BN2102 ASSIGNMENT 1: DATA ANALYSIS REPORT

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OVERVIEW

The aim of this report is to provide a comprehensive evaluation of the newly developed eye drops for the treatment of elevated ocular pressure. The study consists of three parts:

A. a pilot study on rats,
B. a pilot study on rabbits,
C. and a comparison of the new drug with three other drugs made by competitors.

The data collected from these studies will be analysed in-depth to determine the effectiveness of the drug in lowering ocular pressure. A constant confidence level of 97% will be used throughout the data analysis process.

PART A

Objective: To compare the ocular pressure of rats who received no eye drops with that of rats who received the eye drops treatment.

1. Mean Confidence Interval of Rats Without Treatment

	Ocular Pressure / mmHg
Sample Mean	25.24
Lower Bound of 97% Confidence Interval	23.61
Upper Bound of 97% Confidence Interval	26.86

Conclusion: We are 97% confident that the actual mean of ocular pressure of the true population lies between 23.61 mmHg and 26.86 mmHg.

2. Determining Sample Size of Rats Treatment Group

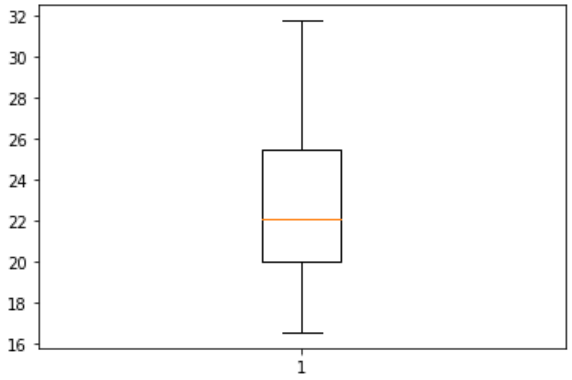
We will use an underlying standard deviation of $\sigma = 3.5$, with the control group's sample size being 22.

Conclusion: In order to be able to detect a difference of 3 mmHg and have a statistical power of at least 85%, the treatment group must have a sample size of at least 43.

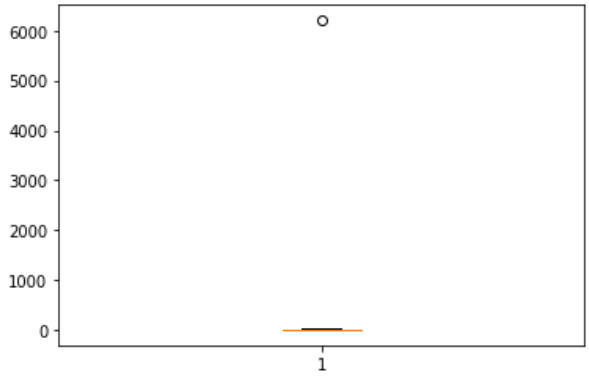
PART B

Objective: To unveil any change in ocular pressure between the two groups.

1. Boxplots of Control and Treatment Groups



Control Group



Treatment Group

As observed in the boxplots above, an outlier was found in the treatment group during the data analysis process. To improve the accuracy of the data analysis, the outlier was excluded. Further investigations should be made to determine if the presence of the outlier signifies an inaccuracy in the data of the treatment group (e.g. instrument used for measurement could be faulty).

Conclusion: More investigations should be made to detect the cause of the outlier.

2. One-sided Test

A one-sided student t-test is performed on the two sets of data. The following hypothesis was made:

H_0: $P_{control} - P_{treatment} = 0$, and **$H_1$**: $P_{control} - P_{treatment} > 0$

t Statistic	2.61
t Critical with 97% Confidence Level	1.92

Since the t statistic is greater than the t critical value, we can reject the NULL hypothesis and accept the alternate hypothesis that $P_{control} - P_{treatment} > 0$. Since the NULL hypothesis was rejected, the associated p-value will be lower than 0.03. Specifically, according to our data, p-value = 0.0057.

Conclusion: We are 97% confident that $P_{treatment} < P_{control}$. The associated p-value is 0.0057.

PART C

Objective: To unveil whether the new eye drops improve on currently available alternatives in terms of lowering ocular pressure.

1. ANOVA Test

In this part of the study, we will be using ANOVA to test whether the variability between groups is greater than the variability within each group. The following hypothesis was used:

H_0: Drugs have no effect on ocular pressure, and **H_1**: Drugs have effect on ocular pressure

F Ratio	14.98
F Critical with 97% Confidence Level	3.07

Since $F_{ratio} > F_{critical}$, we can reject the NULL hypothesis. The p-value associated with this test was calculated to be 1.56×10^{-8}.

Conclusion: Drugs have effect on ocular pressure. However, we can't detect the origin of the differences based on ANOVA test solely.

2. Bonferroni Tests

Bonferroni tests is conducted to determine the origin of the differences.

t Statistic	Values	Associated p-Values
Competitor 1 vs New Drops	4.84	3.26×10^{-6}
Competitor 2 vs New Drops	4.67	6.98×10^{-6}
Competitor 3 vs New Drops	5.46	2.02×10^{-7}
Competitor 1 vs Competitor 2	0.46	0.65
Competitor 1 vs Competitor 3	-0.59	0.56
Competitor 2 vs Competitor 3	-1.07	0.29

The critical t-value calculated during the data analysis process is 2.85. As observed in the table above, the |t-statistics| involving the new drops > critical t value. Not only that, the |t-statistics| involving the 3 competitors < critical t value. So, data failed to support any difference among the competitors.

Conclusion: We can conclude the values computed from Bonferroni tests support a lower ocular pressure with the new drops compared to the 3 other competitors.

DISCUSSION

There are several sources of error that must be taken into account. Firstly, the presence of an outlier in Part B warrants an investigation of its source. Next, during the ANOVA test, we can observe the sample size used to test the new drug is almost twice that of the sample size used for the other competitors, and this may affect the accuracy of the ANOVA test. Also, the use of ANOVA Lastly, the compounding errors generated as a result of the Bonferroni tests should also be considered.

FINAL CONCLUSION

Overall, despite the sources of error, the several statistical tests conducted show that not only does the new drug lower ocular pressure, but the new drops also improve on the available alternatives made by competitor 1,2 and 3.