The normal approximation to the Binomial

Continuity Correction factor

The normal probability distribution is a good approximation to the binomial probability distribution when $n\pi$ and $n(1-\pi)$ are both at least 5.

Only four cases may arise. These cases are:

1. For the probability *at least X* occurs, use the area *above* (*X* -.5).

2. For the probability that *more than X* occurs, use the area *above* (*X*+.5).

3. For the probability that *X or less*occurs (at most), use the area *below* (*X* +.5).

4. for the probability that *less than X* occurs, use the area *below* (*X*-.5).

Example

Assume a binomial probability distribution with $n = 50$ and $\pi = 0.25$. Compute the following:

1-the mean and the standard deviation of the random variable

2-The probability that x=25

3-The probability that x at least 15

4-The probability that x more than15

5-The probability that x is10 or less

6-The probability that x is less 10

Solution

$$1-$$
$$\mu = n\pi = 50 \times 0.25 = 12.5$$
$$\sigma^2 = n\pi(1-\pi) = 50 \times 0.25(1-0.25) = 9.375$$
$$\sigma = \sqrt{9.375} = 3.0619$$

$$2-$$
$$p(x = 25) = 50C_{25} \times 0.25^{25} \times (1-0.25)^{50-25} = 0.000084$$

$3-$

$\because n\pi = 50 \times 0.25 = 12.5 \, and \, n(1-\pi) = 50(1-0.25) = 37.5 \geq 5$

$\therefore \; P(X \geq 15) = P(X \geq 15 - 0,5) = P(X \geq 14.5) = P\left(Z \geq \dfrac{14.5 - 12.5}{3.0619}\right) = P(Z \geq 0.65)$

$= 0.5 - 0.2422 = 0.2578$

$4-$

$\therefore \; P(X > 15) = P(X > 15 + 0,5) = P(X > 15.5) = P\left(Z > \dfrac{15.5 - 12.5}{3.0619}\right) = P(Z > 0.98)$

$= 0.5 - 0.3365 = 0.1635$

$5-$

$\therefore \; P(X \leq 10) = P(X \leq 10 + 0,5) = P(X \leq 10.5) = P\left(Z \leq \dfrac{10.5 - 12.5}{3.0619}\right) = P(Z \leq -0.65)$

$= 0.5 - 0.2422 = 0.2578$

$6-$

$\therefore \; P(X < 10) = P(X < 10 - 0,5) = P(X < 9.5) = P\left(Z < \dfrac{9.5 - 12.5}{3.0619}\right) = P(Z < -0.98)$

$= 0.5 - 0.3365 = 0.1635$