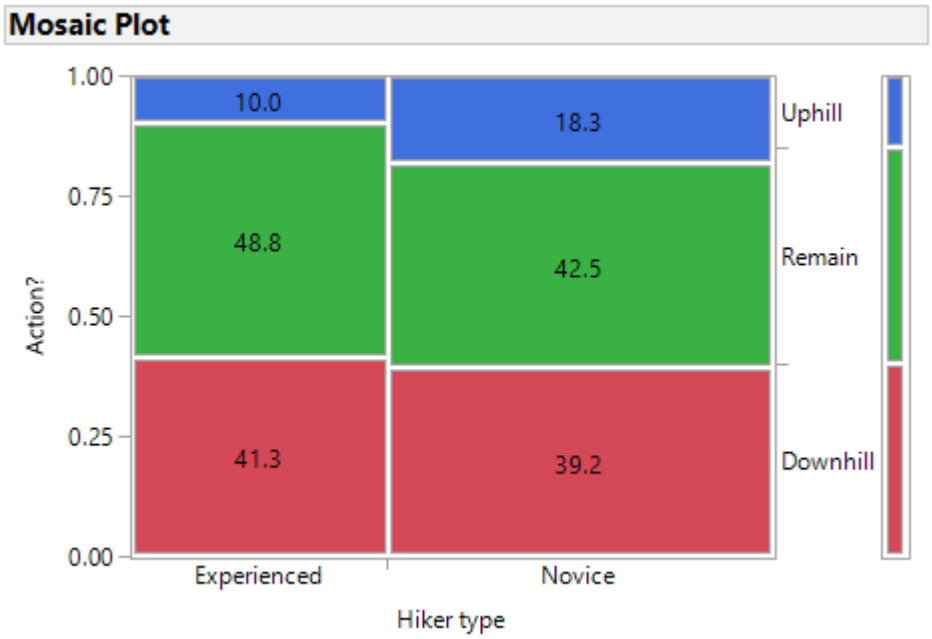
STAT 110: Homework 7 Solutions (20 pts)
Fall 2017

1. Suppose a random sample of 200 hikers was obtained. The hikers were asked if they would walk uphill, downhill, or remain where they were if they became lost in the woods. They were also classified as either a novice or an experienced hiker. The results are summarized in the following table.

	Uphill	Downhill	Remain	*Totals*
Novice	22	47	51	120
Experienced	8	33	39	80
Totals	30	80	90	200

The research question is as follows: Is there a significant association between the direction in which a lost hiker would travel and whether the hiker is experienced or a novice?

a. Create a mosaic plot (sketch it below) and then describe any association you see between the two variables of interest based on the observed data. (1 pt)



Experienced hikers in this data set were more likely than Novice hikers to remain where they were; Novice hikers were more likely to head uphill.

b. Write the null and alternative hypotheses needed to address the research question. (2 pts)

H_0: **There is no association between the direction in which a lost hiker would travel and whether the hiker is experienced or a novice.**

H_a: **There is an association between the direction in which a lost hiker would travel and whether the hiker is experienced or a novice.**

c. Use JMP to carry out an appropriate hypothesis test to determine if the observed association is statistically significant. Include your JMP output with your solutions. (1 pt)

Tests

N	DF	-LogLike	RSquare (U)
200	2	1.4035754	0.0069

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	2.807	0.2457
Pearson	2.691	0.2604

d. Provide the p-value and a conclusion written in everyday language that addresses the research question. (3 pts)

p-value: **0.2604**

Conclusion: **There is not enough evidence to conclude that a significant association exists between the direction in which a lost hiker would travel and whether the hiker is experienced or a novice.**

2. A company that manufactures blue jeans conducted an experiment using 98 samples of denim. Denim fabric naturally contains starch, creating stiffness in the fabric. Since customers often don't like the stiff feel of the fabric, the company treats the denim to make it feel "worn". The researchers used three different methods to treat the fabric samples: Alpha Amalyze, Caustic Soda, and Pumice Stone. Although the feel of the fabric is important, the company is also concerned about the strength of the treated fabric, which is measured by thread wear; so, the thread wear was also classified as either Low, Moderate, or Severe for each of the 98 samples. The data are posted on the course website (**Denim.jmp**).

