One-way ANOVA

Example

```
Dietdata <- read.csv(
  file = "DietWeightLoss.csv",
  header = TRUE,
  sep = ",",
  dec = "."
)
names(Dietdata)
boxplot(Dietdata$WeightLoss~Dietdata$Diet)
ANOVA=aov(Dietdata$WeightLoss~Dietdata$Diet)
ANOVA
summary(ANOVA)
ANOVA$coefficients
```

Note:

If data is in different/multiple columns then combine the data.

```
stdata=stack(data)
names(stdata)=c(“name1”,”name2”)
stdata
```

Example

```
data("mtcars")
data=data.frame(mtcars$hp,mtcars$wt)
data
stdata=stack(data)
names(stdata)=c("name1","name2")
stdata
```

Two-way ANOVA

Example

```
cancerdata <- read.csv(
  file = "cancer.csv",
  header = TRUE,
  sep = ",",
  dec = "."
)
cancerdata

ANOVA2=aov(time~cancerlevel+treatment,data=cancerdata)
ANOVA2
summary(ANOVA2)

ANOVA3=aov(time~cancerlevel*treatment,data=cancerdata)
ANOVA3
summary(ANOVA3)

boxplot(time~cancerlevel*treatment,data=cancerdata)
```

Exercise

1. Compute a one-way ANOVA on the following data.

Sample1	Sample2	Sample3	Sample4	Sample5
14	10	11	16	14
13	9	12	17	12
10	12	13	14	13
	9	12	16	13
	10		17	12
				14

Determine the observed F value. Compare the observed F value with the critical table F value and decide whether to reject the null hypothesis.

Write a R program for above problem.

2. Compute a one-way ANOVA on the following data.

S1	S2
27	22
31	27
31	25
29	23
30	26
27	27
28	23

Determine the observed F value. Compare the observed F value with the critical table F value and decide whether to reject the null hypothesis.

Write a R program for above problem.

3. A management consulting company presents a three-day seminar on project management to various clients. The seminar is basically the same each time it is given. However, sometimes it is presented to high-level managers, sometimes to midlevel managers, and sometimes to low-level managers. The seminar facilitators believe evaluations of the seminar may vary with the audience. Suppose the following data are some randomly selected evaluation scores from different levels of managers who attended the seminar. The ratings are on a scale from 1 to 10, with 10 being the highest. Use a one-way ANOVA to determine whether there is a significant difference in the evaluations according to manager level.

High Level	Midlevel	Low Level
7	8	5
7	9	6
8	8	5
7	10	7
9	9	4
	10	8
	8	

Write a R program for above problem.

Exercise

1. Consider four machines producing alloy spaces. We introduce an extra factor by considering both the machines producing the spacers and the performance of the operators working with the machines. In this experiment, the data appear as follows (spacer lengths in mm). Each operator made one spacer with each machine

Operator	Machine 1	Machine 2	Machine 3	Machine 4
1	46	56	55	47
2	54	55	51	56
3	48	56	50	58
4	46	60	51	59
5	51	53	53	55

Use the two-way ANOVA to analyze these data.

Write a R program for above problem.

2. A vehicle manufacturer wishes to test the ability of three types of steel-alloy panels to resist corrosion when three different paint types are applied. Three panels with differing steel-alloy composition are coated with three types of paint. The following coded data represent the ability of the painted panels to resist weathering.

PaintType	Steel-Alloy1	Steel-Alloy2	Steel-Alloy3
1	40	51	56
2	54	55	50
3	47	56	50

Use a two-way ANOVA procedure to determine whether any difference in the ability of the panels to resist corrosion may be assigned to either the type of paint or the steel-alloy composition of the panels.

Write a R program for above problem.

3. A motor company wishes to check the influences of tyre type and shock absorber settings on the roadholding of one of its cars. Two types of tyre are selected from the tyre manufacturer who normally provides tyres for the company’s new vehicles. A shock absorber with three possible settings is chosen from a range of shock absorbers deemed to be suitable for the car. An experiment is conducted by conducting roadholding tests using each tyre type and shock absorber setting. The (coded) data resulting from the experiment are given below.

Factor Shock Absorber Setting

Tyre	B1=Comfort	B2=Normal	B3=Sport
	5	8	6
Type A1	6	5	9
	8	3	12
	9	10	12
Type A2	7	9	10
	7	8	9

Using appropriate ANOVA, State clearly all the conclusions that may be drawn.

Write a R program for above problem.