Statistical Computing with R
Masters in Data Science 503 (S11)
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Review Preview

- Basic graphics/plots:
  - Bar chart
  - Histogram
  - Q-Q plot
  - Density plot

Basic graphics/plots:

- Pie chart
- Line chart
- Scatterplot
- Boxplot etc.

Graphs/Plots in R:

- Base R: “graphics” & “grDevices” packages, loads automatically, we need to learn it in this course

- “lattice” package # we need to install it to use it, not covered in this course

- **“ggplot2” package #we need to install it to use it in this course**

- **GG = Grammar of Graphics**

Basic plots: Bar Diagram (s)

- It is used to represent the distribution of categorical variable graphically

- It can be:
  - Simple
  - Sub-divided/stacked
  - Multiple/Grouped

Bar diagram in R: base “graphics” packages Type: ?barplot to see the full syntax

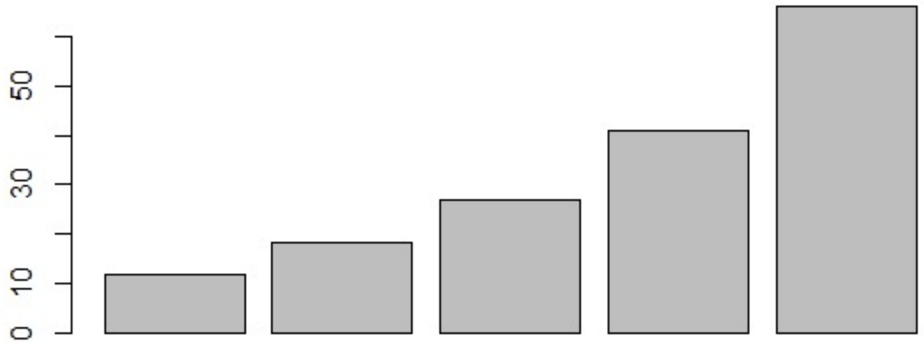
- We can use the R’s built-in dataset: VADeaths

- gd <- as.data.frame(VADeaths)
- View(gd) #You may need to transform your raw data like this one using chapter 5 of your text book!

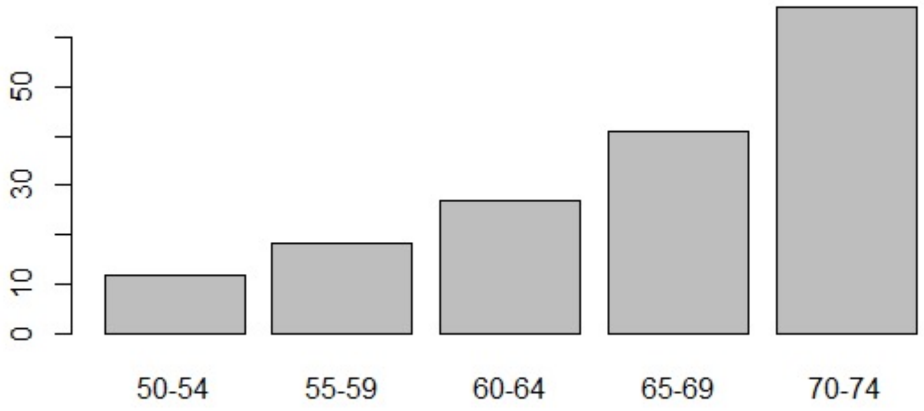
- barplot(gd$`Rural Male`)

- barplot(gd$`Rural Male`, names.arg = c("50-54", "55-59", "60-64", "65-69", "70-74"))

Outputs:



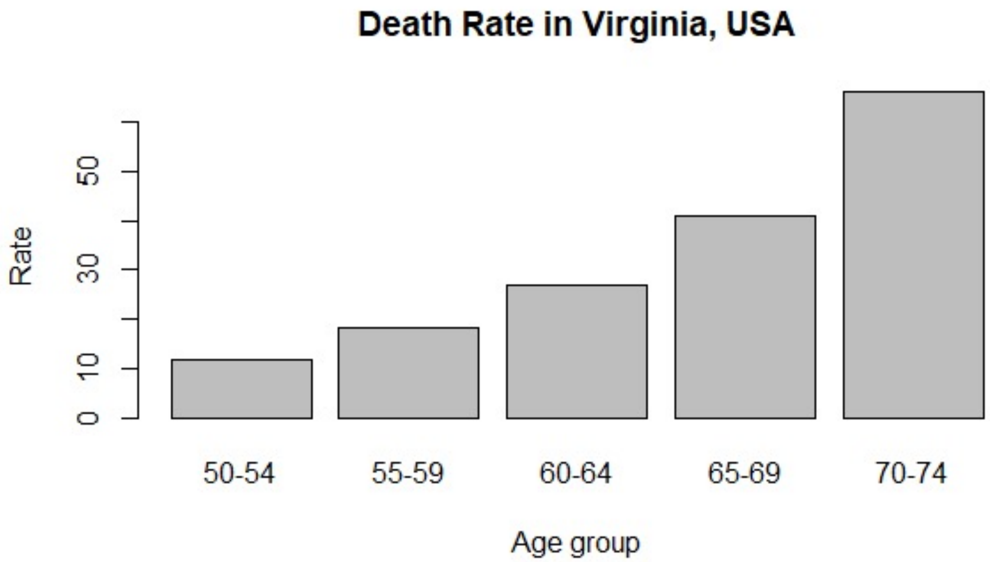
barplot(gd$`Rural Male`)



