Assignment 8
Papoulis Chapter 2 Question 18

Vedant Bhandare (cs21btech11007)

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Outline

Question

Ten passengers get into a train that has three cars. Assuming a random placement of passengers, what is the probability that the first car will contain three of them?

Random Variable Definition

Random Variable X	**Event**
X = 0	0 people in Car 1
X = 1	1 people in Car 1
X = 2	2 people in Car 1
X = 3	3 people in Car 1
X = 4	4 people in Car 1
X = 5	5 people in Car 1
X = 6	6 people in Car 1
X = 7	7 people in Car 1
X = 8	8 people in Car 1
X = 9	9 people in Car 1
X = 10	10 people in Car 1

Table 2: Random Variables

Solution

Binomial Distribution

$$Pr(X = i) = \binom{10}{i} \times p^i \times (1-p)^{10-i} \tag{1}$$

where i denotes the number of people in Car 1. The values for i can be substituted in the above formula, and the graph of the PMF can be obtained.

$$p \text{ (probability of people choosing Car 1)} = \frac{1}{3} \tag{2}$$

Solution

For three people in Car 1,

$Pr(X = 3)$

$$Pr(X = 3) = \binom{10}{3} \times \left(\frac{1}{3}\right)^3 \times \left(\frac{2}{3}\right)^7 \tag{3}$$

$$Pr(X = 3) = 0.26 \tag{4}$$

PMF Graph

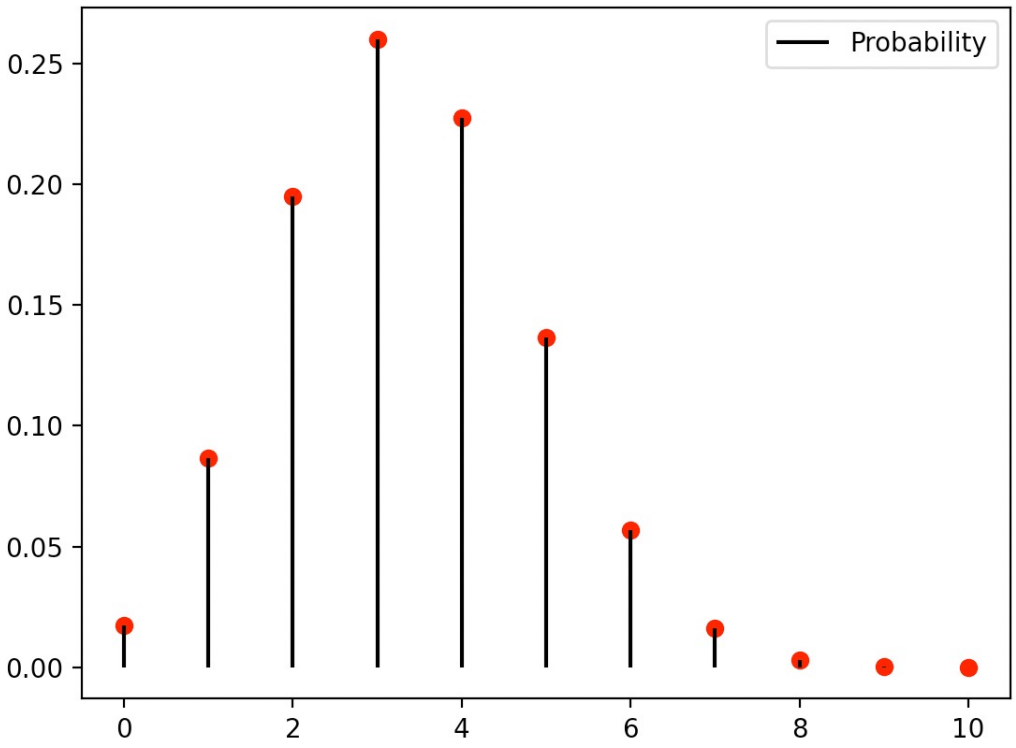

Figure 2: Probability Mass Function

CDF Graph

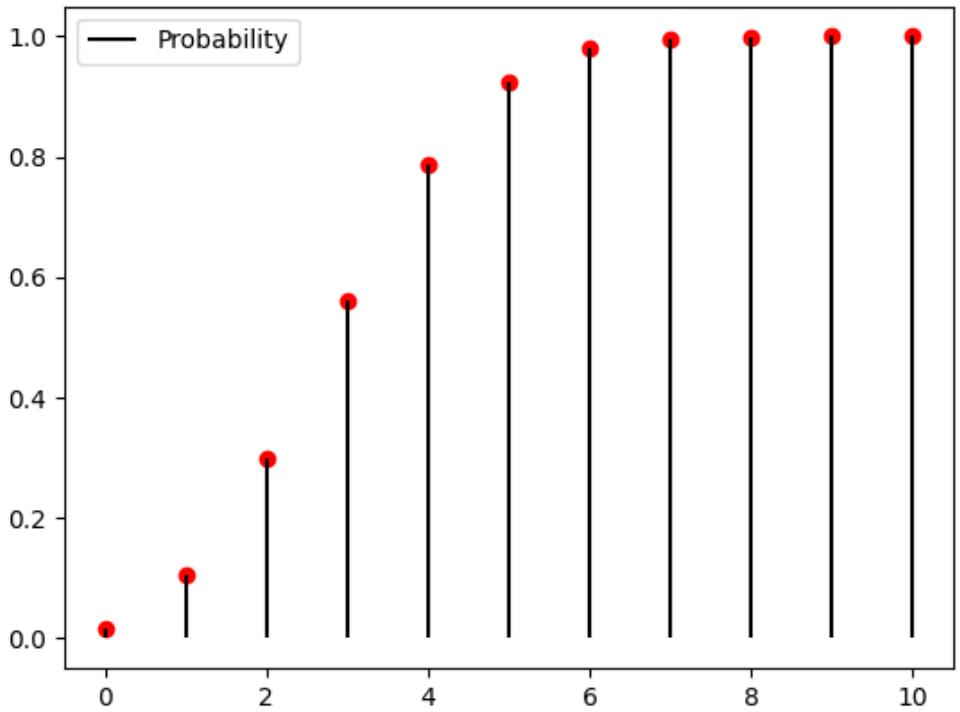

Figure 2: Cumulative Distributive Function