CSE 323 HW3 Report

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Introduction

In this study, we will be doing some statistical analysis based on data from randomly selected users and their performance on navigating different menus. We are given two different datasets, the first will be explored in Question 1 and the second in Question 2.

Question 1:

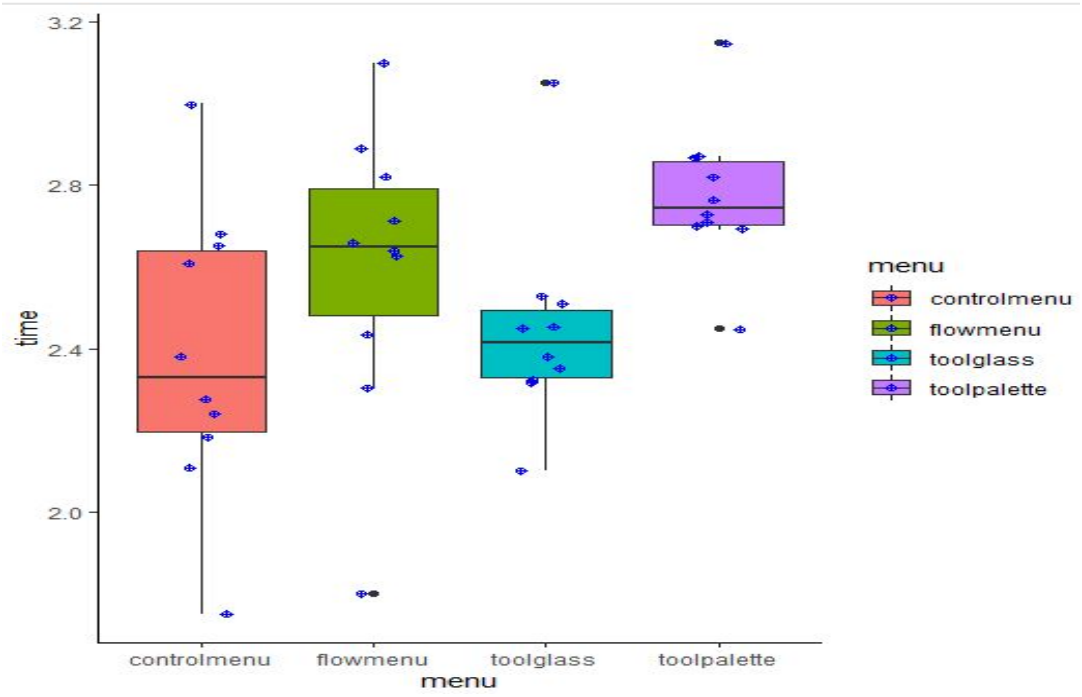
In this half of the project, we will be examining a dataset that contains user ID, type of menu, and time to navigate. We are given the data from 40 users, 10 for each of the 4 menu types. This is a between-group design.

