

Spring 2015, MATH 408, Exam 2

Monday, April 20, 2015; 12–12:50pm

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Name: _____

Circle the time of your discussion section: **8am** **9am** **10am**

Instructions:

- No books or notes of any kind.
- Turn off cell phones.
- You should have (and use!) a calculator and three distribution tables: normal, t , and χ^2 .
- 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. Wrong answer with no explanations is worth zero points.

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

Problem 1. Consider the one-way layout model in the form

$$Y_{ij} = \theta_i + \varepsilon_{ij}, \quad \varepsilon_{ij} \text{ are iid } \mathcal{N}(0, \sigma^2), \quad i = 1, \dots, k, \quad j = 1, \dots, n.$$

Describe the test statistic and the rejection region for testing the null hypothesis

$$H_0 : \theta_1 = \theta_2 = \dots = \theta_k$$

against the alternative that $\theta_p \neq \theta_q$ for at least one pair (p, q) , $p \neq q$.

Problem 2. Consider the model in the form

$$Y_{ij} = \theta_i + \mu_j + \varepsilon_{ij}, \quad \varepsilon_{ij} \text{ are iid } \mathcal{N}(0, \sigma^2), \quad i = 1, \dots, k, \quad j = 1, \dots, n.$$

Describe the test statistic and the rejection region for testing the null hypothesis

$$H_0 : \theta_1 = \theta_2 = \dots = \theta_k$$

against the alternative that $\theta_p \neq \theta_q$ for at least one pair (p, q) , $p \neq q$.

Problem 3. To test whether a die is fair, 66 rolls were made, and the corresponding outcomes were as follows:

Face value	Observed frequency
1	7
2	9
3	17
4	16
5	9
6	8

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

Problem 4. In a certain city, there are about one million eligible voters. To study the relationship between sex and participation in the last 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 -values for the χ^2 -test of the null hypothesis that sex and voting are independent.

Problems 5. A coin-making machine produces pennies in such a way that, for each coin, the probability U to turn up heads is uniform on $[0, 1]$. A coin pops out of the machine. Compute the conditional distribution of U given that the coin is flipped 1000 times and lands heads 300 times.