

Assignment 8

Papoulis Chapter 2 Question 18

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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

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

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.

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

Solution

For three people in Car 1,

$$Pr(X = 3)$$

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

$$Pr(X = 3) = 0.26 \quad (4)$$

PMF Graph

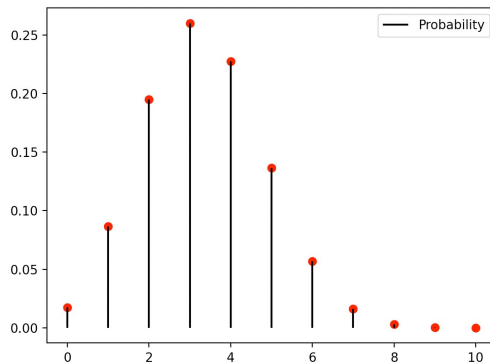


Figure 2: Probability Mass Function