How to Perform a Statistical Hypothesis Test

Instructions on the left pertain to **means** | Instructions on the right pertain to **proportions**

1. POPULATION

a. Identify the parameter of interest:

μ : Mean Numerical (Measurement)	π : proportion Categorical (success-failure)

b. Describe the variable in context of the problem:

μ = mean of the amount of drying time of a particular paint.	π = proportion of people in the community who prefer smoking.

c. Define the NULL and ALTERNATIVE Hypotheses:

The Null hypothesis is usually in the form of:

$H_0 : \mu =$ hypothesized value	$H_0 : \pi =$ hypothesized value

NOTE: The alternative hypothesis (H_a):

- is the research hypothesis
- is what the problem is asking you to show
- uses the ≠, <, or > inequalities

2. STATISTICAL METHOD

a. Determine the level of significance (α):

NOTE: If it is not given in the problem, set it to the default value of **0.05.**

b. Determine the appropriate test statistic:

Population mean

When σ known:

$$z = \frac{\left(\bar{x} - hypothesized \quad value\right)}{\left(\sigma/\sqrt{n}\right)}$$

When σ unknown:

$$t = \frac{\left(\bar{x} - hypothesized \quad value\right)}{\left(s/\sqrt{n}\right)}$$

Population Proportion

$$z = \frac{\left(p - hypothesized \quad value\right)}{\sqrt{\frac{\left(hyp.value\right)\left(1 - hyp.value\right)}{n}}}$$

3. SAMPLE

a. Calculate or identify the descriptive statistics:

Descriptive statistics needed:	Descriptive statistics needed:
• the sample mean • standard deviation • sample size	• the sample proportion • sample size

b. Check the conditions for normality:

population is normal OR $n \geq 30$	n(*hyp value*) ≥ **10** AND n(1-*hyp value*) ≥**10**

4. STATISTICAL RESULTS

a. Compute the test statistic using the formula from step 2.

b. Determine the p-value based on the computed value of the test statistic:

If $H_a : \mu > hyp.value$, then it is the area under curve to the right of calculated *test statistic*. If $H_a : \mu < hyp.value$, then it is the area under curve to the left of calculated *test statistic*. If $H_a : \mu \neq hyp.value$, then it is 2 times the area to right of *test statistic* (if *test statistic* is +) OR 2 times the area to the left of *test statistic* (if *test statistic* is -).	If $H_a : \pi > hyp.value$, then it is the area under *z* curve to the right of calculated *z*. If $H_a : \pi < hyp.value$, then it is the area under *z* curve to the left of calculated *z*. If $H_a : \pi \neq hyp.value$, then it is 2 times the area to right of *z* (if *z* is +) OR 2 times the area to the left of *z* (if *z* is -).

NOTE: Calculator shortcuts for test stat	When σ known: Z-Test When σ unknown: T-Test	1-ProportionZTest

5. CONCLUSION

a. Make a decision:

Check to see if the p-value is less than or equal to the level of significance, α.

In other words, is the p-value ≤ α? If it is, reject H_0. If it is NOT, then fail to reject H_0.

b. Write a concluding statement:

If you rejected H_0…The data is inconsistent with H_0 and it provides sufficient evidence to support H_a.

If you failed to reject H_0…The data does NOT provide sufficient evidence to support H_a.