Assignment 7

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Outline

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Abstract

This document contains 11th problem from exercise 13.5 of CBSE Class 12 (Probability)

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Problem Statement

Problem

Find the probability of getting 5 exactly twice in 7 throws of a die.

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Assignment 7

Probability Mass Function

The probability of success (assuming a fair die) is $p = \frac{1}{6}$.
Therefore, the probability that X maps to i is given by:

$$\Pr(X = i) = \binom{n}{i}(1-p)^{n-i}p^i, \ 0 \le i \le 2 \tag{1}$$

The values for i can be substituted in the above formula, and the graph of
the PMF can be obtained.

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Cumulative Distribution Function

The cumulative probability $\Pr(X \leq i)$ can be defined as under:

$$\Pr(X \leq i) = \sum_{k=0}^{i} \binom{n}{k}(1-p)^{n-k}p^{k}, \ 0 \leq i \leq 2 \tag{2}$$

The values of i can be substituted in the above equation, and the obtained values can be used to plot the CDF graph.

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Solution

The probability to be found corresponds to the case $i = 2$. Substituting $i = 2$ in Equation 1, we get

$$\Pr(X = 2) = \binom{7}{2} \times (1 - p)^{7-2} \times p^2 \tag{3}$$

$$= 21 \times \left(1 - \frac{1}{6}\right)^5 \times \left(\frac{1}{6}\right)^2 \tag{4}$$

$$= 21 \times \left(\frac{5}{6}\right)^5 \times \left(\frac{1}{6}\right)^2 \tag{5}$$

$$= \frac{21875}{2 \times 6^6} \tag{6}$$

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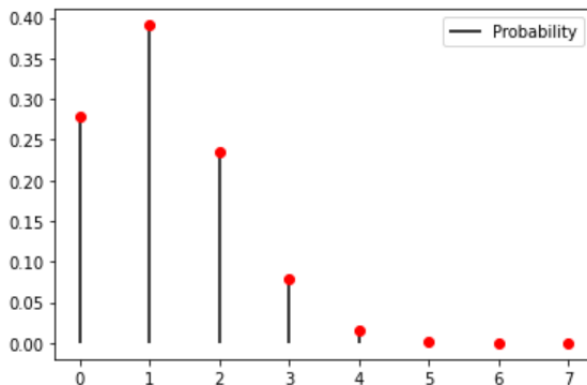
PMF Graph

The PMF graph is:
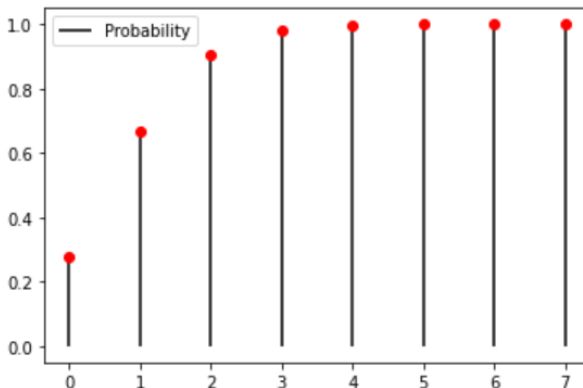

Figure 0: Probability Mass Function

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CDF Graph

The CDF graph is:

Figure 0: Cumulative Distribution Function

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