MT5762 PROJECT 1

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2020

## QUESTION 1[Which 5 elements did you choose, and why?]

The 5 elements chosen to undertake the project are [Mg, K, Ca, Al, Sc]. These five elements have been chosen because the group of [Mg, K, Ca] at the first glimpse of data the store-bough soil and general outdoor soil looked very different in elemental composition, while the group [Al, Sc] looked very similar.

## QUESTION 2[Do the data indicate differences in the elemental composition of Cannabis leaves grown in different soil types?]

From the APPENDIX BOXPLOT[1-5] we cannot determine an obvious answer if there are differences in elemental composition since some soils data overlap with each other.

Our data has to fulfil the F-distribution assumptions to achieve precise results. Data must follow independence, normality and have constant threat between them.

For the normality assumption we need to test hypothesis **Ho:** element follows normal distribution and **H1:** element does not follow normal distribution. We tested the hypothesis using a Shapiro-Wilk test and elements [Mg,K,Ca,Sc] are normally distributed, but [Al] is not.

For constant thread assumption we need to test hypothesis **Ho:** σ(mb)^2 = σ(bhb)^2 = σ(pm)^2 = σ(nth)^2 and **H1:** at least 1 variance is not equal with at least 1 other variance. We tested the hypothesis using a Levene’s Test and element [Sc] satisfies it, but elements [Mg,K,Ca,Al] do not satisfy it.

The ANOVA hypothesis for each of our 5 elements is, **Ho:** μ(mb) = μ(bhb) = μ(pm) = μ(nth) and **H1:** exists at least 1 μ not equal with at least 1 other μ.

The results from the assumptions test and the ANOVA test can be found in APPENDIX TABLE[1]. Our result states that for all 5 elements there exists at least 1 mean that is not equal with at least one other mean. Our conclusion from this is that data indicate differences in the elemental composition of Cannabis leaves grown in different soil types. We should not rely on these results, since all of our assumptions were not met and maybe we have returned false results for some elements. All tests were made considering a 5% type-I-error.

# QUESTION 3[Are some of the elements related to one another in terms of their levels in the sampled leaves?]

We will explore if elements have a relation with each other from the cannabis leave results. The method we will apply to compute such procedure is by using the correlation coefficient ‘ρ’, which measures the relationship between 2 variables(elements). Our pairs for the examination are [Mg-K, Mg-Ca, K-Ca, Al-Sc, Mg-Al]. Results of the correlation coefficient for these pairs can be found in APPENDIX TABLE[2]. Our results state that all of our pairs have a positive linear relationship. This indicates that each element’s value in cannabis leave depends on the other’s elements value. This means that if we know the Mg has an influence on what the value of K will be. Our strongest pair from our tests is Mg with Ca with a value approximately 0.81 and a perfect value of positive linear relation is 1.

## QUESTION 4[Results of this experiment ultimately allow the determination of what soil the plants were grown in, just from the elemental composition of the leaves?]

GRAPHS-PLOTS

Box-Plot[1] Showcases Mg element in the four different soils.

Chart, box and whisker chart

Description automatically generated

Box-Plot[2] Showcases K element in the four different soils.

Chart, box and whisker chart

Description automatically generated

Box-Plot[3] Showcases Ca element in the four different soils.

Chart, box and whisker chart

Description automatically generated

Box-Plot[4] Showcases Al element in the four different soils.

Chart, box and whisker chart

Description automatically generated

Box-Plot[5] Showcases Sc element in the four different soils.

Chart, box and whisker chart

Description automatically generated

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| ELEMENT | F-value | P-Value | Ho=Reject/Accept | Assumption Normality (Shapiro-Wilk) | Assumption Constant-Spread(Levenes) |
| Mg | 150.9 | 2.7826 | Reject | 20.76>0.05 = Accept | 0.0001971 < 0.05 = Reject |
| K | 64.49 | 2.7826 | Reject | 0.16 > 0.05 = Accept | -2.60 < 0.05 = Reject |
| Ca | 110.2 | 2.7826 | Reject | 0.71 > 0.0.5 = Accept | 0.001 < 0.05 = Reject |
| Ai | 34.67 | 2.7826 | Reject | 0.0006 < 0.05 = Reject | 0.02 < 0.05 = Reject |
| Sc | 107.8 | 2.7826 | Reject | 0.30 > 0.05 = Accept | 0.13 > 0.05 = Accept |

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| --- | --- | --- |
| Pair of elements | Value of-ρ | Relation |
| Mg with K | 0.7343837 | Positive Linear Relationship |
| Mg with Ca | 0.8129561 | Positive Linear Relationship |
| K with Ca | 0.5547043 | Positive Linear Relationship |
| Al with Sc | 0.4535501 | Positive Linear Relationship |
| Mg with Al | 0.7656043 | Positive Linear Relationship |

# TABLES-SUMMARIES

# APPENDIX - CODE