Hypothesis Testing for Population Mean

Case 1:

* Population mean is unknown
* Population standard deviation is known
* Sample size < 30
* Population is normally distributed

In this case, we can use normal distribution to run the hypothesis test

Case 2:

* Population mean is unknown
* Population standard deviation is known
* Sample size >= 30
* Population may or may not be normally distributed

In this case, we can use normal distribution to run the hypothesis test

Case 3:

* Population mean is unknown
* Population standard deviation is known
* Sample size < 30
* Population is not normally distributed

In this case, use non-parametric method.

Case 4:

* Population mean is unknown
* Population standard deviation is unknown
* Sample size < 30
* Population is normally distributed

In this case, use t-distribution to perform hypothesis test.

Case 5:

* Population mean is unknown
* Population standard deviation is unknown
* Sample size if >= 30
* Population may or may not be normally distributed

In this case, use t-distribution to perform hypothesis test

Case 6:

* Population mean is unknown
* Population standard deviation is unknown
* Sample size if < 30
* Population is not normally distributed

In this case, use non-parametric method.

In Chapter 9, we only work with cases 1, 2, 4, 5.

**Methods to run hypothesis test**

There are two ways to run a hypothesis test.

1. Rejection region approach
2. P-value approach

For **Cases 1 and 2**, we use normal distribution to run the hypothesis test.

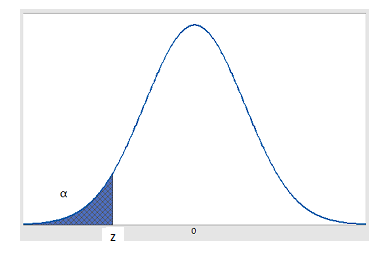
Suppose sample mean . We first have to standardize this value:

Significance level: (usually very small, like 0.1, 0.05, 0.025..)

**Left-tailed test**

* Rejection Region Approach

1. Find the z-critical value that has an area of to the **left**.
2. Compare to the z-critical value



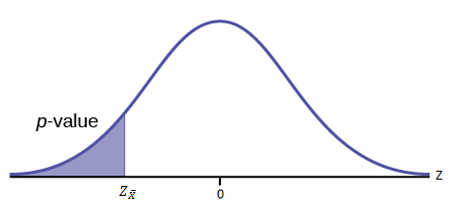
Rejection Rule for left tailed test:

Reject if z critical value

Do not reject if z critical value

* P-value Approach

For left tailed test, find the area to the left of



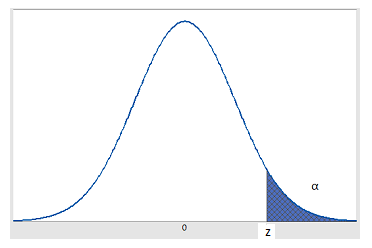
Reject if p-value <

Do not reject if p-value >

**Right-tailed test**

* Rejection Region Approach

1. Find the z-critical value that has an area of to the **right**
2. Compare to the z-critical value



Rejection Rule for right tailed test:

Reject if z critical value

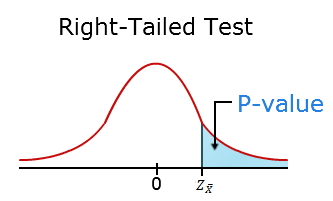
Do not reject if z critical value

* P-value Approach

For a right-tailed test, p-value is the area to the right of .

Reject if p-value <

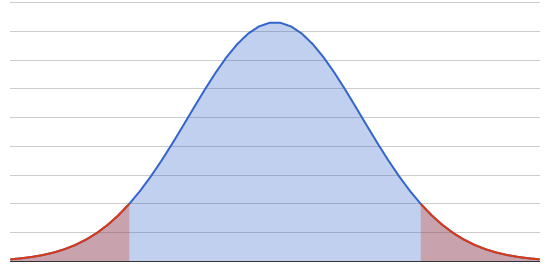
Do not reject if p-value >



**Two-tailed test**

* Rejection Region Approach

1. Find two z-critical values. One that has an area of to the **right**, and one that has an area of to the **left.**
2. Compare to the z-critical values



Rejection Rule:

Reject if or if

Do not reject if

* P-value Approach

For two-tailed tests, p-value is calculated as follows:

If , then p-value is

If , then p-value is

Reject if p-value <

Do not reject if p-value >

Handout for hypothesis tests for Cases 4 and 5 will be distributed next class.