Assignment 1

EE22BTECH11053 - Tanmay Vishwasrao

Question 10.13.3.25
A coin is tossed 3 times. List the possible outcomes. Find the probability of getting (i) all heads (ii) at least 2 heads

Solution: As the coin is tossed 3 times we will get 8 different outcomes.Let us define a random variable X, where getting heads is success.

$$X_i \sim \text{Ber}(p) \tag{1}$$

The cdf of X is given by

$$F_X(k) = \Pr(X \le k) \tag{2}$$

$$= \begin{cases} 0 & k < 0 \\ \sum_{i=1}^{k} \binom{n}{k} p^i (1-p)^{n-i} & 1 \le k \le n \\ 1 & k \ge n \end{cases} \tag{3}$$

Parameter	Value	Description
X	0	0 heads
	1	1 head
	2	2 heads
	3	3 heads
n	3	no. of tosses
p	$\frac{1}{2}$	probability of heads

1) To get all heads: To get all heads Z should be equal to 3. So we need

$$\Pr(Z = 3) = \binom{n}{3} p^3 (1-p)^{n-3} \tag{4}$$

$$= \frac{1}{8} \tag{5}$$

2) To get atleast 2 heads: To get atleast two heads the value of $Z \ge 2$.

$$\Pr(Z \ge 2) = 1 - \Pr(Z < 2) \tag{6}$$

$$= F_Z(3) - F_Z(1) \tag{7}$$

$$= \sum_{k=2}^{3} \binom{n}{k} p^k (1-p)^{n-k} \tag{8}$$

$$= \frac{1}{2} \tag{9}$$