

## Answer on Question #72709 – Math – Statistics and Probability

### Question

Find the mean and variance of the random variable  $X$  in Exercise 5.61, representing the number of persons among 10,000 who make an error in preparing their income tax returns.

### Solution

Suppose that, on average, 1 person in 1000 makes a numerical error in preparing his or her income tax return. If 10,000 returns are selected at random and examined, find the mean and variance of the random variable  $X$ .

We have  $n = 10000$  is large and  $p = 1/1000$  is near 0, then the binomial distribution can be approximated by the Poisson distribution with parameter  $\lambda = np = 10000 \times (1/1000) = 10$ .

Use the Poisson distribution

$$P(X = x) = \frac{e^{-\lambda} \lambda^x}{x!}, \quad x = 0, 1, 2, \dots$$

The mean and the variance of the Poisson distribution are both equal to  $\lambda$

$$\mu = E(X) = \lambda,$$

$$V(X) = \sigma^2 = \lambda,$$

$$\mu = E(X) = 10,$$

$$V(X) = \sigma^2 = 10.$$

**Answer:**  $\mu = E(X) = 10, V(X) = \sigma^2 = 10$