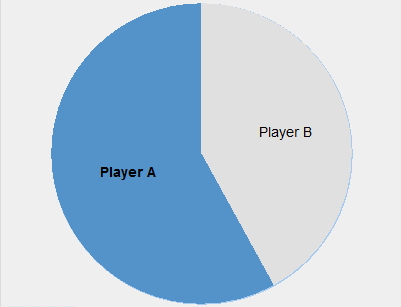
**Chapter 9 – Type I Error, Type II Error, and Power** (p. 538 – p. 545)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Learning Targets*** | **4** | **3** | **2** | **1** | **0** |
| **Advanced**  I can go beyond what is taught in class and use the concepts for other problems. | **Proficient**  I know all of  the simple and complex concepts and problems. | **Partially Proficient**  I know the  simple concepts  and problems. | **Emerging**  I need help with  all of the concepts  and problems. | **No Idea!**  I have never  heard of this. |
| *I can interpret a Type I error and a Type II error in context, and give the consequences of each.* |  |  |  |  |  |
| * *I can define “Type I error”* |  |  |  |  |  |
| * *I can define “Type II error”* |  |  |  |  |  |
| *I can understand the relationship between the significance level of a test, , and power.* |  |  |  |  |  |
| * *I can define “power”* |  |  |  |  |  |

In a 2-player trivia game, a spinner is used to decide which player gets the first shot at answering the question. Player A had access to the spinner before the game, and player B suspects he may have tampered with it to get more chances at answering questions. As a group, test out the spinner to see if you can convict Player A of cheating. (Remember, he’s innocent until proven guilty!) Make sure the judge can’t see the spinner – just the outcomes of the spins.

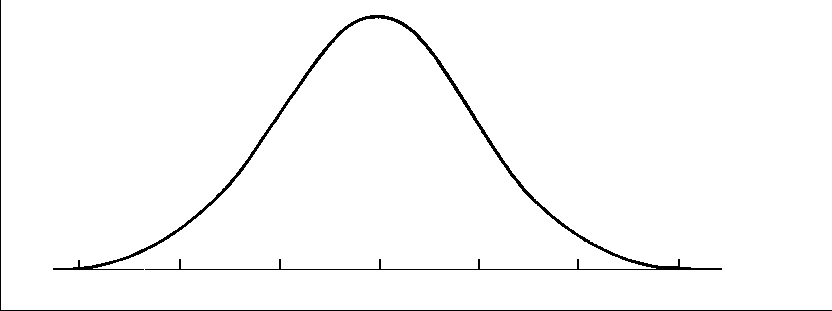
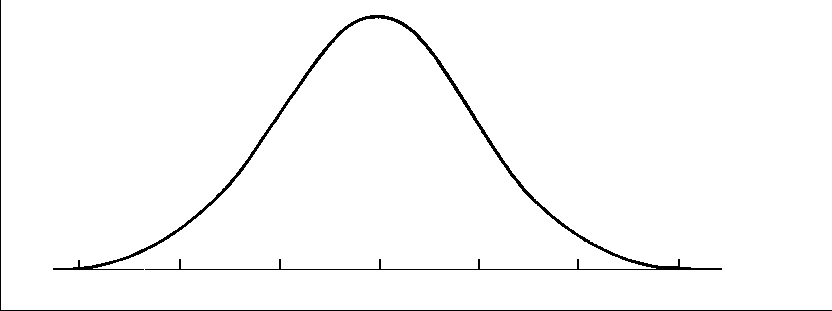
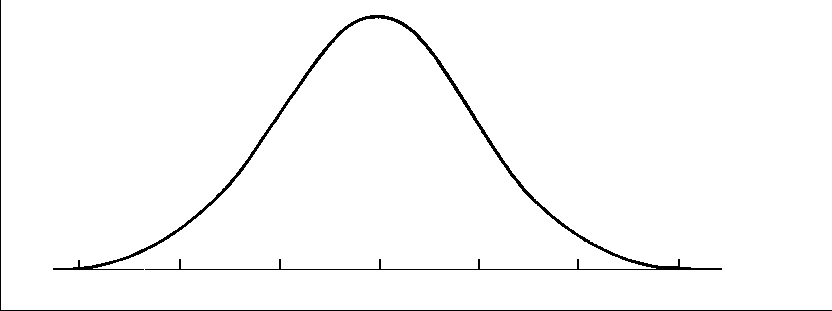


What factors influenced whether or not Player A was convicted?

