$ = 0.5.
g. Are random variable X and Y independent?

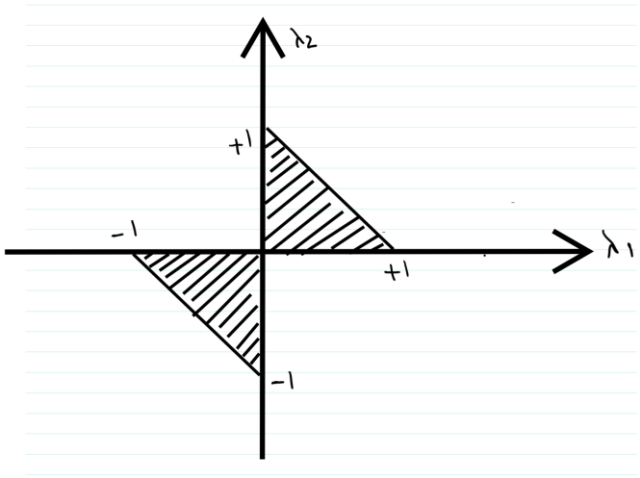



2. Consider the following joint density function for the random variable X and Y with the following distribution:

$$f_{X,Y}(\lambda_1,\lambda_2)=\begin{cases} c \;;\; -1<\lambda_1<1 \; and \; -1<\lambda_2<1 \\ \\ 0 \quad ; \quad Else \end{cases}$$

a. Find the constant c.
b. Find the marginal density $f_X(\lambda_1)$ and $f_Y(\lambda_2)$

c. Graph the marginal density function for random variable X and Y and show that the area under each curve is unity.
d. What is E[X]? what is E[Y]?
e. Find and graph $f_{X|Y}(\lambda_1|\lambda_2)$ . What is $f_{X|Y}(\lambda_1|\lambda_2)$ when $\lambda_2$ = 0.5.
f. Find and graph $f_{Y|X}(\lambda_2|\lambda_1)$. What is $f_{Y|X}(\lambda_2|\lambda_1)$. when $\lambda_1$ = 0.5.
g. Are random variable X and Y independent?




3. Consider the following joint density function for the random variable X and Y uniformly distributed as:

$$f_{X,Y}(\lambda_1,\lambda_2)=\begin{cases} c\lambda_1^2+\dfrac{\lambda_1\lambda_2}{3} & ;\ 0<\lambda_1<1\ and\ 0<\lambda_2<2 \\ \square & \\ 0 \quad ; & Else \end{cases}$$

a. Find the constant c.
b. Find the marginal density $f_X(\lambda_1)$ and $f_Y(\lambda_2)$.
c. Graph the marginal density function for random variable X and Y and show that the area under each curve is unity.
d. Find $P(\lambda_1+\lambda_2>1)$
e. Are random variable X and Y independent?

Please be ready to submit the solution to this homework by the due date. There is no need to use python for this homework. The solution to this homework can be written by hand and a good quality (readable) snapshot of your work should be submitted through the course canvas shell.