TMC 204
Statistical Data Analysis with R
Unit 5
Graphical Analysis in R

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Introduction to Graphical Analysis:

In this graphical analysis you will learn

- How to create a range of graphs to summarize your data and results
- How to create box whisker plots
- How to create scatter plots, including multiple correlation points
- How to create line graphs
- How to create pie charts
- How to create bar charts
- How to move graphs from R to other programs and save graphs as file on disk

Graphs are the powerful way to present your data and results in understandable form rather than words and numbers.

R has powerful and flexible graphical capabilities

R has two kinds of graphical commands

1.For generating basic plot

2.Tweak the output and produce plot with extra features

BOX-WHISKER PLOTS

It is also called Box Plot and used to visualize complex data where you have multiple samples it is used to display difference between samples.

Basic form of box whisker plot shows the **median** value, the **quartile** and **max** **min** values.You can see outliers as well

boxplot() command is used to create box-whisker plots

Basic Boxplots

In R, boxplot (and whisker plot) is created using the **boxplot()** function.

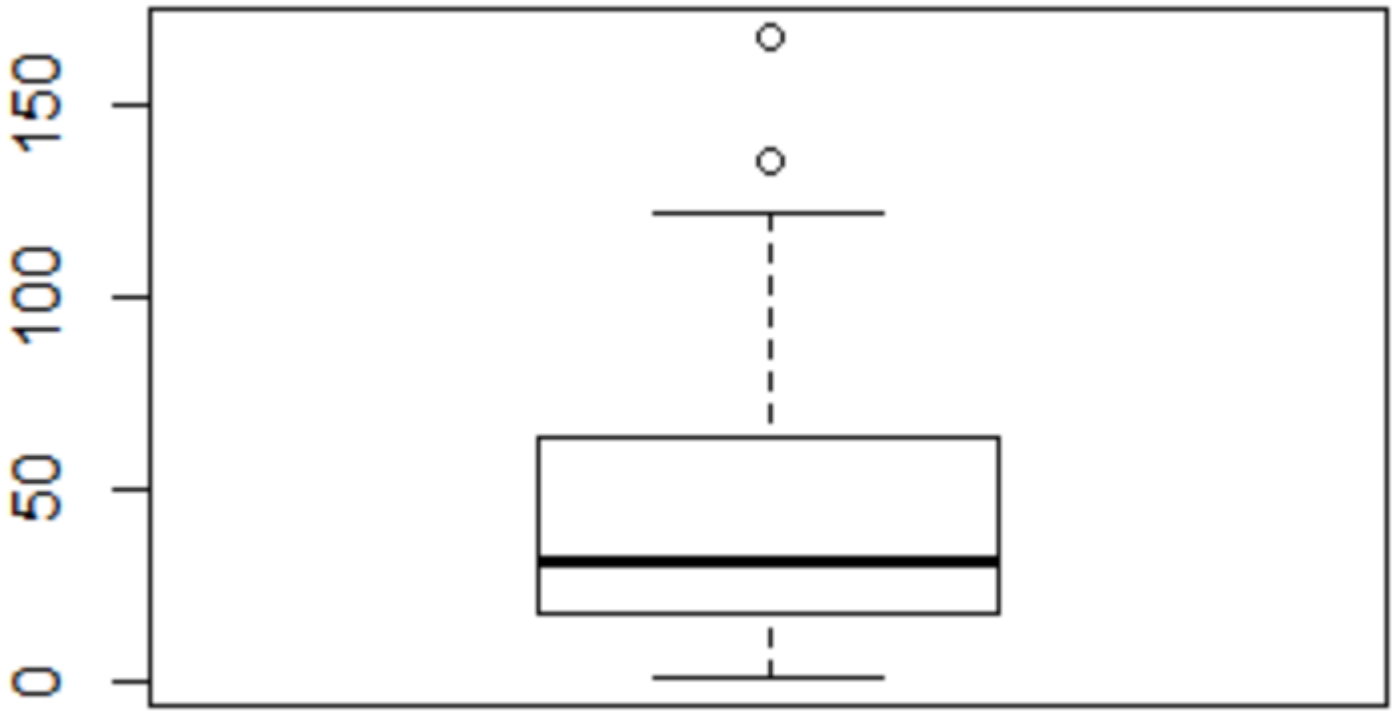
The boxplot() function takes in any number of numeric vectors, drawing a boxplot for each vector.