What are the two possible errors you could make when judging player A?

**The significance level is the probability of a Type I error.**

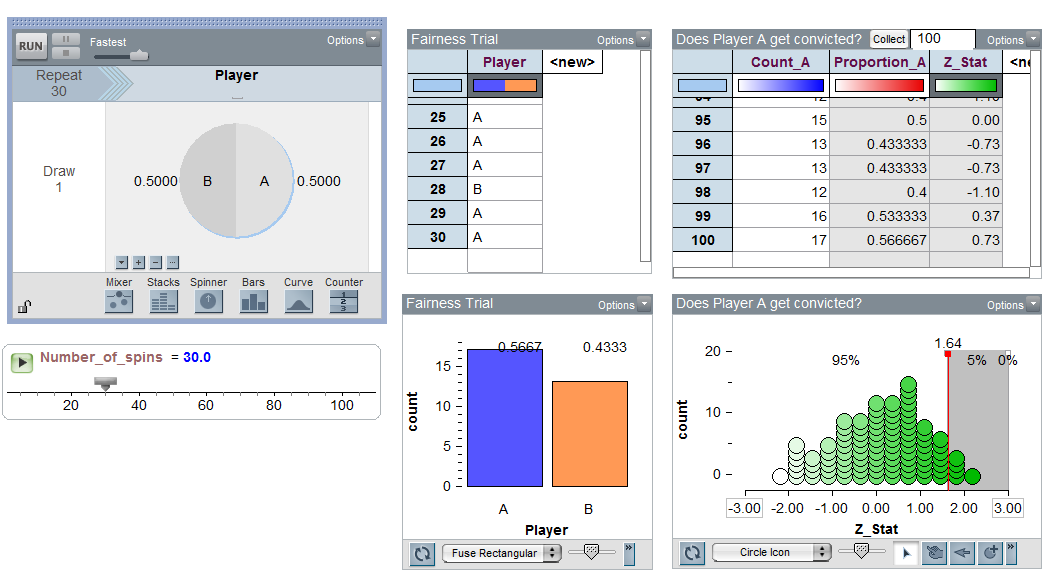
→ It determines how strong the evidence has to be (how big the z statistic has to be) for us to reject .

**Review: One-sample z test**

Calculate a z statistic for your group’s sequence of spins. Is it larger or smaller than ? (  
What do you conclude?

**Modeling Type I error, Type II error, and Power**



What is the (estimated) probability that Player A will be convicted?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | **Significance Level** | | |  |
|  |  |  |  |  |
| **Spinner** | **Number of Spins** |  |  |  |
|  |  |  |  |  | Type I error |
|  |  |  |  |
|  |  |  |  |  | Power |
|  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |

* What happens to the probability of conviction as the significance level goes down?
  + Is this a bad thing, a good thing, or a trade-off? Explain.
* What happens to the probability of conviction as the number of spins goes up? (Is the pattern different depending on which spinner you’re testing?)

* What happens to the probability of conviction as the spinner gets further from fair (as increases)?
  + If you want to be able to convict cheaters even when is only slightly bigger than 0.5, what will you have to do?

**Faster fast food**The manager of a fast-food restaurant is planning a study to determine whether scheduling an additional employee reduces the proportion of customers who have to wait at least two minutes in the drive-thru. Store records show that before the change the proportion of customers who waited more than two minutes was 0.63.

To determine how many customers to include in the study, the manager needs to consider three factors:

* Significance level
* Practical importance

* Power

**Summary**

* A **Type I error** occurs when
* A **Type II error** occurs when
* The **power** of a test (against a specific alternative) is the probability that
* For a fixed significance level, increasing the sample size
* We can also increase the power of a test by using a higher significance level (say, instead of ), but