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Exercise for February 11, 2006

November 1981 Course 110 Examination, Problem No. 50

Suppose X is a binomial random variable based upon n independent trials, with p being the probability of success on each trial. If $\Pr(X = n) = 0.00032$ and

$\Pr(X = n - 1) = 0.00128n$ what is p ?

- A. 0.20 B. 0.25 C. 0.40 D. 0.80 E. $\frac{1}{4n}$

Solution.

For a binomial random variable with parameters n and p , its probability function is

$$\Pr(X = k) = \binom{n}{k} \cdot p^k \cdot (1 - p)^{n-k}.$$

Therefore, given the information in the problem

$$\Pr(X = n) = \binom{n}{n} \cdot p^n \cdot (1 - p)^0 = p^n = 0.00032,$$

$$\Pr(X = n - 1) = \binom{n}{n-1} \cdot p^{n-1} \cdot (1 - p)^1 = np^{n-1}(1 - p) = n(p^{n-1} - p^n) = 0.00128n,$$

so that

$$p^n = 0.00032,$$

$$p^{n-1} - p^n = 0.00128.$$

From these two we conclude that

$$p^{n-1} = 0.00160.$$

Therefore

$$\frac{p^n}{p^{n-1}} = \frac{0.00032}{0.00160} = 0.20.$$

Answer A.

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