First, I performed an ANOVA test on the given dataset. ANOVA, an acronym for Analysis of Variance, is a statistical method that tests differences between two or more means (1). I used RStudio's built in function to grab a summary of the test. This is what I found:

```
                Df Sum Sq  Mean Sq   F value  Pr(>F)
menu             3  0.8998  0.29992   3.455    0.0264 *
Residuals       36 3.1252  0.08681
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

To interpret this result, we can say that, since the P-value obtained (0.0264) is less than 0.05, there is a statistical difference between the two groupings. 0.05 is the standard level of significance here. The P-value is the probability that really determines if the null hypothesis is correct. If it is correct, P would be **greater than or equal** to the significance. Here, it isn't.

In the next part of this project, we are set out to visualize the data--the relationship between data and time. I used a simple box-plot for this part, using the R library, ggplot2. My results are shown here:



Menu is shown here on x-axis, against y-axis time

The box plot supports our rejection of the null hypothesis in the ANOVA section. The null hypothesis essentially states that all of the menus have no difference between each other, but this box plot, and the ANOVA results, show otherwise.

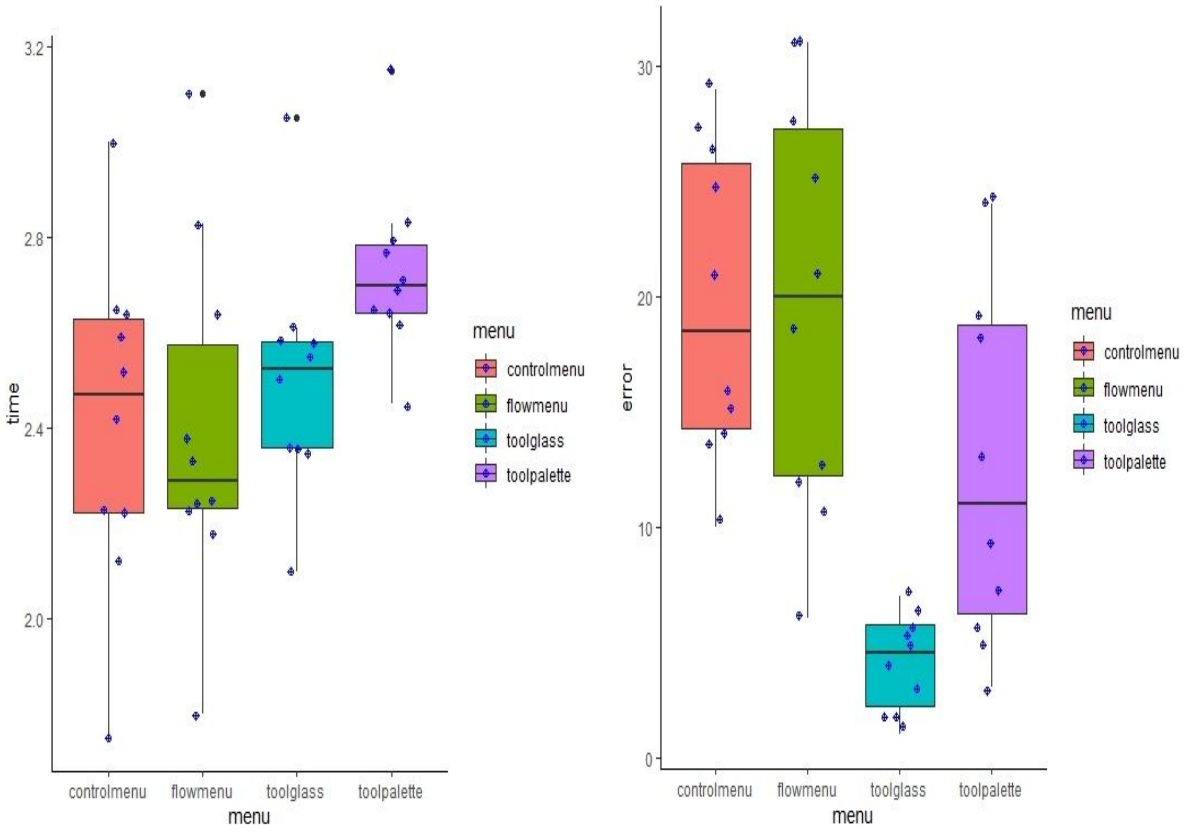
Question 2:

In this second and final half of the project, we are asked to examine a within-subject design with multiple parameters, “Time” and now the inclusion of “Error.”

The first part of this question asks for the mean and standard deviation for each menu -- both the time and the error fields. The table below will represent this.

Menu	Mean Time	Mean Error	SD Time	SD Error
Flowmenu	**5.50**	**19.70**	**0.3686552**	**8.957306**
Toolpalette	2.730	12.80	0.1821477	7.9411452
Toolglass	2.504	4.10	0.24753	2.024846
Controlmenu	2.414	**19.70**	0.3482081	6.700746

The following values above represent the reported statistical analysis on the second dataset. I have bolded the largest value in each column. For the average time it took the user to navigate the menu, the longest was the “Flowmenu” a mean time of 5.50. Interestingly enough, it also had a mean error of 19.70, the same mean error as the “Controlmenu.” What this tells us is that there is an extremely close similarity between the standard deviations of the time for these menus, since error is defined as (SD / sqrt(n)) and n = 10 for all the menus. We can see that Controlmenu’s SD time equates to roughly 0.35, with Flowmenu coming in at about 0.37. Moving onto standard deviation, we see that Flowmenu just beats out Controlmenu for the highest. This means that the user data for these menus is the most spread out across the range of values. The box plots below visualize the menus against both time and error, respectively, and they will help us visualize the results seen in this table.



References

1. http://onlinestatbook.com/2/analysis_of_variance/intro.html