

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS

ELECTRICAL ENGINEERING DEPARTMENT

EE 315

MAJOR 2

DATE: May 11, 2011

TIME: 7:00 PM-9:00 PM

SER#	
ID#	
Name	
Section#	

	Maximum	Score
Problem 1	9	
Problem 2	10	
Problem 3	13	
Problem 4	8	
TOTAL	40	

Problem 1:

Let X and Y have a joint pdf:

$$f_{X,Y}(x, y) = k \cdot e^{-x-y} \quad \text{for } x \geq 0, y \geq 2x$$

- a. Find the constant k that makes $f_{X,Y}(x, y)$ a valid joint pdf.
- b. Find the marginal pdfs $f_X(x)$ and $f_Y(y)$
- c. Show whether X and Y are independent random variables or not?

Problem 2:

Two random variables X and Y have a joint pdf given by:

$$f_{X,Y}(x, y) = \begin{cases} \frac{1}{4}(2x + y), & 0 \leq x \leq 1, \quad 0 \leq y \leq 2 \\ 0, & \text{elsewhere} \end{cases}$$

- a) Find the joint CDF $F_{X,Y}(x, y)$ of X and Y over all $-\infty < x < \infty$, $-\infty < y < \infty$.
- b) Find the conditional pdf $f_X(x|Y=1)$.
- c) Find the probability $P\{2X \leq Y\}$.

Problem 3:

The following information is known about two jointly Gaussian random variables X and Y :

$$E[X]=0, \quad E[Y]=-1, \quad E[X^2]=4, \quad E[Y^2]=9, \text{ and } R_{XY}=-4$$

Two new random variables W and U are defined as

$$W = 3X + Y$$

$$U = -X - 2Y$$

- a) Find $E[W]$, $E[U]$, $E[W^2]$, and $E[U^2]$.
- b) Find the variances σ_X^2 , σ_Y^2 , σ_U^2 and σ_W^2
- c) Find the correlation R_{WU}
- d) Are W and U uncorrelated? Justify your answer.
- e) Determine the joint pdf of W and U .

Problem 4:

A random variable X with the following probability density function:

$$f_X(x) = \begin{cases} 2e^{-2x}, & x \geq 0 \\ 0, & \text{elsewhere} \end{cases}$$

is transformed to a new random variable $Y = (X - 3)^2 - 1$.

Find the probability density function of Y

Plot the pdf $f_Y(y)$