

Assignment 1

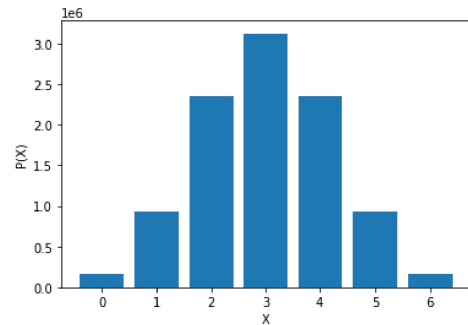
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March 14, 2021

QUESTION:

Suppose X has a binomial distribution. Show that $X = 3$ is the most likely outcome. (Hint : $P(X = 3)$ is the maximum among all $P(x_i)$, $x_i = 0, 1, 2, 3, 4, 5, 6$). Assume $p = 0.5$

Number of times ($X=k$)($k=0,1,2,3,4,5,6$) has occurred out of 10000000 experiments



SOLUTION:

Given number of times event is performed(n)=6

Given probability of event(p)=0.5

Therefore $1-p=0.5$

We know that binomial probability $[P(X=k)] = \binom{n}{k} p^k (1-p)^{n-k}$
substituting $n=6, p=1-p=\frac{1}{2}$

$$\begin{aligned} P(X = k) &= \binom{6}{k} \left(\frac{1}{2}\right)^k \left(\frac{1}{2}\right)^{6-k} \\ \left(\frac{1}{2}\right)^k \left(\frac{1}{2}\right)^{6-k} &= \frac{1}{2}^{6-k+k} = \left(\frac{1}{2}\right)^6 \\ P(X = k) &= \binom{6}{k} \left(\frac{1}{2}\right)^6 \end{aligned}$$

For $P(X=k)$ to be maximum $\binom{6}{k}$ should be maximum, where $k = \{0, 1, 2, 3, 4, 5, 6\}$

$$\begin{aligned} \binom{6}{0} &= 1, \binom{6}{1} = 6, \binom{6}{2} = 15, \binom{6}{3} = 20, \\ \binom{6}{4} &= 15, \binom{6}{5} = 6, \binom{6}{6} = 1 \end{aligned}$$

Therefore $\binom{6}{3}$ is maximum ,therefore $P(X=3)$ is most likely outcome.
Hence proved.

Submitted by Student unknown *on* .

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