

### A. Problem Statement

We would like to test the following hypotheses:

$$H_0: p = 0.8$$

$$H_A: p \neq 0.8,$$

Where:

- $p$  is the proportion of all former students of Dr. Difficult's Calculus class who got A's.

In order to test this, we need to know more about the sampling distribution of

(1) \_\_\_\_\_.

### B. Actual Sampling Distribution Creation

If we wanted to create this sampling distribution by hand, that would help us test these hypotheses we would need to do the following.

1. Collect  $M$  random samples (2) \_\_\_\_\_ (WITH/WITHOUT) replacement from the population of all former Dr. Difficult calculus students.
2. Then calculate the (3) \_\_\_\_\_ of each of these random samples and put them in a list.

### C. Theoretical Sampling Distribution

HOWEVER, we don't actually need to create this sampling distribution above, because we know the following things about this sampling distribution.

1. The mean of this sampling distribution is approximately (4) \_\_\_\_\_.
2. The standard deviation of this sampling distribution (aka the standard error) is approximately (5) \_\_\_\_\_.
3. Because the following (6) \_\_\_\_\_ Theorem conditions for (1) \_\_\_\_\_ below hold, then the distribution of (1) \_\_\_\_\_ is (7) \_\_\_\_\_.
  - a) \_\_\_\_\_.
  - b) \_\_\_\_\_.
  - c) \_\_\_\_\_.

D. What does a p-value really mean?

Because the sampling distribution of (1) \_\_\_\_\_ is (7) \_\_\_\_\_, we are able to calculate the p-value which represents

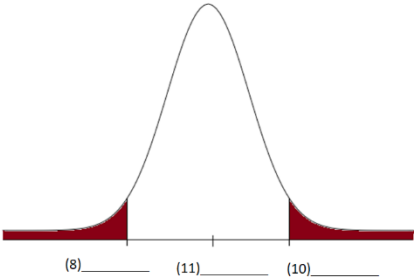
p-value = P( (1) \_\_\_\_\_ that are at least as suspicious (of the alternative hypothesis) as (8) \_\_\_\_\_ assuming that (9) \_\_\_\_\_ )

For this problem, a (1) \_\_\_\_\_ that is at exactly as suspicious (of the alternative hypothesis as (8) \_\_\_\_\_ is (10) \_\_\_\_\_.

E. Calculating the p-value

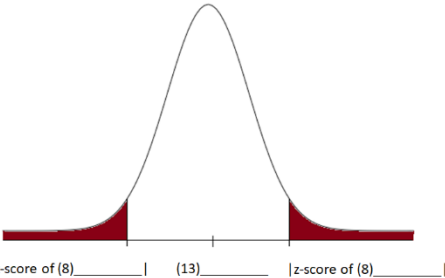
We will assume  $H_0: p = 0.8$  in this entire box.

Sampling Distribution of (1) \_\_\_\_\_



(8) \_\_\_\_\_ (11) \_\_\_\_\_ (10) \_\_\_\_\_

Distribution of the Z-scores of (1) \_\_\_\_\_



-|z-score of (8) \_\_\_\_\_| (13) \_\_\_\_\_ |z-score of (8) \_\_\_\_\_|

Furthermore, because the sampling distribution of (1) \_\_\_\_\_ is (7) \_\_\_\_\_, the distribution of the z-scores of the (1) \_\_\_\_\_ follows the (12) \_\_\_\_\_ distribution, which we know has a mean of (13) \_\_\_\_\_ and a standard deviation of (14) \_\_\_\_\_.

The z-score of (8) = (15) \_\_\_\_\_.

Interpreting the p-value

The p-value is the area represented in red (in all two plots to left).

Therefore, because our p-value that we calculated (16) \_\_\_\_\_ (IS/IS NOT) smaller than  $\alpha = 0.01$ , it (17) \_\_\_\_\_ (DOES/DOESN'T) make us suspicious enough of our **base assumption**, to make us claim that there is sufficient evidence to suggest  $H_A: p \neq 0.8$ .