   The research question is as follows: Is there a significant association between the method used to treat the denim and thread wear?

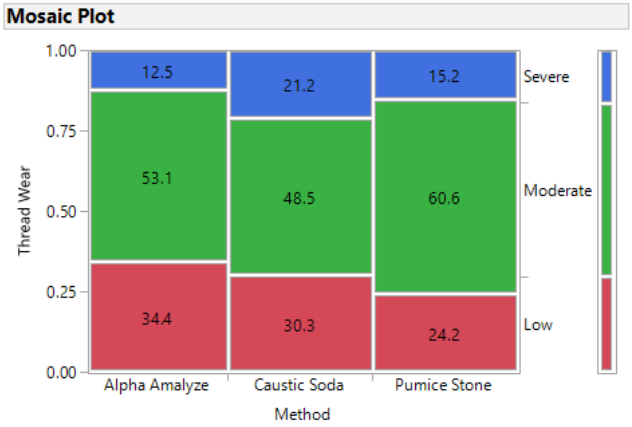
   a. Use JMP to find the counts needed to complete the contingency table below. Write these counts into the table. (1 pt)

	Thread Wear		
Method	Low	Moderate	Severe
Alpha Amalyze	**11**	**17**	**4**
Caustic Soda	**10**	**16**	**7**
Pumice Stone	**8**	**20**	**5**

   b. Write the null and alternative hypotheses needed to address the research objective (i.e., is there a significant association between method used to treat the denim and thread wear?). (2 pts)

   H_o: **There is no association between the method used to treat the denim and thread wear.**
   H_a: **There is an association between the method used to treat the denim and thread wear.**

   c. Describe any differences you see in thread wear across the various methods based on the observed data. Use relevant percentages in your discussion. (2 pts)



Fabric treated with Alpha Amalyze was more likely to have low thread wear (34.4%) than fabric treated with Caustic Soda (30.3%) or Pumice Stone (24.2%).

Fabric treated with Caustic Soda, on the other hand was most likely to have severe thread wear (21.2%), followed by Pumice Stone (15.2%) and then Alpha Amalyze (12.5%).

d. Next, you will conduct a chi-square test to investigate this research question. In the table below, write the <u>expected counts</u> that are needed to compute the chi-square test statistic. (2 pts)

	Thread Wear			
Method	Low	Moderate	Severe	Total
Alpha Amalyze	**9.469**	**17.306**	**5.224**	**32**
Caustic Soda	**9.765**	**17.847**	**5.388**	**33**
Pumice Stone	**9.765**	**17.847**	**5.388**	**33**
Total	**29**	**53**	**16**	**98**

e. By hand, find the chi-square test statistic (you must show your work to earn full credit). (2 pts)

$$\sum\left(\frac{\textbf{(Observed - Expected}}{\textbf{Expected}}\right)^2 = \frac{(11-9.469)^2}{9.469} + \frac{(17-17.306)^2}{17.306} + \frac{(4-5.224)^2}{5.224} + \frac{(10-9.765)^2}{9.765}$$
$$+ \frac{(16-17.847)^2}{17.847} + \frac{(7-5.388)^2}{5.388} + \frac{(8-9.765)^2}{9.765} + \frac{(20-17.847)^2}{17.847} + \frac{(5-5.388)^2}{5.388} = \mathbf{1.826}$$

f. Use JMP to carry out the analysis. Include the output with your solutions. (1 pt).

Tests

N	DF	-LogLike	RSquare (U)
98	4	0.90795611	0.0094

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	1.816	0.7696
Pearson	1.826	0.7678

g. Provide the p-value and a conclusion written in everyday language that addresses the research question. (3 pts)

p-value: **<u>0.7678</u>**

Conclusion: **There is not enough evidence to conclude that the method used to treat the denim is associated with the thread wear**.