Example 2.1: Claims of Numbness After Automobile Accident - Solutions

A 28-year-old white woman developed pain involving the spine and the left side of her body after an automobile collision. She was actively involved in a personal litigation against the company that owned the other vehicle, and she reported constant pain and numbness in the left arm. To test her claims, researchers touched her left arm with either 1 finger or 2 fingers simultaneously while her eyes were closed. The word "touch" was said simultaneously with the presentation of the tactile stimulus so that the subject knew when to respond. She then had to indicate whether she felt 1 single touch or 2 simultaneous touches (with the double-touch stimulus, the fingertips were always spaced 2 inches apart). The subject received 100 stimuli overall; she was correct on 30 of them. Is there statistical evidence that she is intentionally answering incorrectly?

Questions:

1. Identify both the population and sample of interest.

   Population: all potential trials to which she could have been subjected
   Sample: the 100 trials to which she was subjected

2. Identify the single categorical variable of interest.

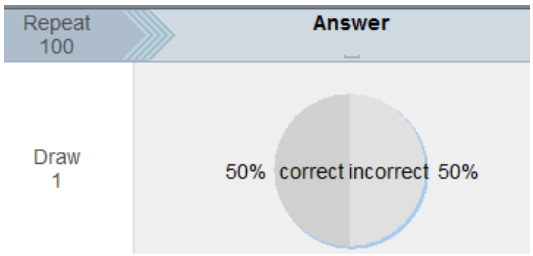
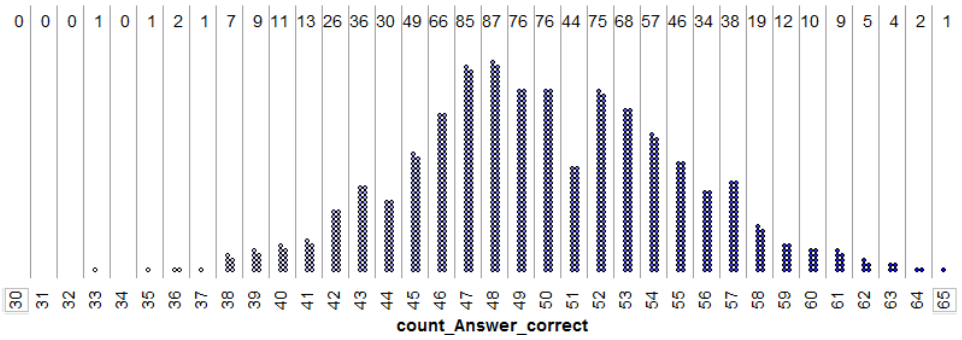
   Whether or not she was correct

3. Identify both the parameter and statistic of interest.

   Parameter: π = the true probability of her answering correctly
   Statistic: $\hat{\pi}$ = the proportion she got correct out of the 100 trials = 30/100 = 30%

4. Carry out the formal hypothesis test to address the research question.

Claims of Numbness After Automobile Accident	
Research Question	Is there statistical evidence that she is intentionally answering incorrectly?
Hypotheses	**Let π = the probability she answers correctly.** H_o: **She is guessing (π = 50%)** H_a: **She is intentionally giving wrong answers (π < 50%)**

Estimated p-value	Carry out the simulation study to investigate this p-value. Sketch in the spinner that you used:  Sketch in the results of your simulation (keep track of the number of CORRECT responses on each trial):  Use the simulation results to estimate the p-value: **0/1000 of the simulated outcomes were at 30 or fewer, so the estimated p-value is 0%.**
Conclusion	**The data provide enough statistical evidence that she is intentionally giving wrong answers.**

Example 2.2: Effectiveness of an Experimental Drug - Solutions

Suppose a commonly prescribed drug for relieving nervous tension is believed to be only 70% effective. Experimental results with a new drug administered to a random sample of 20 adults who were suffering from nervous tension show that 18 received relief. Is there statistical evidence that the new experimental drug is more than 70% effective?

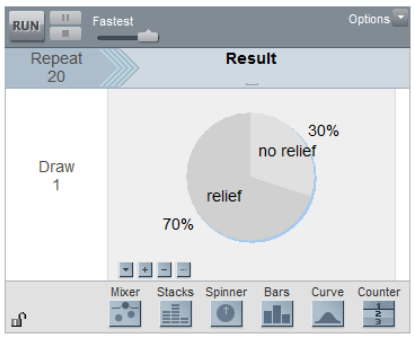
Questions:

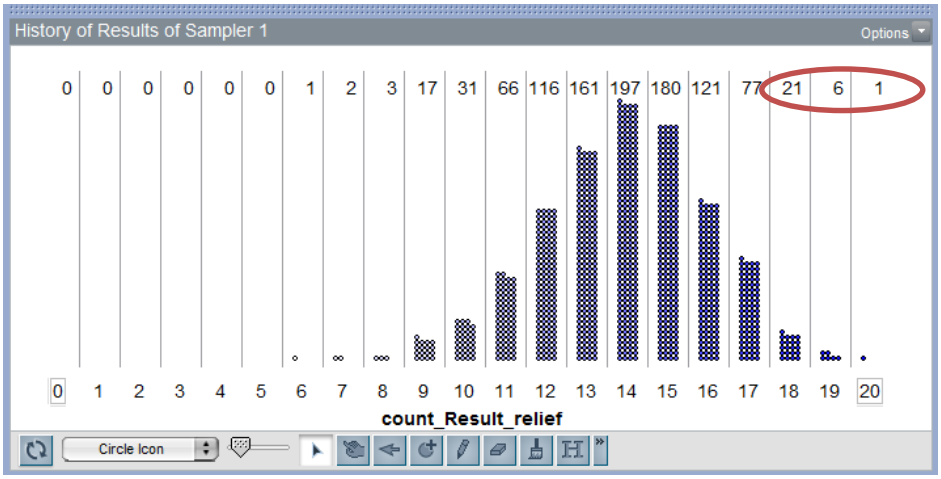
1. Identify both the population and sample of interest.
   Population: all adults suffering from nervous tension
   Sample: the 20 adults suffering from nervous tension that were used in this study

2. Identify the single categorical variable of interest.
   Whether or not they receive relief

3. Identify both the parameter and statistic of interest.
   Parameter: π = the true probability of the drug bringing relief to a randomly selected adult suffering from nervous tension
   Statistic: $\hat{\pi}$ = the proportion of adults in this sample who got relief = 18/20 = 90%

4. Carry out the formal hypothesis test to address the research question.

Effectiveness of an Experimental Drug	
Research Question	Is there statistical evidence that the new drug is more than 70% effective?
Hypotheses	H_o: **The new drug is only as effective as the old drug (π = .70)** H_a: **The new drug is more effective than the old drug (π > .70)**
Estimated p-value	Carry out the simulation study to estimate this p-value. Sketch in the spinner that you used: 

	Sketch in the results of your simulation (keep track of the number that experience RELIEF on each trial):  Use the simulation results to estimate the p-value: **28/1000 = .028**
Conclusion	**We have statistical evidence that the new drug is more than 70% effective.**