Sec. 10.2: Hypothesis Tests for a Population Proportion *p*

Idea Behind Hypothesis Tests (for p)



If $\hat{p} = 35\%$, believe the king

- If $\hat{p} > 35\%$, believe the king
- If $\hat{p} < 35\%$, it depends!

If $\hat{p} < 35\%$ but close to 35%, still believe the king

If $\hat{p} < 35\%$ but far from 35%, then believe the peasant

Hypothesis Tests for *p* Formulas and Info

Quantity you are performing a hypothesis test about: p

- Significance level: \propto (helps you determine the cutoff of the rejection region)
- Probability distribution: z distribution

Test statistic formula: z =

 $\frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$ (helps you determine how many steps apart \hat{p} and p are)

Condition: $npq \ge 10$

P - Values

P-Values is a 2nd way of performing hypothesis tests, without needing to be given a significance level α (why?)

- A P-value is a probability (or an area)
- You always calculate a P-value for a test statistic
- If α is given, then
 - If P-value $\leq \alpha$, reject H_0
 - If P-value > α , do not reject H_0
- If α is not given, then if the P-value is small enough (by your judgement), reject H_0
- The P-Value tells you how deep into the rejection region your test statistic is (the smaller the P-value, the further into the rejection region the test statistic is)

Calculating P – Values (for 1 population *p* problems)

For a left-tailed test The P-value is P(z < t.s.)i.e. the P-value is the area to the left of the test statistic



Calculating P – Values (for 1 population p problems)

For a right-tailed test The P-value is P(z > t.s.)i.e. the P-value is the area to the right of the test statistic





Why reject Ho when P-value $\leq \alpha$?

Suppose we are performing a left tailed test.

Suppose α is given.

Then the rejection region is the red area below...

If t.s. is inside rejection region:

• P-value $\leq \alpha$

• Reject
$$H_0$$



Why reject Ho when P-value $\leq \alpha$?

Suppose we are performing a left tailed test.

Suppose α is given.

Then the rejection region is the red area below...



Type I & Type II Errors / Meaning Of The Significance Level





Meaning of the significance level α

If you perform the same hypothesis test many times, each time drawing a new sample, you will reject H_0 when H_0 is true about 100 α percent of the time.

Ex 1 (Sec. 10.2 Hw #21 pg. 494): **Taught Enough Math?** In 1994, 52% of parents of children in high school felt it was a serious problem that high school students were not being taught enough math and science. A recent survey found that 256 of 800 parents of children in high school felt it was a serious problem that high school students were not being taught enough math and science. Do parents feel differently than they did in 1994?

a) Perform the appropriate hypothesis test using the rejection region method at the $\alpha = 0.05$ level of significance.

b) Perform the appropriate hypothesis test using the P-value method at the $\alpha = 0.05$ level of significance.

c) What is the meaning of the $\alpha = 0.05$ level of significance

<u>Ex 2</u>: A claim has been made that more than 50% of Rio Hondo students have a job. To test the claim, 47 Rio Hondo students were polled and asked it they have a job. Of the 47 students polled, 31 said that they do have a job.

a) Use the P-value method to test the claim that more than 50% of Rio Hondo students have a job at the $\alpha = 0.03$ significance level.

b) Use the rejection region method to test the claim that more than 50% of Rio Hondo students have a job at the $\alpha = 0.03$ significance level.

c) What is the meaning of the $\alpha = 0.03$ level of significance

Ex 3 (Sec. 10.2 Hw #20 pg. 493): Eating Together In December 2001, 38% of adults with children under the age of 18 reported that their family ate dinner together 7 nights a week. In a recent poll, 403 of 1122 adults with children under the age of 18 reported that their family ate dinner together 7 nights a week. Has the proportion of families with children under the age of 18 who eat dinner together 7 nights a week decreased?

a) Use the P-value method to test the appropriate claim at the $\alpha = 0.08$ significance level.

b) Use the rejection region method to test the appropriate claim at the $\alpha = 0.08$ significance level.

c) What is the meaning of the $\alpha = 0.08$ level of significance