You can also pass in a list (or data frame) with numeric vectors as its components. Let us use the built-in dataset airquality which has “Daily air quality measurements in New York, May to September 1973.”-R documentation.

```
> str(airquality)
'data.frame':153 obs. of  6 variables:
 $ Ozone  : int  41 36 12 18 NA 28 23 19 8 NA ...
 $ Solar.R: int  190 118 149 313 NA NA 299 99 19 194 ...
 $ Wind   : num  7.4 8 12.6 11.5 14.3 14.9 8.6 13.8 20.1 8.6 ...
 $ Temp   : int  67 72 74 62 56 66 65 59 61 69 ...
 $ Month  : int  5 5 5 5 5 5 5 5 5 5 ...
 $ Day    : int  1 2 3 4 5 6 7 8 9 10 ...
```

Let us make a boxplot for the ozone readings.

> boxplot(airquality$Ozone)




```
summary(airquality$Ozone)
 Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
 1.00   18.00   31.50   42.13   63.25  168.00      37
```

Stripe shows the median, box represents upper and lower hinges , whisker shows the max and min value

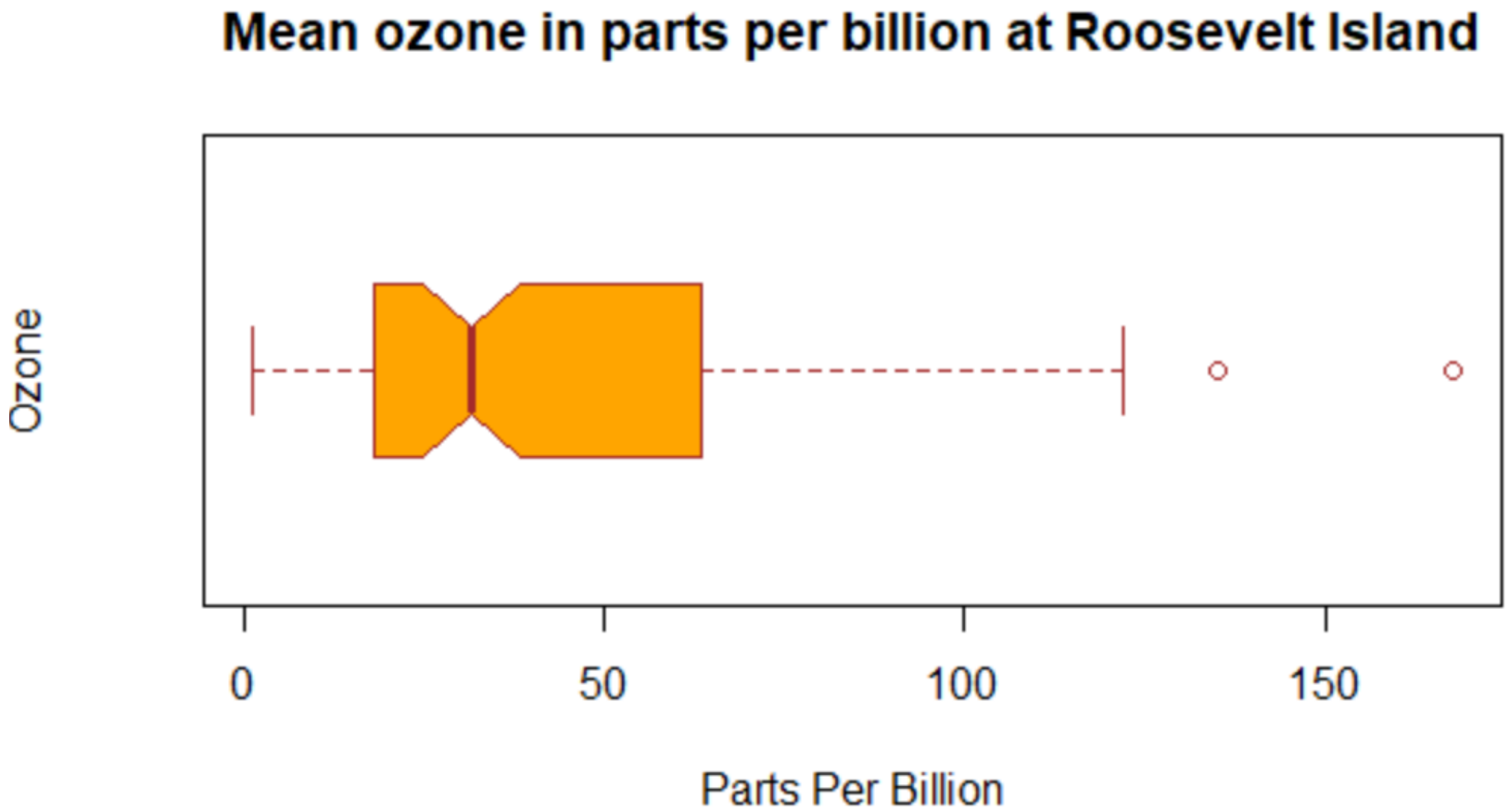
We can see that data above the median is more dispersed. We can also notice two outliers at the higher extreme.

