STAT 110: Practice Problem 2 Solutions
Fall 2017

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1. A college professor hypothesizes that the majority of *all* WSU undergraduate students prefer PCs. Of the random sample of 318 students surveyed, 171 reported that they preferred PCs.

   <u>Research Hypothesis</u>: The majority of all WSU undergraduates prefer PCs.

   a. Write the null and alternative hypotheses in terms of the population parameter of interest, π. Let π = the true proportion of all WSU undergraduate students that prefer the PC.

   H_o: **$\pi = 50\%$**
   H_a: **$\pi > 50\%$**

   b. $\hat{\pi}$ **= 171/318 = 53.8%**

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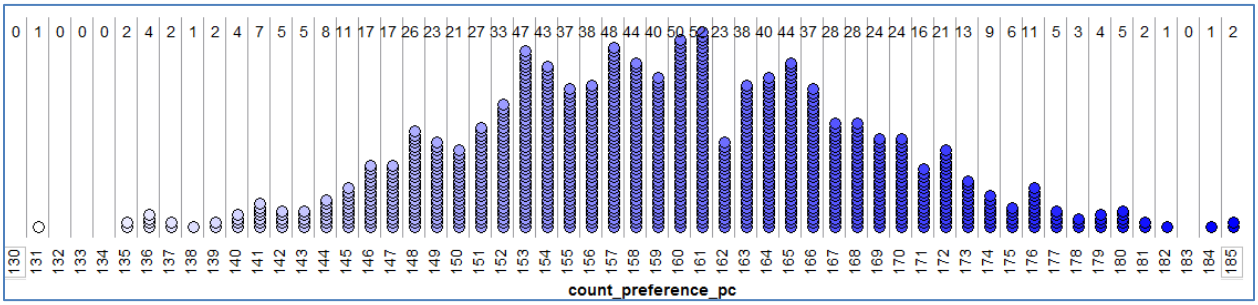
   c. The following dotplot shows the results of 1,000 runs of the simulation carried out under the assumption that there really is no preference for one computer over the other amongst all WSU undergraduates.



   Use the simulation results to estimate the p-value. **99/1000 = 0.099**

   d. Write a conclusion in the context of the research question, and be sure that you don't generalize your results beyond the population of interest.

   Based on this study, even though the majority of the sample prefers PCs (54%), this study does not provide enough statistical evidence that the majority of <u>all</u> WSU students prefer PCs.

2. Consider the previous example. This time, suppose the college professor just wants to know if there is a preference for *either* the mac or the PC. Recall that of the random sample of 318 students surveyed, 171 reported that they preferred PCs.

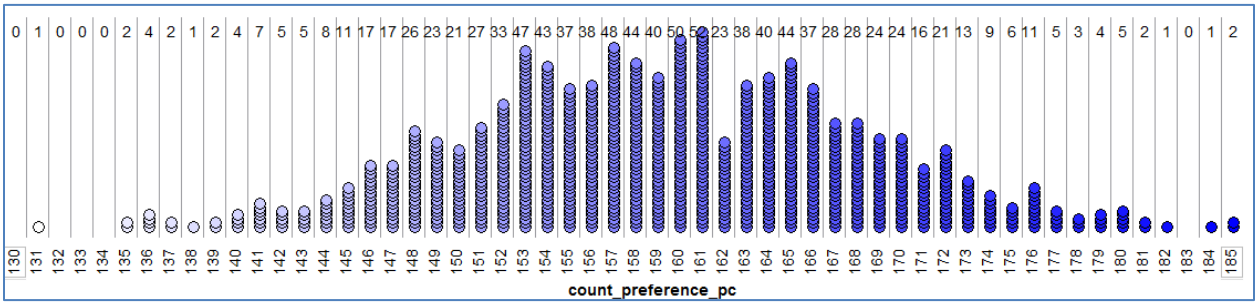
   <u>Research Hypothesis</u>: WSU undergraduates have a preference for one computer over the other.

   a. Write the null and alternative hypotheses in terms of the population parameter of interest, π. Let π = the true proportion of all WSU undergraduate students that prefer the PC.

   H_o: $\boldsymbol{\pi = 50\%}$
   H_a: $\boldsymbol{\pi \neq 50\%}$

   b. $\hat{\pi}$ **= 53.8%**

   c. The following dotplot shows the results of 1,000 runs of the simulation carried out under the assumption that there really is no preference for one computer over the other amongst all WSU undergraduates.



   Use the simulation results to estimate the p-value for addressing this research question.
   estimated p-value = 86/1000 + 99/1000 = 0.185.

   d. Write a conclusion in the context of the research question, and be sure that you don't generalize your results beyond the population of interest.

   This study does not provide enough statistical evidence that WSU students prefer either the mac or the PC over the other.

