

STAT 110: Practice Problem 3

Fall 2017

1. A recent U.S. Census report indicated that 71% of the nation's college undergraduates work while in school. Suppose that in a random sample of 185 undergraduates at Winona State, 124 reported working while in school. The research hypothesis is as follows: **The proportion of Winona State University undergraduates who work while in school is less than the national average.**

- a. Identify both the population of interest and the sample in this study.

Population:

Sample:

- b. Let π = the proportion of all WSU undergraduates who work while in school. Calculate the statistic of interest in this study.

$\hat{\pi} =$

- c. Set up the null and alternative hypotheses to test the research hypothesis.

$H_0:$

$H_a:$

- d. Next, set up a simulation in Tinkerplots that will allow you estimate a p-value for investigating this research hypothesis. Sketch your spinner, including (1) the labels you used, (2) the probabilities attached to these labels, and (3) the Repeat value.



e. Carry out 1,000 runs of your simulation study. Sketch your results below.

f. Recall that in this study, 124 of the 185 WSU undergraduates surveyed reported working while in school. Use the results of your simulation to estimate the p-value.

Estimated p-value:

g. Write a conclusion in the context of the problem to address whether or not the evidence supports the research hypothesis.

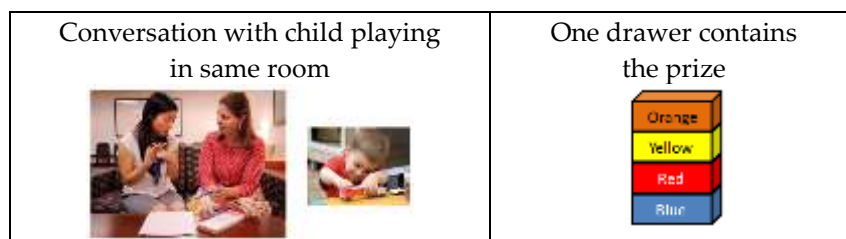
2. Consider the following study in which researchers were interested in trying to determine how much information a child gathers from conversations held between others.

A child was told by the experimenter that they were going to soon be setting up a game to play and that the child might win a prize at the end. The experimenter asked the child to sit quietly off to the side and play with a toy for a few moments while she talked with her friend, who was a bystander in the room. The experimenter then started a conversation (that was purposely scripted to be uninteresting to the child) with the bystander in the room, and the following statement was made in the middle of this conversation.

Experimenter: "Oh, wait. I don't remember which drawer has the prize in it. Is it the ____ drawer?"

Bystander: "Yes, it is in the _____ drawer." The blanks were filled in at random with one of the four colors of the actual drawers: orange, yellow, red, or blue. These colors were counterbalanced amongst the participants.

The conversation continued for a few more moments, and then the experimenter returned to the child and continued setting up their game. The experimenter then made the following statement, "Oh, I can't remember which drawer the prize is in!" They asked the child, "Which drawer should I open?" The researchers recorded whether the child chose the correct drawer or not (the correct drawer was the one that had been mentioned in the conversation). **This was repeated with 51 children, and 33 of them identified the correct drawer.**



Source: "Little Pitchers Use Their Big Ears: Preschoolers Solve Problems by Listening to Others Ask Questions" by Mills, C.M, Danovitch, J.H, Grant, M.G, and Elashi, F.B. (2012). *Child Development*, March/April 2012, Volume 83, Number 2, Pages 568-580.

The researchers in this study want to show that children are able to apply information overheard from a third-party conversation that took place while their attention was engaged in another task and with no prior instruction to listen to that conversation. In other words, they want to show that **more children are choosing the correct drawer than we would expect by guessing.**

- a. Identify both the population of interest and the sample in this experiment.

Population:

Sample:

- b. Set up the null and alternative hypotheses to address the research hypothesis.

Let π = the proportion of all preschoolers that would identify the correct drawer (or, you could think of this as the true probability of a preschooler choosing the correct drawer).

H₀:

H_a:

- c. Set up a simulation in Tinkerplots that will allow you estimate a p-value for investigating the research hypothesis. Sketch your spinner, including the labels you used, the probabilities attached to these labels, and the Repeat value.



d. Carry out the simulation study by tracking the number of children who correctly identify the correct drawer just by guessing, repeating this process a total of 1000 times. Sketch your results below.

e. Recall that in this study, 33 of the 51 children identified the correct drawer. Use the results of your simulation to estimate the p-value.

Estimated p-value:

f. Write a conclusion in the context of the problem to address whether the evidence supports the research hypothesis.

g. The researchers have asked you to complete the following statement to include in their paper: "Above-chance performance as measured by a binomial test required that at least ___ of the 51 children identify the correct drawer." Basically, they are asking you how many of the 51 children have to identify the correct drawer in order for them to have statistical evidence supporting their research question. Give this cutoff and explain your reasoning.

Cutoff =

Your Reasoning:

3. In the 1980s, it was generally believed that autism affected about 5% of the nation's children. Some people believe that an increase in the number of chemicals in the environment has led to an increase in the incidence of autism today. A recent study examined 384 children and found that 46 of them showed signs of some form of autism. Do these results provide evidence that the incidence of autism has increased since 1980? *Comment: Note that even if there is evidence that the incidence of autism has increased, we can't be sure that it's due to chemicals – this is just a theory. It's also reasonable to assume that the incidence of autism has increased simply because more people are diagnosed today than in 1980.*

a. Identify both the population and the sample in this experiment.

Population:

Sample:

b. Define the parameter of interest, π .

$\pi =$

c. Calculate the statistic and **explain how this differs from the parameter.**

$\hat{\pi} =$

d. Set up the null and alternative hypotheses to address the research hypothesis.

H₀:

H_a:

e. Set up a simulation in Tinkerplots that will allow you estimate a p-value for investigating the research hypothesis. Sketch your spinner, including the labels you used, the probabilities attached to these labels, and the Repeat value.



f. Carry out the simulation study by tracking the number of children who have autism, repeating this process a total of 1000 times. Sketch your results below.

g. Recall that in this study, 46 of the 384 children studied had autism. Use the results of your simulation to estimate the p-value.

Estimated p-value:

h. Write a conclusion in the context of the problem to address whether the evidence supports the research hypothesis.