

EXAM P QUESTIONS OF THE WEEK

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Week of April 9/07

As part of the underwriting process for insurance, each prospective policyholder is tested for diabetes.

Let X represent the number of tests completed when the first person with diabetes pressure is found. The expected value of X is 8. Calculate the probability that the fourth person tested is the first one with high blood pressure.

- A) 0.000 B) 0.050 C) 0.084 D) 0.166 E) 0.394

The solution can be found below.

Week of April 9/07 - Solution

This problem makes use of the geometric distribution. The experiment being performed is the diabetes test on an individual. We define "success" of the experiment to mean that the individual has high diabetes. We denote the probability of a success occurring in a particular trial by p . Since X is the number of persons tested until the first person with diabetes is found, it is a version of the geometric distribution, where Y is the trial number of the first success (the trial number of the first success is 1, or 2, or 3, ...). The probability function is $P(Y = k) = (1 - p)^{k-1}p$, $k = 1, 2, 3, \dots$

The mean of this form of the geometric distribution is $\frac{1}{p}$, so that

$\frac{1}{p} = 8$ and therefore $p = \frac{1}{8}$. The probability that the first success occurs on the 4th trial (first case of diabetes is the 4th individual) is $(1 - p)^3p$, since there will be 3 failures and then the first success. This probability is $(\frac{7}{8})^3(\frac{1}{8}) = .08374$. Answer: C