Assignment 7 - Presentation

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Outline

Abstract

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- This document contains the solution to Question 3.12 in Chapter 3 of Papoulis Book.

Question

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- 3 dice are rolled and the player may bet on anyone of the face values 1,2,3,4,5 and 6. If the player's number appears on 1,2, or all 3 dice, the player receives respectively 1,2 or 3 times his original stake plus his own money back. Determine the expected loss per unit stake for the player.

Solution I

Let k be the number that player bets on.
Now, Let the random variable $X \in \{0, 1, 2, 3\}$ denote the number of times k appears on the 3 dice.

Event	Description
$X = 0$	k appears on none of the dices
$X = 1$	k appears on 1 of the dices
$X = 2$	k appears on 2 of the dices
$X = 3$	k appears on 3 dices

Table: Description of Events

Solution II

Then,

$$\Pr(X=0) = \binom{3}{0}\left(\frac{1}{6}\right)^0\left(\frac{5}{6}\right)^3 = \frac{125}{216} \tag{1}$$

$$\Pr(X=1) = \binom{3}{1}\left(\frac{1}{6}\right)^1\left(\frac{5}{6}\right)^2 = \frac{75}{216} \tag{2}$$

$$\Pr(X=2) = \binom{3}{2}\left(\frac{1}{6}\right)^2\left(\frac{5}{6}\right)^1 = \frac{15}{216} \tag{3}$$

$$\Pr(X=3) = \binom{3}{3}\left(\frac{1}{6}\right)^3\left(\frac{5}{6}\right)^0 = \frac{1}{216} \tag{4}$$

Given, If the player's number appears on 1, 2, or all 3 dice, the player receives respectively 1, 2, or 3 times his original stake plus his own money back.

Solution III

Hence, The Expected gain per unit stake for the player is

$$= \sum_{k=1}^{3} (k+1) \Pr(X = k) - \Pr(X = 0) \tag{5}$$

$$= 2\left(\frac{75}{216}\right) + 3\left(\frac{15}{216}\right) + 4\left(\frac{1}{216}\right) - \frac{125}{216} \tag{6}$$

$$= \frac{74}{216} = \underline{0.3426} \tag{7}$$

Graph

The PMF graph is:

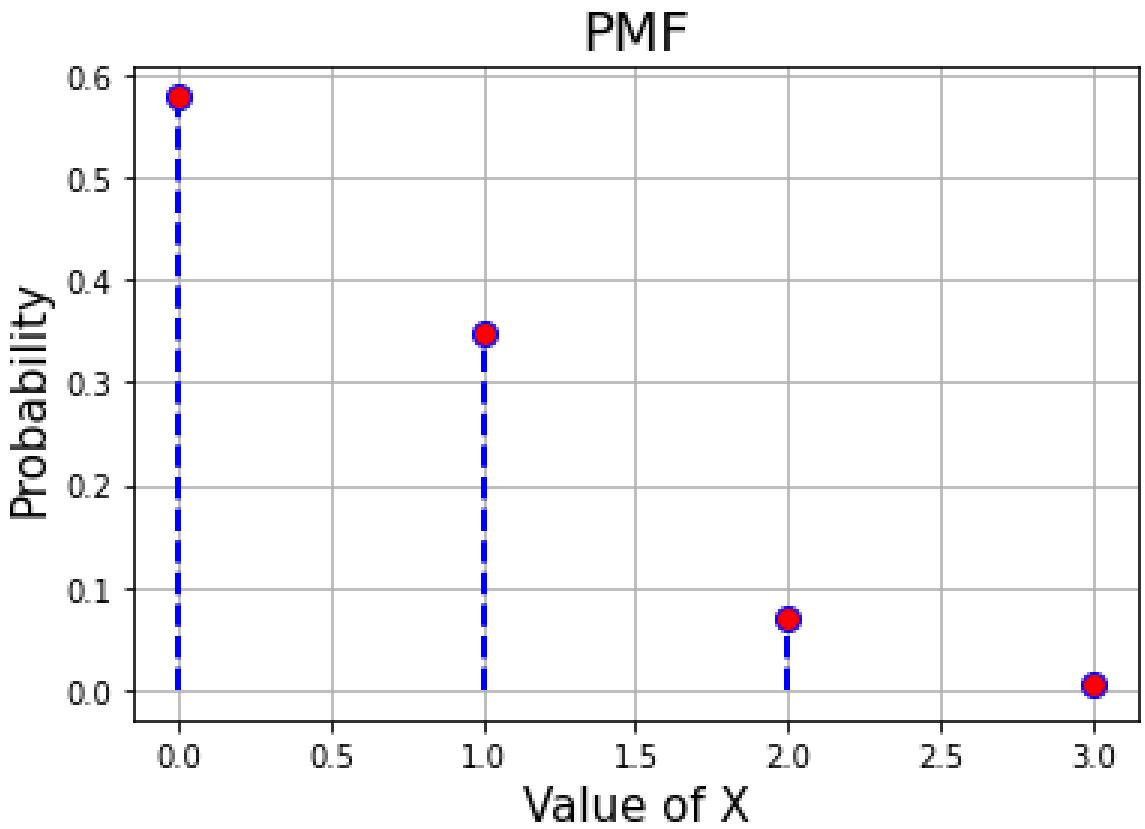

Figure: Probability Mass Function