ANSWER TO QUESTION #86599 – MATH – STATISTICS AND PROBABILITY

QUESTION

The distribution of the binomial random variable (X) has the following parameters p = 0.3 and n = 9. Determine E(X).

SOLUTION

Given X ~B (n, p)

$P(X = r) = \binom{n}{r} p^r (1-p)^{n-r}$ where r = 0,1,2,...,n;

$E(X)=\sum_{r=0}^{n} r \binom{n}{r} p^r (1-p)^{n-r}.$

Since $r\binom{n}{r} = \frac{r.n!}{n-r!.r!} = \frac{r.n.\ n-1!}{n-r!.r.\ r-1!} = \frac{n.\ n-1!}{n-r!\ r-1!} = \frac{n.\ n-1!}{(n-1)-(r-1)!\ r-1!} = n\binom{n-1}{r-1}$

Hence $E(X)=\sum_{r=0}^{n} r \binom{n}{r} p^r (1-p)^{n-r} = \sum_{r=1}^{n} np \binom{n-1}{r-1} p^{r-1} (1-p)^{(n-1)-(r-1)}$

$$= np\,(p+1-p)^{n-1} = np$$

Given n = 9, p = 0.3 hence E(X) = np =9(.3) = 2.7.

Answer: E(X)= 2.7.

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