Distribution of the Sample Proportion

Sample Proportion

$$\hat{p} = \frac{x}{n}$$

sample proportion is a statistic that estimates the population proportion p.

Sampling Distribution of $\hat{p}$

For a simple random sample of size n with a population proportion p

- The shape of the sampling distribution of phat is approximately normal provided np(1-p)≥10
- Mean of the sampling distribution of $\hat{p}$ is $\mu_{\hat{p}} = p$
- Standard deviation of the sampling distribution of $\hat{p}$ is $\sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$
- n is less than or equal to 0.05N (5% of the population)

"By Hand"

Step 1: Find the mean and standard deviation

$$\mu_{\hat{p}} = p \qquad \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

Step 2: Convert the value(s) you are working with to a z score (round z score to 2 decimal places)

$$Z = \frac{\hat{p} - \mu_{\hat{p}}}{\sigma_{\hat{p}}}$$

Step 3: Look it up in the table based on area to the right, left, and in between

NormalCDF Usage

Step 1: Find the mean and standard deviation

$$\mu_{\hat{p}} = p \qquad \sigma_{\hat{p}} = \sqrt{\frac{p(1-p)}{n}}$$

Step 2: Convert the value(s) you are working with to a z score (round z score to 2 decimal places)

$$Z = \frac{\hat{p} - \mu_{\hat{p}}}{\sigma_{\hat{p}}}$$

Step 3: Plug it into one of the following 3 forms

$$normalcdf\,(Z, E99, 0, 1)$$
$$normalcdf\,(-E99, Z, 0, 1)$$
$$normalcdf\,(Z_1, Z_2, 0, 1)$$

1. Distribution of the Sample Proportion

According to www.statisticbrain.com, 70% of YouTube visitors are from outside of the United States.

a) Suppose a random sample of 800 YouTube visitors are asked where they are from. Describe the sampling distribution of $\hat{p}$, be sure to verify the model.

1. Distribution of the Sample Proportion (cont.)

b) In the sample obtained in part (a), what is the probability the proportion of visitors who are from outside of the United States is greater than 0.74?

c) In the sample obtained in part (a), what is the probability the proportion of visitors who are from outside of the United States is less than 0.65?

1. Distribution of the Sample Proportion (cont.)

d) In the sample obtained in part (a), what is the probability the proportion of visitors who are from outside of the United States is between 0.60 and 0.68?

e) Would it be unusual that, in a survey of 800 YouTube visitors that 400 or fewer are from outside of the United States?