

## Answer on Question #46553 – Math – Statistics and Probability

### Question.

If 5 million people voted for a ballot which had a yes or a no answer, what is the probability that the outcome is evenly split 50:50?

### Solution.

The probability of event that one person will take the yes answer is equal to  $\frac{1}{2}$ . So we have the Bernoulli scheme with rates  $n = 5.000.000, p = q = \frac{1}{2}$ . We shall find the requirement probability using a local theorem of Moivre-Laplace:  $P(X = k) \approx \frac{1}{\sqrt{2\pi npq}} e^{-\frac{(k-np)^2}{2npq}}$ . In our case  $k = 2.500.000$  so we have:

$$P(X = 2.500.000) \approx \frac{1}{\sqrt{2\pi \cdot 5.000.000 \cdot 0.5 \cdot 0.5}} e^{-\frac{(2.500.000 - 5.000.000 \cdot 0.5)^2}{2 \cdot 5.000.000 \cdot 0.5 \cdot 0.5}} = \frac{1}{\sqrt{2.500.000 \pi}} = \frac{\sqrt{10}}{5000\sqrt{\pi}} \approx 0.0003568.$$

**Answer.** 0.0003568.