Answer on Question #55369 – Math – Statistics and Probability

Question

Suppose that 61.5% of brides are younger than their grooms. Suppose one were to consider simple random samples of size 40 of brides. What is the probability that the proportion of brides in a sample of size 40 who are younger than their grooms exceeds 0.625?

Solution

First of all, we find $40 \cdot 0.625 = 25$. Let ξ be a number of brides who are younger than their grooms. We must find the next probability:

$P\{25 < \xi \leq 40\}$.

Notice that ξ has the binomial distribution with the parameters $p = 0.615, n = 40$.

We shall use the normal approximation (i.e. the integral theorem of Moivre-Laplace):

$$P\{25 < \xi \leq 40\} = P\left\{\frac{25-40\cdot 0.615}{\sqrt{40\cdot 0.615\cdot 0.385}} < \frac{\xi - np}{\sqrt{npq}} \leq \frac{40-40\cdot 0.615}{\sqrt{40\cdot 0.615\cdot 0.385}}\right\} = P\left\{0.13 < \frac{\xi - np}{\sqrt{npq}} \leq 5\right\} \approx$$

$$\approx \Phi(5) - \Phi(0.13) = 0.5 - 0.05172 = 0.44828.$$

Here $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_0^x e^{-\frac{t^2}{2}} dt$ is a tabulated function of Laplace and we found $\Phi(5), \Phi(0.13)$ using the table of this function.

Answer: 0.44828.