Psyc 3101, Homework 13
Due Dec. 11

Name:______________________________ **TA:** ☐ Daniel ☐ Dorian ☐ Jess ☐ Kiri ☐ Nicole

Here are the actual data from our family over five weeks, indicating how often each kid was selected to set the dinner table.

Days	Eunice	Clarence	Matilda	Horace	Betty	Total
Weekdays	2	7	4	10	2	25
Weekends	1	4	0	2	3	10
Total	3	11	4	12	5	35

There are two nominal variables here: Kid (with 5 values) and Day (with two values–weekday and weekend). There are two questions we can ask about these variables.

First, do a multinomial test on how often each kid is selected (i.e., on the Kid variable, ignoring Day).

1. Write a sentence describing the null hypothesis.

All kids have an equal chance of being selected on any given day.

2. Fill in the marginal frequencies for the five kids in the table above. These are your observed frequencies.

3. Find the expected frequencies according to the null hypothesis.

Eunice	Clarence	Matilda	Horace	Betty	Total
7	7	7	7	7	35

$f^{exp} = n/k = 35/5 = 7$

4. Calculate the chi-square statistic for the goodness-of-fit of the null hypothesis.

$$\chi^2 = \sum \frac{\left(f^{obs} - f^{exp}\right)^2}{f^{exp}}$$
$$= \frac{4^2}{7} + \frac{4^2}{7} + \frac{3^2}{7} + \frac{5^2}{7} + \frac{2^2}{7}$$
$$= 10$$

5. The critical value (on 4 df, with α = 5%) is 9.48. What do you conclude?

There are reliable differences in how often the kids are chosen.

Second, test the independence between Kid and Day.

6. Write a sentence describing the null hypothesis.

Each kid's chance of being selected is the same on a weekday as on a weekend.

7. Calculate the expected frequencies according to the null hypothesis.

Days	Eunice	Clarence	Matilda	Horace	Betty
Weekdays	2.14	7.86	2.86	8.57	3.57
Weekends	.86	3.14	1.14	3.43	1.43

f^{exp}(kid,day) = f^{obs}(kid)*f^{obs}(day)/35
f^{exp}(Eunice,weekday) = 3*25/35 ≈ 2.14
f^{exp}(Eunice,weekend) = 3*10/35 ≈ .86
etc.

8. Calculate the chi-square statistic for the goodness-of-fit of the null hypothesis.

$$\chi^2 = \sum \frac{\left(f^{obs} - f^{exp}\right)^2}{f^{exp}}$$
$$= \frac{.14^2}{2.14} + \frac{.14^2}{.86} + \ldots + \frac{1.57^2}{1.43}$$
$$= 5.21$$

9. The critical value (again on 4 df, with α = 5%) is 9.48. What do you conclude?

There is not enough evidence to conclude the parents' preferences among their children differs between weekdays and weekends.

Indicate the best statistical test to use for each of the following situations.

10. Ten subjects are each measured on two ordinal-scale variables. We want to know how the variables are related.

Spearman correlation

11. Two groups of 8 subjects each are measured on some variable. We want to know whether there's a difference in central tendency between the groups. Histograms for both groups show the variable is strongly skewed.

Mann-Whitney

12. 500 subjects are divided equally into five groups. Every subject is measured on some variable. We want to know whether there's a difference in central tendency among the groups. Histograms show the variable has a bimodal distribution.

One-way ANOVA

13. 20 subjects are measured on some ordinal-scale variable, both before and after being given some drug. We want to know whether the drug affects the average value of the dependent variable.

Wilcoxon