

Fall 2020, MATH 408, Exam 2

Friday, November 6; 9–9:50am

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Instructions:

- If you have a question, please write to the instructor using the private chat function of the zoom meeting. Other than that, do not communicate with anybody during the exam.
- You should have (and use!) a calculator or other computing device and three distribution tables: normal, t , and χ^2 . Instead of the tables, you are welcome to use the corresponding statistical functions on your computing device.
- Answer all questions and clearly indicate your answers.
- **Each problem is worth 10 points.**

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

Source	SS	df	MS	F	Prob $> F$
Columns		5			
Rows	6664				
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. 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 4. Compute the Spearman rank correlation coefficient for the data set

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

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

Indicate the formula you are using and show your work. 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.

Problem 5. For the first-year students at a certain university, the correlation between SAT scores and first-year GPA was 0.4. Assume the distribution of the scores is jointly normal. Predict the percentile rank on the first-year GPA for a student whose percentile rank on the SAT was 85%.