barplot(gd$`Rural Male`, names.arg = c("50-54", "55-59", "60-64", "65-69", "70-74"))

Adding title and labels for x & y axis:

```
barplot(gd$`Rural Male`,
names.arg = c("50-54", "55-59",
"60-64", "65-69", "70-74"),
main = "Death Rate in Virginia,
USA", xlab = "Age group", ylab =
"Rate")
```

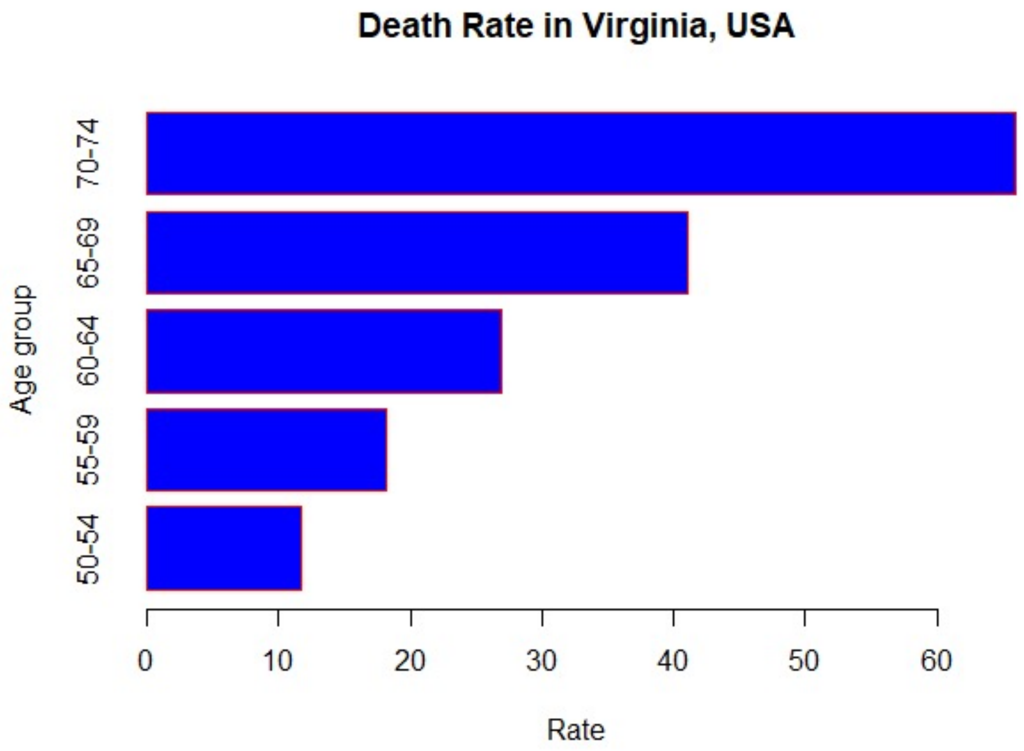


Changing orientation and adding colors:

barplot(gd$`Rural Male`, **horiz = T**, names.arg = c("50-54", "55-59", "60-64", "65-69", "70-74"),

main = "Death Rate in Virginia, USA", **xlab = "Rate", ylab = "Age group"**,

col = “blue", border = “red")



