STAT 110: Homework 4 Solutions (20 pts)
Fall 2017

<u>Instructions</u>: To obtain full credit, print a copy of the JMP output relevant to each question and submit this with your homework solutions.

1. Suppose that the table below shows the choices made by 126 players on their first turn of a Rock-Paper-Scissors game. Recall that in this game, rock beats scissors which beats paper which beats rock. Note that a player gains an advantage in playing this game if there is evidence that the choices made on the first turn are not equally distributed among the three options.

Option Selected on First Turn	Count in the Sample
Rock	67
Paper	40
Scissors	19
Total	126

<u>Research Question</u>: Does this study provide evidence that the choices made on the first turn are not equally distributed among the three options?

a. Write the null and alternative hypotheses for investigating this research question. (2 pts)

H_o: the choices are equally distributed among the three options
($\pi_{rock} = 1/3$, $\pi_{paper} = 1/3$, $\pi_{scissors} = 1/3$

H_a: the choices are not equally distributed among the three options

b. How many of the 126 players do we expect to see make each of the choices if the choices made on the first turn *<u>are</u>* equally distributed among the three options? Show your work to justify your answer. (2 pts)

Rock: 1/3 of 126 = 42
Paper: 1/3 of 126 = 42
Scissors: 1/3 of 126 = 42

c. Find the chi-square test statistic for investigating this research question by hand. Show your work to receive full credit. (2 pts)

$$\sum\left(\frac{\text{(Observed - Expected}}{\text{Expected}}\right)^2 = \frac{(67-42)^2}{42} + \frac{(40-42)^2}{42} + \frac{(19-42)^2}{42} = 27.57$$

d. Carry out the chi-square test in JMP, and find the p-value for investigating this research question (you must attach your JMP output to receive full credit). (2 pts)

Test Probabilities

Level	Estim Prob	Hypoth Prob
paper	0.31746	0.33333
rock	0.53175	0.33333
scissors	0.15079	0.33333

Test	ChiSquare	DF	Prob>Chisq
Likelihood Ratio	28.5351	2	<.0001*
Pearson	27.5714	2	<.0001*

Method: Fix hypothesized values, rescale omitted

p-value: **<.0001**

e. Write a conclusion in the context of the research question. (2 pts)

The data provide evidence that the choices made on the first turn of this game are not equally distributed across the three categories.

2. At a major credit card bank, the percentages of people who historically apply for the Silver, Gold, and Platinum cards are 60%, 30%, and 10%, respectively. In a recent sample of 200 customers responding to a promotion, 110 applied for Silver, 55 for Gold, and 35 for Platinum.

   Research Question: Is there evidence to suggest that the percentages for this promotion may be different from the historical proportions?

   a. Write the null and alternative hypotheses for investigating this research question. (2 pts)

      H_o: the percentages for this promotion are the same as the historical proportions ($\pi_{silver} = 0.60$, $\pi_{gold} = 0.30$, $\pi_{platiumum} = 0.10$)

      H_a: the percentages for this promotion are different from the historical proportions

   b. How many of the 200 customers do we expect to see in each category if the percentages from this promotion do *not* differ from the historical proportions? Be sure to give the expected count for each category. Show your work to justify your answer. (2 pts)

      Silver: 60% of 200 = 120
      Gold: 30% of 200 = 60
      Platinum: 10% of 200 = 20

c. Find the chi-square test statistic for investigating this research question by hand. Show your work to receive full credit. (2 pts)

$$\sum\left(\frac{\text{(Observed - Expected}}{\text{Expected}}\right)^2 = \frac{(110-120)^2}{120} + \frac{(55-60)^2}{60} + \frac{(35-20)^2}{20} = 12.5$$

d. Carry out the chi-square test in JMP, and find the p-value for investigating this research question (you must attach your JMP output to receive full credit). (2 pts)

Test Probabilities

Level	Estim Prob	Hypoth Prob
gold	0.27500	0.30000
platinum	0.17500	0.10000
silver	0.55000	0.60000

Test	ChiSquare	DF	Prob>Chisq
Likelihood Ratio	10.4594	2	0.0054*
Pearson	12.5000	2	0.0019*

Method: Fix hypothesized values, rescale omitted

p-value: **0.0019**

e. Write a conclusion in the context of the research question. (2 pts)

The data provideevidence that the percentages for this promotion are different from the historical proportions.