3. The prevalence of left-handedness in the general population of females is known to be 10.7%. However, in a study of 25 females with Williams-Beuren syndrome, researchers have observed that 5 are left-handed.

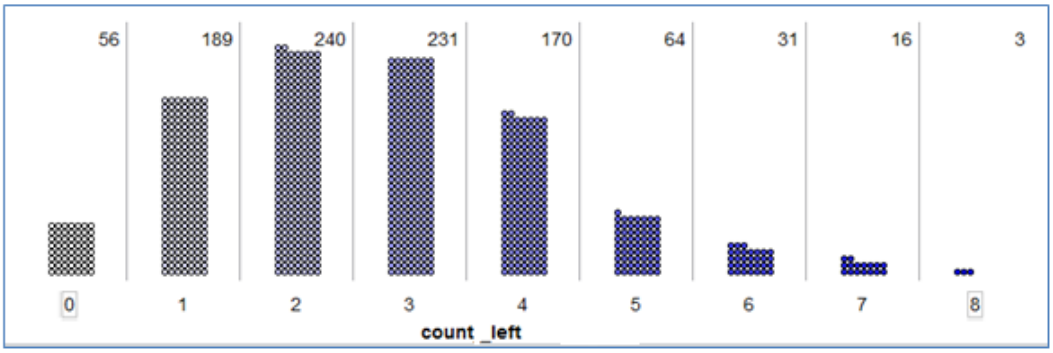
<u>Research Hypothesis</u>: The prevalence of left-handedness is greater for females with Williams-Beuren syndrome than in the general population.

a. Write the null and alternative hypotheses in terms of the population parameter of interest, π. Let π = the proportion of all women with Williams-Beuren syndrome who are left-handed.

H_0: **$\pi = 10.7\%$**
H_a: **$\pi > 10.7\%$**

b. $\hat{\pi}$ **= 5/25 = 20%**

c. The following dotplot shows the results of 1,000 runs of the simulation carried out under the assumption that the prevalence of left-handedness is the same for women with Williams-Beuren syndrome as for women in the general population.



Use the simulation results to estimate the p-value.
estimated p-value = 114/1000 = 0.114

d. Write a conclusion in the context of the research question, and be sure that you don't generalize your results beyond the population of interest.

Even though the 20% of the women with Williams-Bueren syndrome in the study were left-handed (which is higher than what is typically seen in the general population), the study does not provide enough statistical evidence that the chance of being left-handed is higher for women with Williams-Bueren syndrome than for women in the general population.

4. Consider Example 1.1 from the lecture notes. On 100 trials of the red/blue lightbulb experiment, the subject answered correctly on only 36 trials.

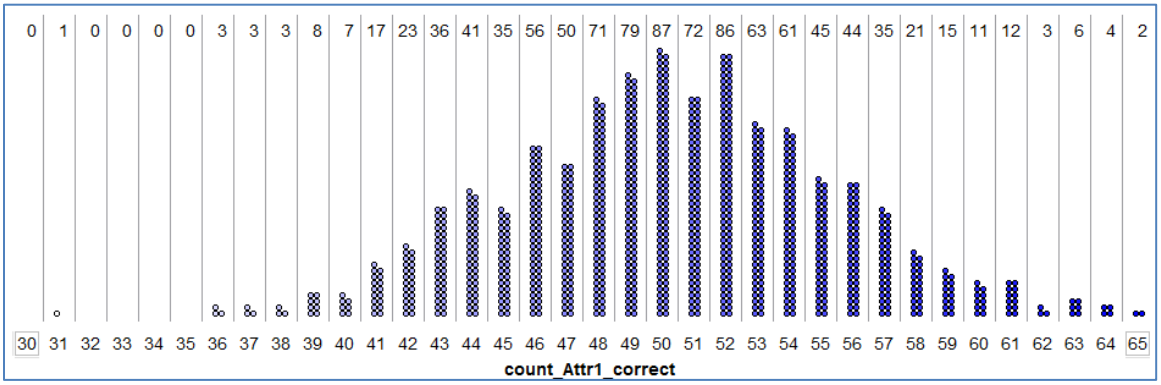
<u>Research Hypothesis</u>: The suspect is intentionally giving incorrect answers in order to mislead investigators.

a. Write the null and alternative hypotheses in terms of the population parameter of interest, π. Let π = the true, long-run probability that the subject answers correctly.

H_o: **$\pi = 50\%$**
H_a: **$\pi < 50\%$**

b. $\hat{\pi}$ **= 36/100 = 36%.**

c. The following dotplot shows the results of 1,000 runs of the simulation carried out under the assumption that the subject was truly guessing on each trial.



Use the simulation results to estimate the p-value.
estimated p-value = 4/1000 = 0.004

d. Write a conclusion in the context of the research question, and be sure that you don't generalize your results beyond the population of interest.

The study provides statistical evidence that she is intentionally giving wrong answers.