

### Answer on Question #50955 – Math – Statistics and Probability

In San Francisco, 30% of workers take public transportation daily (Use binomial distribution)

1. In a sample of 10 workers, what is the probability that exactly three workers take public transportation daily (4 decimal places)
2. In a sample of 10 workers, what is the probability that at least three workers take public transportation daily (4 decimal places)
3. How many workers are expected to take public transportation daily? (2 decimal places)
4. Compute the variance of the number of workers that will take the public transport daily. (2 decimal places)
5. Compute the standard deviation of the number of workers that will take the public transportation daily. (3 decimal places)

#### Solution

1. The probability that exactly three workers take public transportation daily is

$$P(X = 3) = \frac{10!}{3!(10-3)!} 0.3^3 (1 - 0.3)^{10-3} = 0.2668, \text{ where } X \text{ is a binomial random variable, } p = 0.3, n = 10.$$

2. The probability that at least three workers take public transportation daily is

$$P(X \geq 3) = 1 - P(X = 0) - P(X = 1) - P(X = 2).$$

$$P(X = 0) = \frac{10!}{0!(10-0)!} 0.3^0 (1 - 0.3)^{10-0} = 0.0282.$$

$$P(X = 1) = \frac{10!}{1!(10-1)!} 0.3^1 (1 - 0.3)^{10-1} = 0.1211.$$

$$P(X = 2) = \frac{10!}{2!(10-2)!} 0.3^2 (1 - 0.3)^{10-2} = 0.2335.$$

So,

$$P(X \geq 3) = 1 - 0.0282 - 0.1211 - 0.2335 = 0.6172.$$

3. The number of workers are expected to take public transportation daily is the expectation

$$\mu = pn = 0.3 \cdot 10 = 3.00.$$

4. The variance of the number of workers that will take the public transport daily is

$$\sigma^2 = p(1 - p)n = (1 - 0.3)0.3 \cdot 10 = 2.10.$$

5. The standard deviation of the number of workers that will take the public transportation daily is

$$\sigma = \sqrt{\sigma^2} = \sqrt{p(1 - p)n} = \sqrt{(1 - 0.3)0.3 \cdot 10} = 1.449.$$