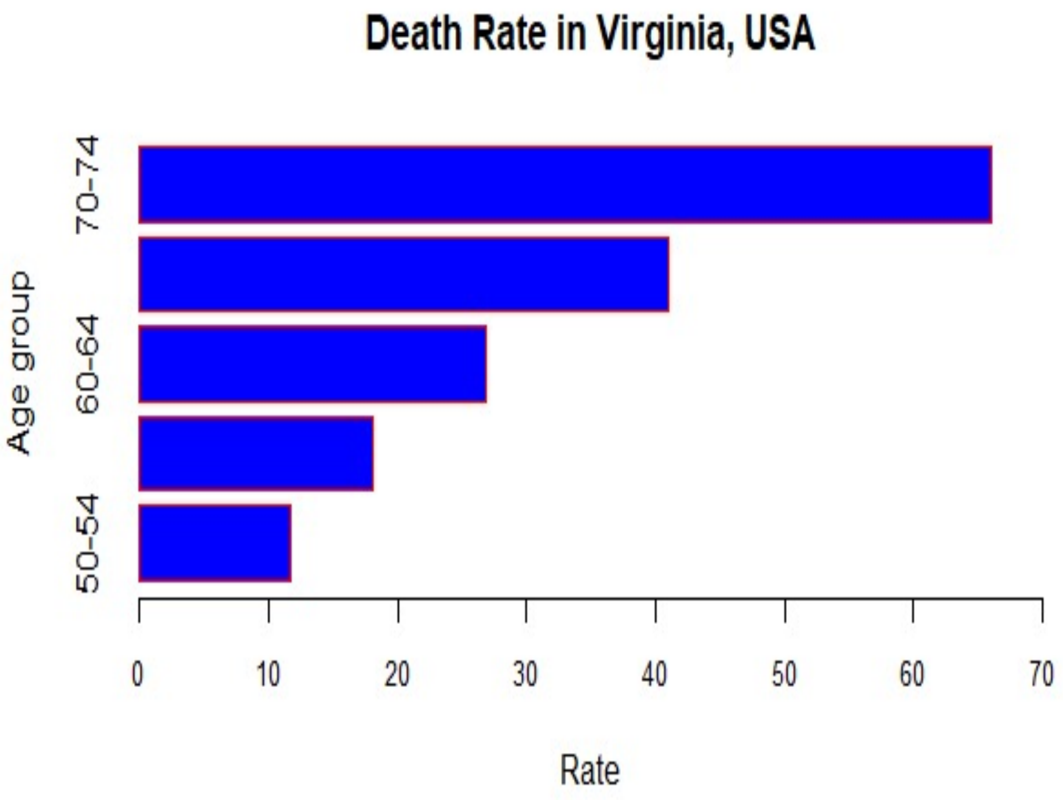
Changing axis length and font size:

- barplot(gd$`Rural Male`, horiz = T, names.arg = c("50-54", "55-59", "60-64", "65-69", "70-74"),

main = "Death Rate in Virginia, USA", xlab = "Rate", ylab = "Age group",

col = "blue", border = "red",

xlim = c(0,70), cex.axis = 0.80)



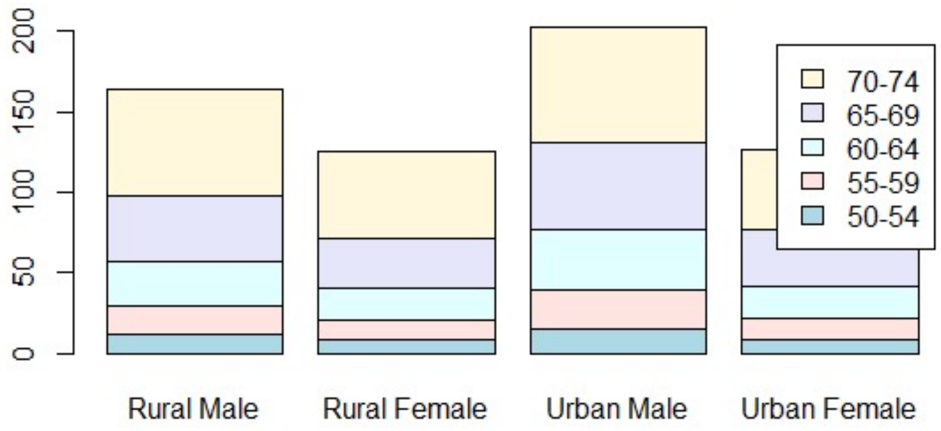
Sub-divided/Staked Bar diagram:

```
barplot(gd,
        col = c("lightblue", "mistyrose", "lightcyan",
                "lavender", "cornsilk"),
        legend = rownames(VADeaths))
```

- Error in barplot.default(gd, col = c("lightblue", "mistyrose", "lightcyan", :
- 'height' must be a vector or a matrix

Sub-divided/Staked Bar diagram:

```
gdm <- as.matrix(gd)
barplot(gdm,
        col = c("lightblue",
"mistyrose", "lightcyan",
                "lavender", "cornsilk"),
        legend = rownames(gd))
```



Note: The gdm is a matrix!

