

EE 483 Communications Systems I  
Instructor: Batalama  
Homework Set 7

1. Consider transmitting a three digit message over a noisy channel having error probability  $P(E) = \frac{2}{5}$  per digit, so that the probability of a correct digit is  $P(C) = 1 - \frac{2}{5} = \frac{3}{5}$ . We assume that the 3 digits are statistically independent.
  - (i) What are the error patterns that constitute the sample space and what are their probabilities?
  - (ii) What is the probability of one error? What is the probability of two errors?

2. Derive the chain rule:  $P(XYZ) = P(X)P(Y|X)P(Z|XY)$

3. Let  $X = \frac{1}{2}N^2$ , where  $N$  is a random integer whose value is equally likely to be any in the range  $-1 \leq N \leq 3$ . Plot the CDF of  $X$  and use it to evaluate the probabilities of the following events:  $X \leq 0$ ,  $2 < X \leq 3$ ,  $X < 2$ ,  $X \geq 2$ .

4. Suppose that a certain random variable has the CDF

$$F(x) = \begin{cases} 0 & x \leq 0 \\ kx^2 & 0 < x \leq 10 \\ 100k & x > 10 \end{cases}$$

Evaluate  $k$ , find the values of  $P(X \leq 5)$  and  $P(5 < X \leq 7)$ , and plot the corresponding PDF.