

Monday, August 24: Unit 2: Comparing Two Proportions; Stating Hypotheses

In the 2008-2009 basketball season, the UA had 9 wins and 9 losses in PAC-10 play. However, at home they had 7 wins and 2 losses (7-2) and on the road they were the reverse: 2-7. Does this indicate that the Wildcats have more *Ability* to win at home than on the road?

Make graphs to compare the Home and Road *Performances* and briefly describe what you see.

Stating Hypotheses:

In this example, the claim that the *Ability* of the UA is the SAME at home and on the road is called the null hypothesis and the claim that the UA has more *Ability* to win at home is called the alternative hypothesis.

Notation:

H_0 : The UA has the same *Ability* to win at home and on the road.

H_a : The UA has a greater *Ability* to win at home than on the road.

Note: The alternative hypothesis is what we suspect is true while the null hypothesis is that there is no difference.

Note: Hypotheses should always be written in terms of *Ability* (not *Performance*)

State hypotheses for the following questions:

Do the Chicago Cubs play better during the day than during the night?

Do the Minnesota Vikings play better on artificial turf than on real grass?

HW #5: Suggested Reading pages 1-2; Problems 1-4

Tuesday/Wednesday, August 25/26: Unit 2: Simulating the Difference Between Two Proportions

We want to test the hypotheses about the UA basketball team:

H_0 : The UA has the same *Ability* to win at home and on the road.

H_a : The UA has a greater *Ability* to win at home than on the road.

To compare the UA's *Performances* at home and on the road, we will look at the difference of their winning percentages:

Home winning percentage = $7/9 = 77.8\%$

Road winning percentage = $2/9 = 22.2\%$

Difference = $77.8\% - 22.2\% = 55.6\%$

Since this difference is greater than 0, it appears that the UA has a better *Ability* to win at home. However, it is possible that their *Ability* is the same at home and on the road and we got a difference of 55.6% because of *Random Chance*.

We want to know how likely it would be to get such a big difference by chance, assuming their *Ability* is the same in both locations. Let's do a simulation!

Note: Whenever we test hypotheses, we always start by assuming the null hypothesis is true (they have the same *Ability* in both locations) and only reject it if we have convincing evidence that it is false.

How likely is it to get a difference of 55.6% or higher, just due to *Random Chance*, assuming there is no difference in *Ability*?

From the simulation, the probability is approximately:

This probability is called a *p*-value. In this type of context, a *p*-value is the probability of getting a difference at least as extreme as the actual difference observed, assuming the null hypothesis is true.

Since the *p*-value is pretty small, it is unlikely that the difference of 55.6% was due to just *Random Chance*. Therefore, we can conclude that the UA has a greater *Ability* to win at home than on the road.

In general:

If the *p*-value is small, *Random Chance* is an unlikely explanation, and we conclude that the alternative hypothesis is true.

If the *p*-value is large, it is possible the results were due to *Random Chance* and we would not conclude the alternative hypothesis is true.

For example, if the *p*-value had been 0.23, we would say that it is possible that the difference of 55.6% could be due to *Random Chance*. Therefore, we would not conclude that the UA has a greater *Ability* to win at home.

Note: We haven't proven that the UA has the same *Ability* at home and on the road, we just don't have enough evidence to say that their *Ability* is greater at home. So, we never conclude that the null hypothesis is true.

Remember, we only conclude that the alternative hypothesis is true if we have convincing evidence that the null hypothesis is false!

HW #6: Suggested Reading pages 2-3, Problems 5-6

Thursday/Friday, August 27/28: Unit 2: Simulations using Technology

Do UA example again, with technology:

- Graphing Calculators: by hand and with program
- Applet: www.rossmanchance.com/applets (click on Two-way table simulation applet)

Ian Kinsler Article (Home vs. Away)

HW #7: Suggested Reading pages 3-9; Problems 7-8

Monday, August 31: Unit 2: Conclusion

Connections—How is this different than unit 1??

- In unit 1, we assumed an established *Ability* level based on previous history and tested if that *Ability* level had changed (comparing before and after such as in the regular season and then the playoffs).
- In unit 2, we don't assume an established *Ability* level but test if an athlete's *Ability* changes in different contexts (comparing two contexts within the same time period, such as home games and away games within the same season)

In the 2008 NFL season, the San Francisco 49ers used 2 different starting quarterbacks: Shaun Hill and JT O'Sullivan. Overall, the team was 7-9, however Shaun Hill was 5-3 as a starter while JT O'Sullivan was 2-6. Does this give convincing evidence that the 49ers have a greater *Ability* to win when Shaun Hill is the quarterback?

Caution about Causation: Even if we conclude that the 49ers had a greater *Ability* to win when Shaun Hill was the starter, we cannot conclude that Hill is the sole cause of this increase. For example, it is possible that other key players were injured when O'Sullivan was the starter or that the opposing teams were weaker in the games that Hill started.

HW #8: Problems 9-10

Tuesday/Wednesday, September 1/2: Research for Projects (this time in pairs)

First half of class: review HW, etc.

Second half of class: go to computer lab and get data

Thursday/Friday, September 3/4: Work on Projects, Review for Test

Monday, September 7: No school!

Tuesday/Wednesday, September 8/9: Project due, Test on Unit 2