Using Randomized Complete Block Design to find if there is significant difference in the various weight loss methods

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2021-09-08

Introduction:

ANOVA is a statistical test used to determine whether or not there is a significant difference between the means of treatments. The analysis of variance is the systematic algebraic procedure of decomposing (i.e., Partitioning) overall variation. If we find there is significant difference, we conduct a post-hoc test to check where the difference occurs.

Randomized Complete Block Design (RCBD) is the most common design of experiments in many disciplines, including agriculture, engineering, medical, etc. In addition to the experimental error reducing ability, the design widens the generalization of the study findings. The repeated application of the treatments under investigation is known as replication. If the treatment is applied only once we have no means of knowing about the variations in the results of a treatments. Only when we repeat the application of the treatment several times, we can estimate the experimental error.

Objective:

To check whether the different weight loss methods result in the same amount of weight lost

Data Description:

The data set contains information on 20 people who undertook one of four diets (referred to as diet A, B, C and D). The aim of the study was to see which diet was best for losing weight. The variable 'Method' describes the various dieting methods and WeightL shows how much weight the participants had lost in pounds. Replications shows the repeated application of the methods.

Data Summary:

```
library(readxl)
data<- read_excel("C:/Users/Srikar/Desktop/SS/R/Sem 5/Design of Exp/Practical 6/dataset.xlsx")
head(data,6)
```

Method	Replicatio	WeightL
<chr>	<dbl>	<dbl>
A	1	21
A	2	47
A	3	27
A	4	75
A	5	30
B	1	88

```
summary(data)
```

Method	Replications	WeightL
Length:20	Min. :1	Min. :17.00
Class :characte	1st Qu.:2	1st Qu.:30.00
Mode :charac	Median :3	Median :44.50
	Mean :3	Mean :50.95
	3rd Qu.:4	3rd Qu.:70.50
	Max. :5	Max. :95.00

We observe that the range of values are from 17kgs to 95kgs which are the minimum and maximum values.

```
dim(data)
```

```
## [1] 20  3
```

There are 20 observations with 3 variables : Method, replications and weight

```
names(data)
```

```
## [1] "Method"       "Replications" "WeightL"
```

Hypothesis Statement:

Null Hypothesis (H 0): There is no significant difference in the different die methods **(μ1 = μ2=μ3= μ4)** where (μ1, μ2, μ3, μ4) are mean weight loss by different methods followed

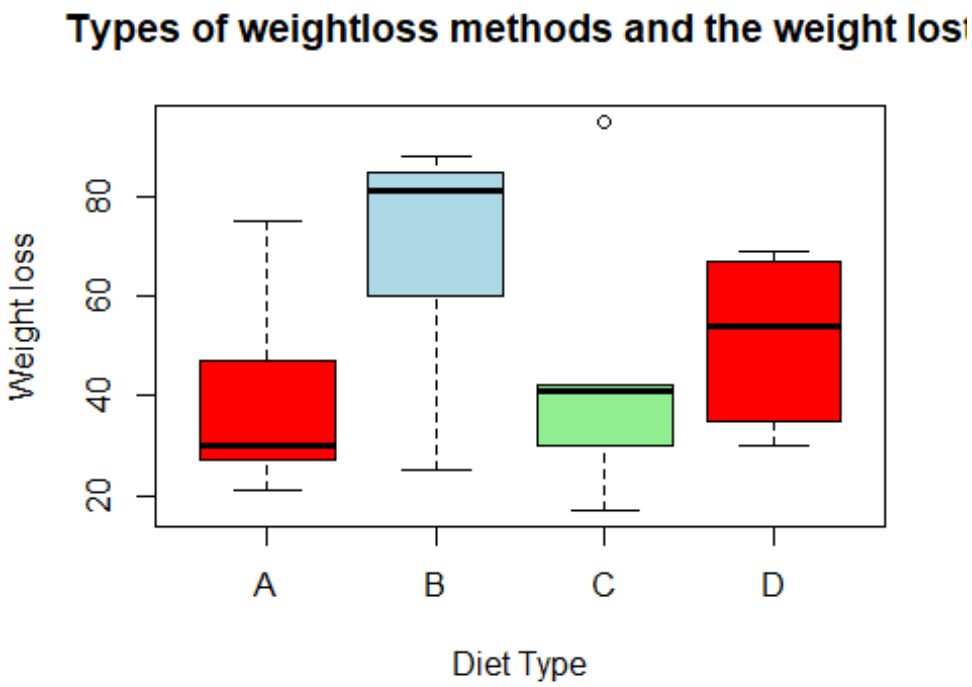
Alternative Hypothesis (H 1): At least two diet methods have significant difference.(**μ1 ≠ μ2≠μ3≠ μ4**)

```
#We keep the significance level as 5% or 0.05
```

Procedure

#1)Plotting boxplot

```
A.box=boxplot(data$WeightL~ data$Method, xlab = "Diet Type",ylab = "Weight loss", col = c("red", "light blue", "light green"),
        main="Types of weightloss methods and the weight lost")
```




```
Table.A <- A.box$stats
colnames(Table.A)<-A.box$names
rownames(Table.A)<-c('min','lower quartile','median','upper quartile','max')
Table.A
```

		Box plot table		
	A	B	C	D
min	21	25	17	30
lower quartile	27	60	30	35
median	30	81	41	54
upper quartile	47	85	42	67
max	75	88	42	69

The above boxplot represents the above table.The minimum weight lost using any of the methods was found in mehtod C.There is only one outlier in found in method C. The max imum weight loss was found in Method B. The median weight loss was highest in metho d B.

#2) Constructing the anova model

```
model=aov(data$WeightL~data$Method+data$Replications, data = data)
summary(model)
```

		ANOVA Table for RCBD design			
	Df	**Sum Sq**	**Mean Sq**	**F value**	**P-value**
data$Method	3	2196	732.1	1.162	0.357
data$Replicatio	1	46	46.2	0.073	0.79
Residuals	15	9449	629.9		

We observe that the weight loss methods and the replications are not significant as their p -value is more than 0.05. Hence, we accept the null hypothesis. There is no significant dif ference in the different weight loss methods.

Conclusion:

All the weight loss methods lead to same amount of weight loss.