

AI1110 Assignment 7

SADINENI ABHINAY-CS21BTECH11055

May 18, 2022

Outline

- 1 Abstract
- 2 Question
- 3 Theory
- 4 Solution
- 5 PMF

Abstract

- This document contains the solution to Question of Chapter 13 (Probability) in the NCERT Class 12 Textbook.

Question

Probability ex 13.5 q8.

Suppose X has a binomial distribution $B(6, \frac{1}{2})$. Show that $X = 3$ is most likely outcome.

(*hint* : $\Pr(X = 3)$ is the max among all $\Pr(x_i)$, $x_i = 0, 1, 2, 3, 4, 5, 6$)

Theory

Binomial Distribution

the binomial distribution with parameters n and p is the discrete probability distribution of the number of successes in a sequence of n independent experiments, each asking a yes–no question, and each with its own Boolean-valued outcome: success (with probability p) or failure (with probability $q = 1-p$)

The Expression is given by:

$$\sum_{i=0}^n \Pr(X = i) = \sum_{i=0}^n {}^nC_i(p)^i (1-p)^{n-i} \quad (1)$$

$$\Pr(X = i) = {}^nC_i(p)^i (1-p)^{n-i} \quad (2)$$

Solution

Given X has binomial distribution $B(6, \frac{1}{2})$, Now let us find out individual probabilities for all $i = 0, 1, 2, 3, 4, 5, 6$, here $n = 6$ and $p = \frac{1}{2}$.

$$\Pr(X = 0) = {}^6C_0 \left(\frac{1}{2}\right)^0 \left(\frac{1}{2}\right)^{6-0} = \frac{1}{64} \quad (3)$$

$$\Pr(X = 1) = {}^6C_1 \left(\frac{1}{2}\right)^1 \left(\frac{1}{2}\right)^{6-1} = \frac{3}{32} \quad (4)$$

$$\Pr(X = 2) = {}^6C_2 \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^{6-2} = \frac{15}{64} \quad (5)$$

$$\Pr(X = 3) = {}^6C_3 \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^{6-3} = \frac{5}{16} \quad (6)$$

$$\Pr(X = 4) = {}^6C_4\left(\frac{1}{2}\right)^6 = \frac{15}{64} \quad (7)$$

$$\Pr(X = 5) = {}^6C_5\left(\frac{1}{2}\right)^6 = \frac{3}{32} \quad (8)$$

$$\Pr(X = 6) = {}^6C_6\left(\frac{1}{2}\right)^6 = \frac{1}{64} \quad (9)$$

Probability	Value
$\Pr(X = 0)$	0.016
$\Pr(X = 1)$	0.094
$\Pr(X = 2)$	0.234
$\Pr(X = 3)$	0.312
$\Pr(X = 4)$	0.234
$\Pr(X = 5)$	0.094
$\Pr(X = 6)$	0.016

Table 1: Values

From the Table-1 we come to know that $\Pr(X = 3)$ has the maximum among all the values, We can also verify from the PMF plot in following section, at $X = 3$ it has the highest y-value(probability, $\Pr(X = i)$)
 $\therefore X = 3$ is most likely outcome.

PMF

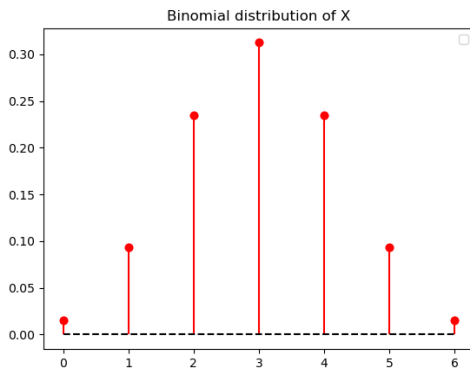


Figure 1: PMF