Choices in Hypothesis Testing

* Although you can follow the five-step model to test hypotheses, there are two choices that would affect your testing process:
    * One-tailed or two-tailed test
   * Alpha (α) level

One-Tailed or Two-Tailed Test

* Two-tailed: States that population mean is "not equal" to value stated in null hypothesis
    * H_1: $\mu \neq 7.2$ (a difference in the number of absent day)
    * H_1: $\mu \neq 25.3$ (a difference in the commute-to-work time)
* One-tailed: Differences in a specific direction
    * H_1: $\mu < 7.2$ (treated people have lower number of absent day)
    * H_1: $\mu > 25.3$ (the citizens in the city spend more time on commuting to work)
* The choice between one and two-tailed test is based on the researcher's expectation about the two groups.
* If the direction is not clear, we use the two-tailed test.

One-Tailed or Two-Tailed Test

✴ Your choices of one-tailed or two-tailed test would affect the Z score of the given α value
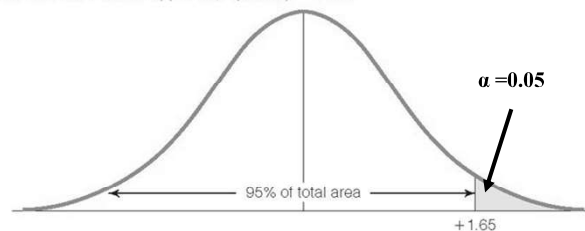
Establishing the Critical Region, One-Tailed Tests Versus Two-Tailed Tests (alpha = 0.05)
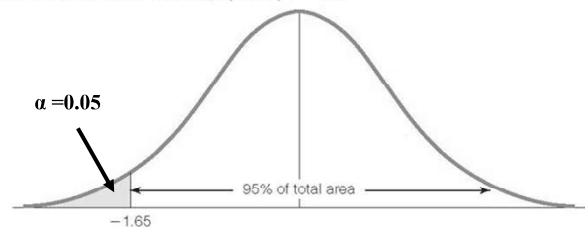
A. The two-tailed test, **Z**(critical) = ±1.96

α =0.025   α =0.025

95% of total area

−1.96   +1.96
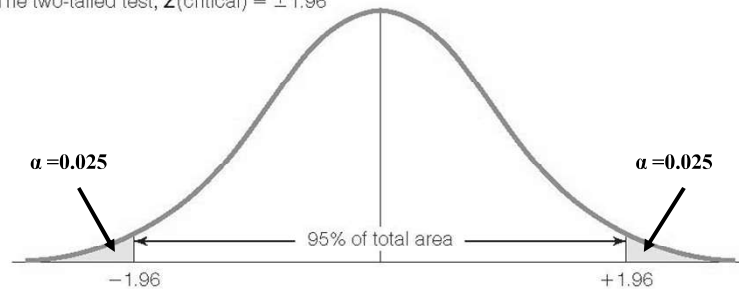
One-Tailed or Two-Tailed Test

B. The one-tailed test for upper tail, **Z**(critical) = +1.65

α =0.05

95% of total area

+1.65

C. The one-tailed test for lower tail, **Z**(critical) = −1.65

α =0.05

95% of total area

−1.65

One-Tailed or Two-Tailed Test

* Your choices of one-tailed or two-tailed test would affect the Z score of the given α value

One- vs. Two-Tailed Tests, $\alpha = 0.05$

If the Research Hypothesis (H_1) Uses	The Test Is	Concern Is on	Z(critical) Is
$\neq$	Two-tailed	Both tails	± 1.96
$>$	One-tailed	Upper tail	$+1.65$
$<$	One-tailed	Lower tail	-1.65

Finding Critical Z Scores for One- and Two-Tailed Tests

Alpha	Two-Tailed Value	One-Tailed Value Upper Tail	One-Tailed Value Lower Tail
0.10	± 1.65	$+1.29$	-1.29
0.05	± 1.96	$+1.65$	-1.65
0.01	± 2.58	$+2.33$	-2.33
0.001	± 3.32	$+3.10$	-3.10
0.0001	± 3.90	$+3.70$	-3.70

Selecting an Alpha Level

* By assigning an alpha level, one defines an "unlikely" sample outcome
* Alpha level is the probability that the decision to reject the null hypothesis is incorrect

The Relationship Between Alpha and Z(Critical) for a Two-Tailed Test

If Alpha =	The Two-Tailed Critical Region Will Begin at Z(Critical) =
0.100	± 1.65
0.050	± 1.96
0.010	± 2.58
0.001	± 3.32