Practice Problems - 2 EC 252 PTSP

- 1. X and Y are uniformly on the triangular region 0< x ≤ y ≤ x+y <2. Find the pdf of x+y and x-y. Assume X and y are independent.
- 2. X and Y independent uniformly distributed random variables on (0,1) Find the joint pdf of X+Y and X-Y.
- 3. The random variables X and y are independent and y is uniform in the jutinal (0,1). Show that if Z=X+Y, then

$$f_{z}(s) = F_{x}(s) - F_{x}(s-1).$$

4. X and Y are independent uniformly distributed random variables in (0,1). Let $W = \max(X,Y)$, $Z = \min(X,Y)$.

Find the pdf of
$$S = W + Z$$
.

- 5. Let the joint pdf of x and y be given by $f_{XY}(x,y) = \begin{cases} e^{-x}, & 0 < y < x < \infty \\ 0, & \text{otherwise.} \end{cases}$
 - Define Z = X+Y, W = X-Y. Find the joint pdf of Z and W.

6. Suppose that random variables X and Y have joint pdf:

$$f_{xy}(x,y) = \begin{cases} 4x^2, & 0 < y < x < 1, \\ 0, & \text{otherwise}. \end{cases}$$

- a) Find E(XY) b) Find fy(y)
- c) Find $f_{X|Y}(x|y)$ d) Find $E[x^2|y=y]$ for 0 < y < 1.
- 7. Let U and V be independent random variables such that U is uniformly distributed over the interval [0,1] and V has the exponential probability density function with parameter A. Calculate a) $\mathbb{E}[V^2 \mid 1+U]$ b) $P(U \leq V)$.
- 8. Let X and Y be statistically independent Gaussian-distributed random variables, each with zero mean and unit variance.

 Define the process

$$Z(t) = X cos(2at) + y sin(2at)$$

- a) Determine the joint pdf of the random variables Z(ti) and Z(ti) obtained by Z(t) at times b, and to respectively.
- b) Is the process Z(t) stationary?

9. Consider a pair of stationery processes X(t) and Y(t). Show that the Cross-correlations Rxy(T) and Ryx(T) have the following properties:

 \sim) $R_{xy}(\tau) = R_{yx}(-\tau)$

b) $|R_{xy}(\tau)| \leq \frac{1}{2} \left[R_{xx}(0) + R_{yx}(0) \right]$.

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6) Is the pround 2(4) statement?