Fall 2017, MATH 408, Exam 2

Monday, November 13, 2017; 1–1:50pm

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Name: _____

Circle the time of your discussion section: **2pm** **3pm**

Instructions:

- No books or notes of any kind.
- Turn off cell phones.
- Answer all questions and clearly indicate your answers.
- **Each problem is worth 10 points.**
- **Show your work!** Points might be taken off for a correct answer with no explanations.

Problem	Possible	Actual
1	10	
2	10	
3	10	
4	10	
5	10	
Total	50	

Problem 1. Fill in the rest of the following two-way ANOVA table.

Source	SS	df	MS	F	Prob $> F$
Columns					
Rows	6664	4			
Error	8290	20			
Total	23157	29			

Problem 2. To test whether a die is fair, 66 rolls were made, and the corresponding outcomes were as follows:

Face value	Observed frequency
1	8
2	9
3	16
4	15
5	9
6	9

Estimate the p-value if the χ^2 test is used.

Would you consider the die fair? Explain your conclusion.

Problem 3. In a certain city, there are about one million eligible voters. To study the relationship between sex and participation in a particular election, a simple random sample of size 10,000 was chosen. The results:

	Men	Women
Voted	2,850	3,550
Didn't vote	1,450	2,150

Compute the p-value for the χ^2-test of the null hypothesis that sex and voting are independent.

Would you reject the null hypothesis on the basis of your calculations? Explain your conclusion.

Problem 4. Assume that

$$X_1 = 2, X_2 = 4, X_3 = 6, X_4 = 1, X_5 = 5, X_6 = 3$$

is an independent random sample from a population with a continuous cdf $F_X = F(x)$, and assume that

$$Y_1 = 1, Y_2 = 3, Y_3 = 5, Y_4 = 2, Y_5 = 4, Y_6 = 6$$

is an independent random sample from a population with cdf $F_Y = F(x - \theta)$. Compute the p-value of the sign test for the null hypothesis $\theta = 0$ against the alternative $\theta < 0$.

You will need the binomial coefficients $1, 6, 15, 20, 15, 6, 1$.

Problems 5. Compute the Spearman rank correlation coefficient for the data set

$$X_1 = 2, X_2 = 4, X_3 = 6, X_4 = 1, X_5 = 5, X_6 = 3;\ Y_1 = 1, Y_2 = 3, Y_3 = 5, Y_4 = 2, Y_5 = 4, Y_6 = 6.$$

You can speed up your computations by noticinng that $1 + 2 + 3 + 4 + 5 + 6 = 21$ and $1^2 + 2^2 + 3^2 + 4^2 + 5^2 + 6^2 = 7 \cdot 13 = 91$. Keep in mind that your final answer should be in the interval $[-1, 1]$; ideally, the answer should simplify to a nice fraction, either ordinary or decimal.