We can pass in additional parameters to control the way our plot looks. You can read about them in the help section ?boxplot.

Some of the frequently used ones are, main-to give the title, xlab and ylab-to provide labels for the axes, col to define color etc.

Additionally, with the argument horizontal = TRUE we can plot it horizontally and with notch = TRUE we can add a notch to the box.

```
boxplot(airquality$Ozone,
main = "Mean ozone in parts per billion at Roosevelt Island",
xlab = "Parts Per Billion",
ylab = "Ozone",
col = "orange",
border = "brown",
horizontal = TRUE,
notch = TRUE
)
```



Return Value of boxplot()

```
> x<-boxplot(airquality$Ozone)
> x
$stats
     [,1]
[1,]   1.0
[2,]  18.0
[3,]  31.5
[4,]  63.5
[5,] 122.0
attr(,"class")
       1
"integer"
```

```
$n
[1] 116
$conf
         [,1]
[1,] 24.82518
[2,] 38.17482
$out
[1] 135 168
$group
[1] 1 1
$names
[1] "1"
```

As we can see above, a list is returned which has stats-having the position of the upper/lower extremes of the whiskers and box along with the median,

n-the number of observation the boxplot is drawn with (notice that NA‘s are not taken into account)
conf-upper/lower extremes of the notch, out-value of the outliers
group-a vector of the same length as out whose elements indicate to which group the outlier belongs and
names-a vector of names for the groups.

Multiple Boxplots

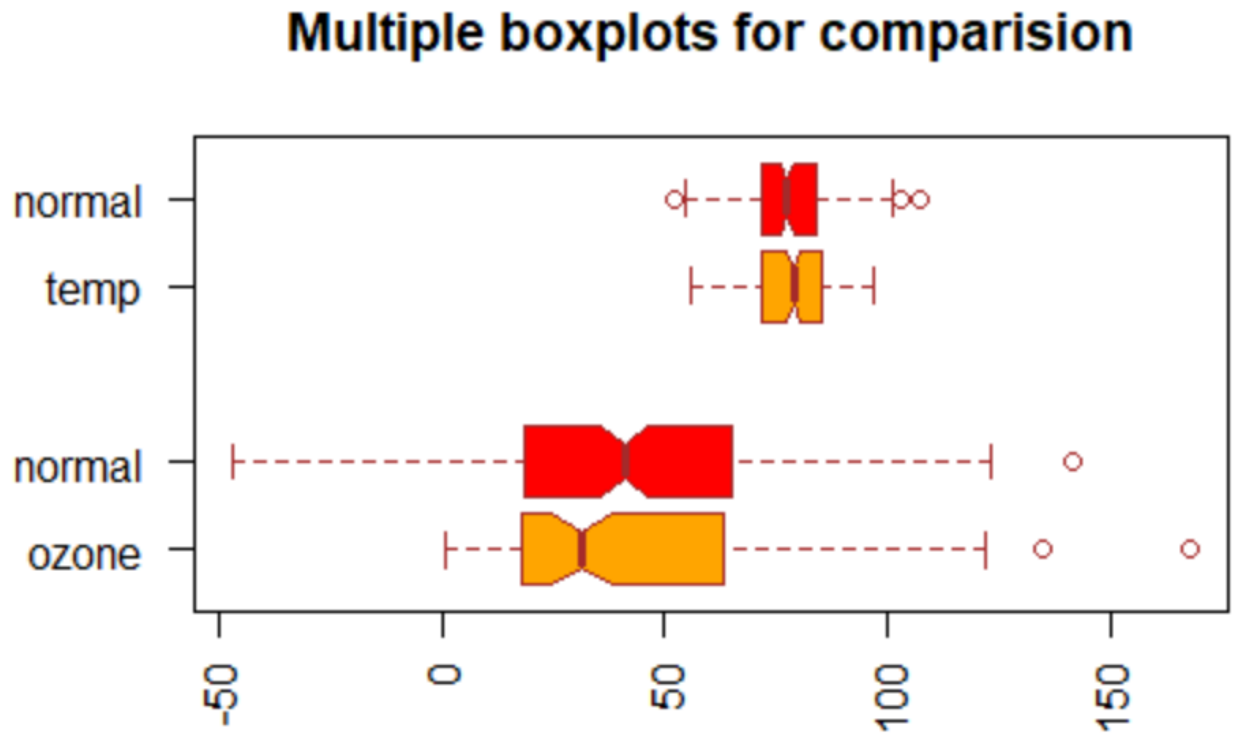
We can draw multiple boxplots in a single plot, by passing in a list, data frame or multiple vectors.

