

## 2^3 Factorial Experiment

Srikar

2021-11-17

### 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. Post hoc analysis consists of statistical analyses that were specified after the data were seen.

Factorial Experiment- Factorial experiments involve simultaneously more than one factor and each factor is at two or more levels. Several factors affect simultaneously the characteristic under study in factorial experiments and the experimenter is interested in the main effects and the interaction effects among different factors.

**Aim:** To find out whether there is significant difference in the 3 factors

### Data Description:

The dataset contains the information about the different types of ingredients used to bake a cake. The three ingredients are flour, shortening and eggs. Each factor contains two levels. Every level is denoted by 0 and 1 i.e., F1 is one level and the other is F0. This goes for every factor. There are totally 9 observations that were recorded. The response variable is mean tasting which is rated from 0 to 7 where 0 is the worst possible test and 7 is the best taste.

Source: <https://www.itl.nist.gov/div898/software/dataplot/data/BOXCAKE2.DAT>

```
library(readxl)
```

```
data <- read_excel("C:/Users/Srikar/Desktop/SS/R/Sem 5/Design of  
Exp/Practical 12/dataset.xlsx")
```

```
head(data)
```

Dataset				
	FLOUR	SHORT	EGGS	MeanTaste
	<chr>	<chr>	<chr>	<dbl>
1	F0	S0	E1	4.68
2	F1	S1	E0	3.62
3	F0	S0	E1	3.78
4	F1	S1	E0	4.6
5	F0	S1	E1	5.48
6	F1	S0	E0	5.25

## Hypothesis Statement

Factor 1:

H0: There is no significant effect of Flour on the cake

H1: There is a significant effect of Flour on the cake

Factor 2:

H0: There is no significant effect of shortening on the cake

H1: There is a significant effect of shortening on the cake

Factor 3:

H0: There is no significant effect of egg on the cake

H1: There is a significant effect of egg on the cake

## Interaction:

H0: There is no significant effect of interaction of flour, eggs and shortening on the cake

H1: There is a significant effect of interaction of flour, eggs and shortening on the cake

## Procedure:

### 1) Constructing the ANOVA model:

```
model=aov(data$MeanTaste~data$FLOUR+data$SHORT+data$SHORT*data$FLOUR+data$EGG
S+data$EGGS*data$FLOUR+data$EGGS*data$SHORT+data$EGGS*data$SHORT+data$FLOUR,d
ata=data)
summary(model)
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
data\$FLOUR	1	0.2916	0.2916	1.120	0.3383
data\$SHORT	1	0.1112	0.1112	0.427	0.5423
data\$FLOUR:data\$SHORT	1	2.1673	2.1673	8.326	0.0344 *
Residuals	5	1.3015	0.2603		

---  
 Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

We observe that the interaction between flour and short is significant on the cake rating as its p-value is below 0.05. Flour and short are not significant

### **Conclusion:**

**Only the interaction between flour and short have an effect on the taste of the cake**