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EXAM ID NUMBER:________

COURSE NUMBER: AMCS 241

PROBLEM: 1

Problem 1 (20 Points)

Part 1 (10 points)

1) (7 points) Let *X* be a continuous random variable. Find a general formula for the probability density function (PDF) of *Y=|X|.*

2) (3 points) Evaluate your formula if *X* is a standard normal random variable.

Hint: The PDF of a normal random variable with mean □ and standard deviation □ is given by

$$f_X(x) = \frac{1}{\sqrt{2\pi}\,\sigma} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right).$$

Part 2 (10 points)

A random process *X[n]* for -∞ < *n* < ∞ consists of independent random variables with

$$X[n] \sim \begin{cases} \text{Gaussian with zero mean and unit variance for } n \text{ even i.e. } \mathcal{N}(0,1) \text{ for } n \text{ even} \\ \text{Uniformly distributed over } [-\sqrt{3}, \sqrt{3}] \text{ for } n \text{ odd i.e. } \quad \mathcal{U}(-\sqrt{3}, \sqrt{3}) \quad \text{for } n \text{ odd} \end{cases}$$

1) (5 points) Is the random process *X[n]* wide sense stationary (WSS)?

2) (5 points) Is *X[n]* stationary?

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EXAM ID NUMBER:_______

COURSE NUMBER: ACMS 241

PROBLEM: 2

Problem 2 (20 Points)

Part 1 (10 points)

Let *X* and *Y* be two discrete random variables with joint probability mass function (PMF) given by

$$p_{X,Y}[i,j] = p_1\, p_2\, (1-p_1)^i\, (1-p_2)^j \qquad i = 0, 1, \ldots; j = 0, 1, \ldots$$

where $0 < p_1 < 1$, $0 < p_2 < 1$. Find $P[Y > X]$.

Part 2 (10 points)

1) (8 points) If the discrete white Gaussian random process *X[n]* with $\square_x^2=1$ is input to a differencer to generate the output random process *Y[n]=X[n]-X[n-1]*, find the joint probability density function (PDF) of the samples *Y[0], Y[1].*

2) (2 points) Are the samples *Y[0]* and *Y[1]* independent?