AUA CS108, Statistics, Fall 2020

Lecture 11

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Contents

BoxPlot, Example

Hovhannes's Problem: Assume 50% of our data is 0, 25% is -1 and 25% is 1. Are all -1's and 1's Outliers?

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```
fivenum
```

```
## function (x, na.rm = TRUE)
## {
##     xna <- is.na(x)
##     if (any(xna)) {
##         if (na.rm)
##             x <- x[!xna]
##         else return(rep.int(NA, 5))
##     }
##     x <- sort(x)
##     n <- length(x)
##     if (n == 0)
##         rep.int(NA, 5)
##     else {
##         n4 <- floor((n + 3)/2)/2
##         d <- c(1, n4, (n + 1)/2, n + 1 - n4, n)
##         0.5 * (x[floor(d)] + x[ceiling(d)])
##     }
## }
## <bytecode: 0x0000000007eeac68>
## <environment: namespace:stats>
```

BoxPlot, Common Errors

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And an important

Note: always keep the scale on the x-axis! Place the numbers in correct places, keep the distance between numbers.

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See, for Example, this page.

Boxplot, Why we use it

We use BoxPlots to:

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Boxplot, Why we use it

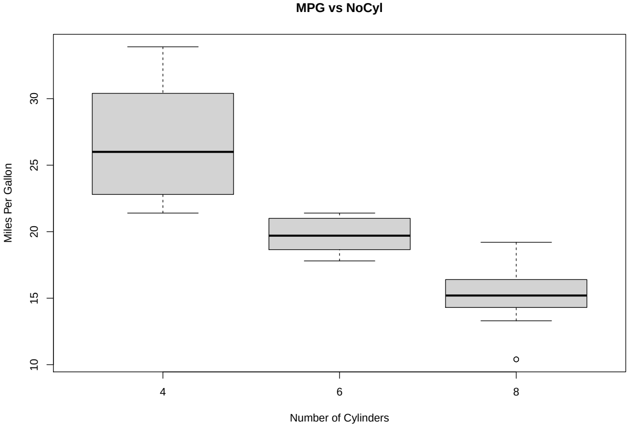
We use BoxPlots to:

- Visualize the distribution of the Dataset
- To compare two or more Datasets

Example

Here we use the `mtcars` Dataset:

```
boxplot( mpg~cyl, data=mtcars, main="MPG vs NoCyl",
   xlab="Number of Cylinders", ylab="Miles Per Gallon")
```

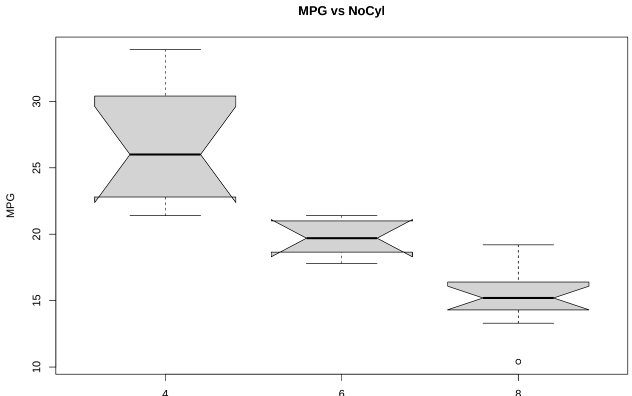


Example

Again,

```
boxplot( mpg~cyl, data=mtcars, notch = T,
         main="MPG vs NoCyl", xlab="Number of Cylinders", y
```

```
## Warning in bxp(list(stats = structure(c(21.4, 22.8, 26,
## notches went outside hinges ('box'): maybe set notch=FAI
```



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This is an Exploratory Analysis for the Kangaroo, Meghu and Russian Bear Cub contests results in Armenia and Artsakh. The Shiny app (created by **R**), is here: link.

BoxPlot, Notes

Note: Recall that an **Outlier** in the BoxPlot sense is a Datapoint x_k with

$$x_k \notin \left[Q_1 - \frac{3}{2} IQR,\ Q_3 + \frac{3}{2} IQR \right].$$

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$$\mathbb{P}(X \in [Q_1 - 1.5 \cdot IQR, Q_3 + 1.5 \cdot IQR]) \approx 0.993,$$

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so the chances that an Observation will be outside of this interval are very small. So if we see that kind of Observation, we think that this number is an Outlier.

BoxPlot, Notes

Note: Sometimes, BoxPlot's Whiskers span to the Max and Min Datapoints, so in this case BoxPlot doesn't show Outliers.