

5.2 Probability for Proportions using the Excel Spreadsheet

Definition: Normal approximation to the Binomial Distribution

Central Limit Theorem for Proportions: If the sample size times the probability of success is greater than or equal to 5 and the sample size times the probability of failure is greater than or equal to 5. The probability related to proportions of successes can be approximated based on the Normal distribution with a mean of p and standard deviation of $\sqrt{\frac{p(1-p)}{n}}$.

✓ Example 1

A question is asked of 4800 sophomore, and 58% of the students know the correct answer. If a sample of 144 students is taken repeatedly, answer the following questions.

- What is the expected value of the mean of the sampling distribution of sample proportions?
- What is the standard deviation of the mean of the sampling distribution of sample proportions? (Round to 4 decimal places)
- What is the $P(\hat{p} > 0.61)$? (Round to 4 decimal places)
- What is the $P(\hat{p} < 0.62)$? (Round to 4 decimal places)
- What is the $P(0.68 < \hat{p} < 0.7)$? (Round to 4 decimal places)

Find the answer using a Blank Excel spreadsheet

- What is the expected value of the mean of the sampling distribution of sample proportions?

The mean is the proportion of student with the correct answer, **58%** enter **0.58**.

- What is the standard deviation of the mean of the sampling distribution of sample proportions?

The standard deviation is $\sqrt{\frac{.58(1-.58)}{144}}$.

Enter the following formula into the Excel Spreadsheet

`=sqrt(.58*(1-.58)/144)`

0.04113

To include rounding in the formula.

`=round(sqrt(.58*(1-.58)/144), 4)`

0.0411

- What is the $P(\hat{p} > 0.61)$? (Round to 4 decimal places)

The probability computed using a Normal Probability. **Enter the following formula into the Excel Spreadsheet.**

`=1 - norm.dist(0.61, 0.58, 0.0411, TRUE)`

0.232717

To include rounding in the formula.

`=round(1-norm.dist(0.61, 0.58, 0.0411, TRUE), 4)`

0.2327

- What is the $P(\hat{p} < 0.62)$? (Round to 4 decimal places)

The probability computed using a Normal Probability. **Enter the following formula into the Excel Spreadsheet.**

```
=norm.dist(0.62, 0.58, 0.0411, TRUE)
```

```
0.834782
```

To include rounding in the formula

```
=round(norm.dist(0.62, 0.58, 0.0411, TRUE), 4)
```

```
0.8348
```

e) What is the $P(0.68 < \hat{p} < 0.7)$? (Round to 4 decimal places)

The probability computed using a Normal Probability. **Enter the following formula into the Excel Spreadsheet.**

```
= norm.dist(0.7, 0.58, 0.0411, TRUE) - norm.dist(0.68, 0.58, 0.0411, TRUE)
```

```
0.005733
```

To include rounding in the formula

```
= rounding(norm.dist(0.7, 0.58, 0.0411, TRUE) - norm.dist(0.68, 0.58, 0.0411, TRUE),4)
```

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