Let us consider the Ozone and Temp field of airquality dataset. Let us also generate normal distribution with the same mean and standard deviation and plot them side by side for comparison.

```
# prepare the data

ozone <- airquality$Ozone

temp <- airquality$Temp

# gererate normal distribution with same mean and sd

ozone_norm <- rnorm(200,mean=mean(ozone, na.rm=TRUE), sd=sd(ozone, na.rm=TRUE))

temp_norm <- rnorm(200,mean=mean(temp, na.rm=TRUE), sd=sd(temp, na.rm=TRUE))
```

Now we us make 4 boxplots with this data. We use the arguments at and names to denote the place and label.

```
boxplot(ozone, ozone_norm, temp, temp_norm,
        main = "Multiple boxplots for comparision",
        at = c(1,2,4,5),
        names = c("ozone", "normal", "temp", "normal"),
        las = 2,
        col = c("orange","red"),
        border = "brown",
        horizontal = TRUE,
        notch = TRUE
)
```

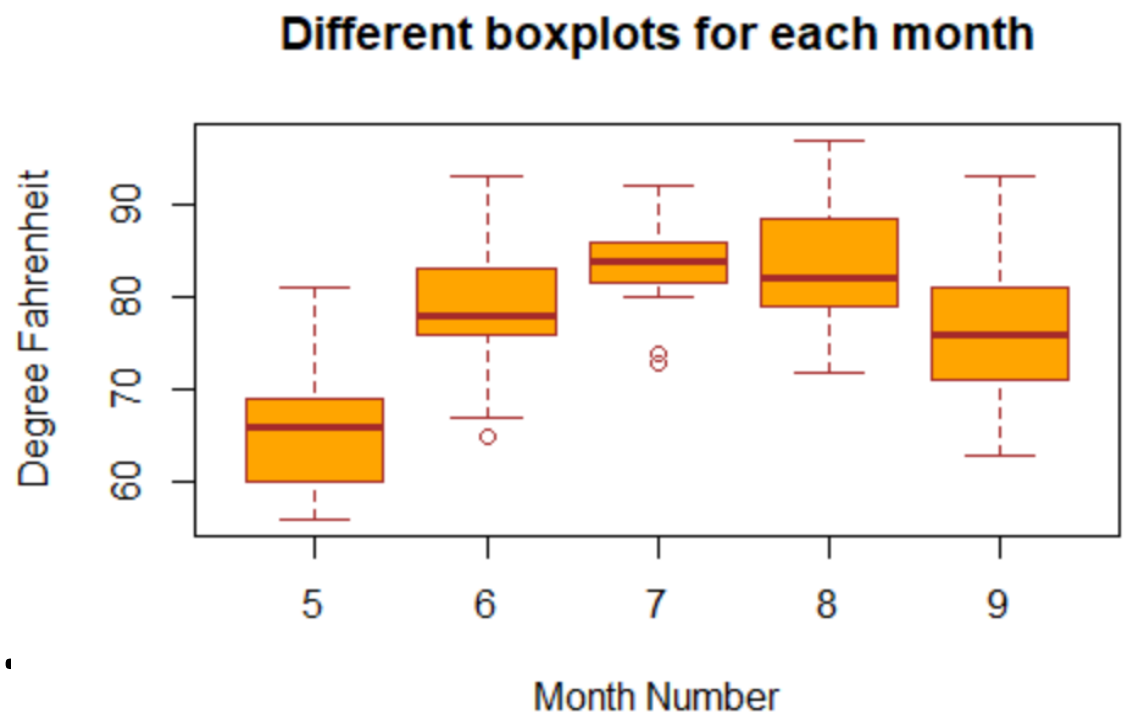


Boxplot form Formula

The function boxplot() can also take in formulas of the form y~x where, y is a numeric vector which is grouped according to the value of x.

For example, in our dataset airquality, the Temp can be our numeric vector. Month can be our grouping variable, so that we get the boxplot for each month separately. In our dataset, month is in the form of number (1=January, 2-Febuary and so on).

```
boxplot(Temp~Month,
        data=airquality,
        main="Different boxplots for each month",
        xlab="Month Number",
        ylab="Degree Fahrenheit",
        col="orange",
        border="brown"
)
```



It is clear from the above figure that the month number 7 (July) is relatively hotter than the rest.