

CS 598AK Fall 2021

Homework 3

due by email to alexkirlik@gmail.com at 5pm one week after assignment given.

In this homework assignment, you will demonstrate the statistical techniques discussed in Experimental Human-Computer Interaction, chapters 5.3 - 5.3.3. You are provided with an Excel file ("Homework3.xlsx") which contains the data you will use to perform the analysis and worksheets where you should show your solutions to the below questions. Additionally, provided are PDF files (q, F, U, Wilcoxon, CHI-squared tables), which you should use in your calculations. You are to submit 2 files for grading:

- A filled out "Homework3.xlsx", which contains worksheets labeled "Question 1" through "Question 4" to show your solution and work.
- A PDF file containing explanations for the solutions for the questions below.

You are to base your calculations on chapters 5.3 - 5.3.3 and use the formulas listed in Appendix A1 and A2. You are NOT to use any statistical packages, such as R or SPSS, nor any statistical add-ons or inferential statistical tools found in Microsoft Excel or Google Sheets. You may use descriptive statistic formulas such as SUM, SUMSQ, AVERAGE, and SUMXMY2.

The purpose of this assignment is to perform the analysis and demonstrate the process by showing your work. You may use Excel, Google Sheets, or other spreadsheet software to complete the assignment, but submission of your analysis must be as an Excel file.

Marc wanted to understand how changing the interface for users of a software application affected completion time and error rate. He is also interested in examining the difference in satisfaction scores within condition only as people use the interface over time.

The sheet Datasheet 1 in the attached Excel file shows the data Marc collected. He split his 20 participants between the 2 versions of the interface: Interface X and Y. After using the application for one week, all participants answered questions regarding their satisfaction. This resulted in a satisfaction score, Score 1. After 1 month of using the application, participants answered the same questions regarding their satisfaction. This is the column of data labeled Score 2. Additionally, users performed a series of tasks in her lab where their average time and error rate were recorded. These are labeled in the worksheet Datasheet 1 as Time and Error.

Will wanted to compare his interface, Interface Z as well. He decided to use a similar design to Marc's experiment, as he was also interested in understanding how changing the interface for users of a software application affected completion time and error rate and in observing the difference in satisfaction scores within condition only as people use the interface over time. The sheet Datasheet 2 in the attached Excel file shows the data Will collected. He split his 30 participants between the 3 versions of the interface: Interface X, Y, and Z.

In Will's experiment, after using the application for one week, all participants answered questions regarding their satisfaction. This resulted in a satisfaction score, Score 1. After 1 month of using the application, participants answered the same questions regarding their satisfaction. This is the column of data labeled Score 2. After two months, participants answered the same questions regarding their satisfaction. This is the column of data labeled Score 3. Additionally, users performed a series of tasks in his lab where their average time and error rate were recorded. These are labeled in the worksheet Datasheet 2 as Time and Error. You can assume all data is non-normal and should be analyzed using nonparametric statistical techniques.

ERRATA: On page 223 (Appendix A2), the formula for calculating the \bar{u}_2 value is incorrect. The denominator $(nk)(nk+1)$ should be $(nk)(k+1)$, so remove the extra "n" in your calculations. When reporting test statistics, be sure to use the examples provided in the text as templates, such as on the bottom of page 146 for reporting Wilcoxon tests, bottom of page 210 for Mann-Whitney, bottom of page 215 for Nemenyi, etc. Note: To calculate a tie between values when computing ranks, you assign the mean of the tied ranks as the rank (i.e. ranks 2, 3, and 4 have the same value and thus the rank 3 is assigned for each value.) Please answer the questions below.

1. Perform the appropriate test(s) to answer Marc's question of whether there are differences in satisfaction scores within condition. Show your work on the tab labeled Question 1. Report your findings in the PDF.
2. Perform the appropriate test(s) to answer Marc's questions of whether there are differences in time and error rate between conditions. Show your work on the tab labeled Question 2. Report your findings in the PDF.

3. Perform the appropriate test(s) to answer Will's question of whether there are differences in satisfaction scores within condition. Show your work on the tab labeled Question 3. Report your findings in the PDF. If necessary, perform the appropriate post-hoc comparison test, show your work on the tab labeled Question 3-Post, and report your findings in the PDF.

4. Perform the appropriate test(s) to answer Will's questions of whether there are differences in time and error rate between conditions. Show your work on the tab labeled Question 4. Report your findings in the PDF. If necessary, perform the appropriate post-hoc comparison test, show your work on the tab labeled Question 4-Post, and report your findings in the PDF.