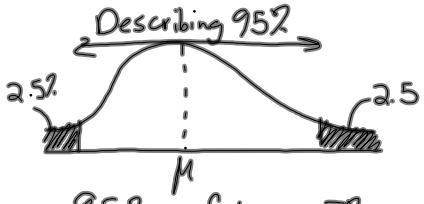
Hypothesis Testing

- Last Class
  - Steps in hypothesis testing

① State null & alternative hypothesis

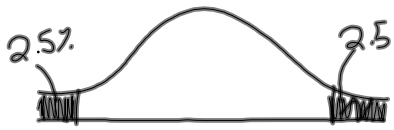
null → H_0 (What you're testing)
alternative → H_A

② Determine level of confidence.
↳ Rule of thumb: 5%
↳ But can be any level: 10%, 1%



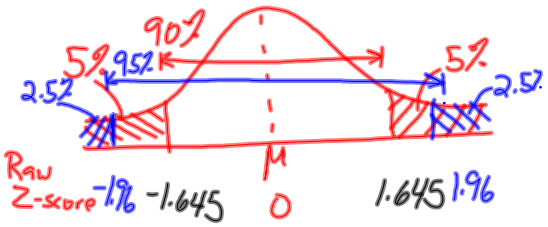
95% Confidence = 5% error

③ Determine critical value (depends on step 2)



at 5% z (-1.96) (1.96)

What if I want a 10% margin of error?

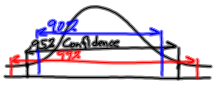


④ Conduct statistical test.

⑤ Draw conclusions.

Z-tests & Confidence Intervals

- Our statistical tests rely on our "confidence"
  - Typically 5%, but that's by convention.
- Confidence is the percentage of the distribution being described



Standard Error

$$SE = \frac{\sigma}{\sqrt{N}}$$

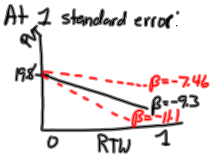
How much does our estimate vary? ⇒ SE
(remember regressions?)

Standard errors can be used to calculate the "confidence interval"

Ex: RTW & regression

	Coefficient	SE
α:	19.8	1.163
β:	-9.3	1.838

At 1 standard error:



1 SE represents 66% of the population (remember from normal dist)

95% of the distribution is covered with 1.96 SE

Confidence interval:

$$\beta \pm Z \times SE$$

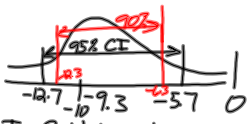
(± : plus and minus; Z: determined by confidence level)

At 95% confidence, then the confidence interval is:

low estimate: $-9.3 - (1.96)(1.838) = -12.9$

high estimate: $-9.3 + (1.96)(1.838) = -5.7$

So, the estimate for β will vary between -5.7 and -12.7 95% of the time.



Is β likely to be equal to zero?

- Probability of $\beta = 0$, is less than 5%

Is β likely to be equal to -10?

Remember from regressions, Statistical significance means a coefficient is not likely to be zero.

β is statistically significant at 5%.

What is the CI of β when our confidence is 90%?

$$-9.3 - (1.645)(1.838) = -12.3$$
$$-9.3 + (1.645)(1.838) = -6.3$$
$$= (-6.3, -12.3)$$

At 90% level of confidence, is β likely to be equal to 0?

- No.

Ex

H_0: $\beta = 0$ → at 95% β is between −5.7, −12.7, which doesn't include zero.

H_a: $\beta \neq 0$

Statistical tests are reformulations of CI, but simply state whether it rejects H_0, or fails to reject H_0.

Types of statistical tests:

- Comparing the mean from two samples.
  - e.g. is the average grade in this class the same in the summer class?
- Comparing means from the same observation over time.
  - e.g. is the % of women in the workforce the same in Des Moine in 1990 and 2010?
- Is there a difference in the average of a sample compared to a given numbe
  - e.g. is the average

Ex: Women in Workforce.

(1) Is the percentage of women in the workforce statistically equivalent to 50%?

(1) H_0: prop of women in workforce $= 50\%$

H_a: " " $\neq 50\%$

(2) Confidence level: 95%

(3) CV: 1.96

(4) $t = 1.653$

$-1.96 \leq 1.653 < 1.96$

Our CI for the difference is:

$-.007, .06$

→ Not statistically significant

(5) Reject null hypothesis. so prop. of women $\neq .5$

$\Rightarrow$ t-test

paired t-test compares the same observation between two periods of time (aka pooled t-test)

e.g. is the perc. of women in the labor force the same between 1968 & 1972?

(1) H_0: $P_{1972} = P_{1968}$

H_a: $P_{1972} \neq P_{1968}$

(2) Confidence: 99%

(3) CV: 2.575

(4) TS: 2.458

$-2.575 < 2.458 < 2575$

(5) Reject null.

$\Rightarrow P_{1972} \neq P_{1968}$

Independent samples t-test compares means from two groups