Sub-divided bar diagram with placement, size and box of the legend:

- **# Define a set of colors**

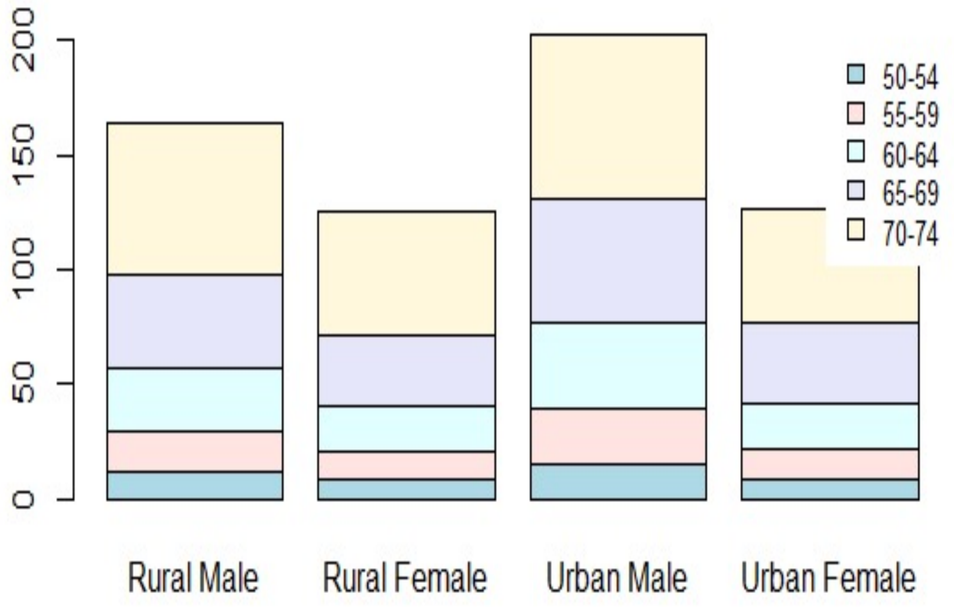
```
my_colors <- c("lightblue",
"mistyrose", "lightcyan",
             "lavender", "cornsilk")
```

- **# Bar plot**

```
barplot(gdm, col = my_colors)
```

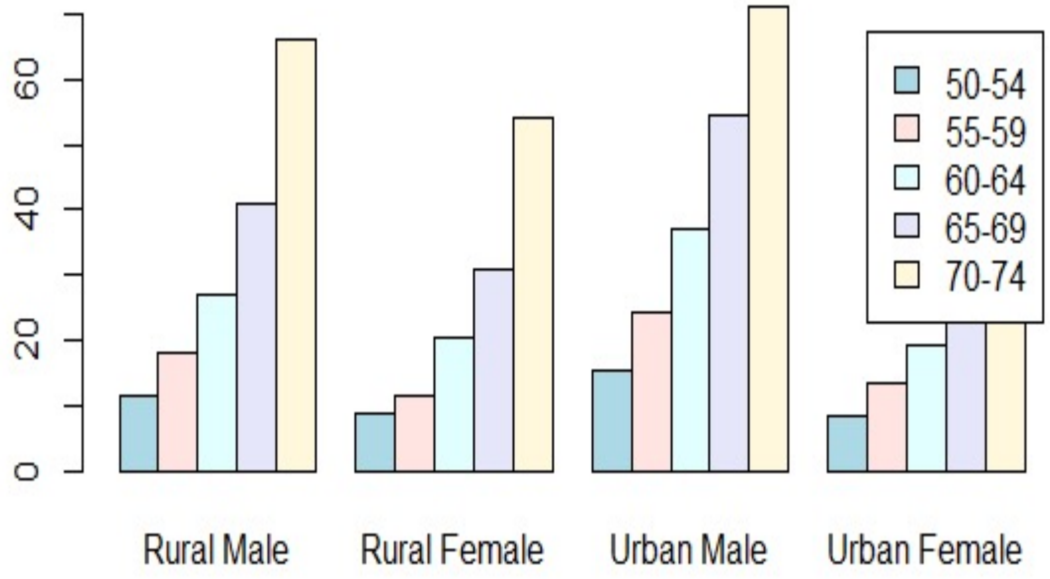
# Add legend

```
legend("topleft", legend =
rownames(gdm),
fill = my_colors, box.lty = 0, cex = 0.8)
```



Multiple/Grouped Bar Diagram:

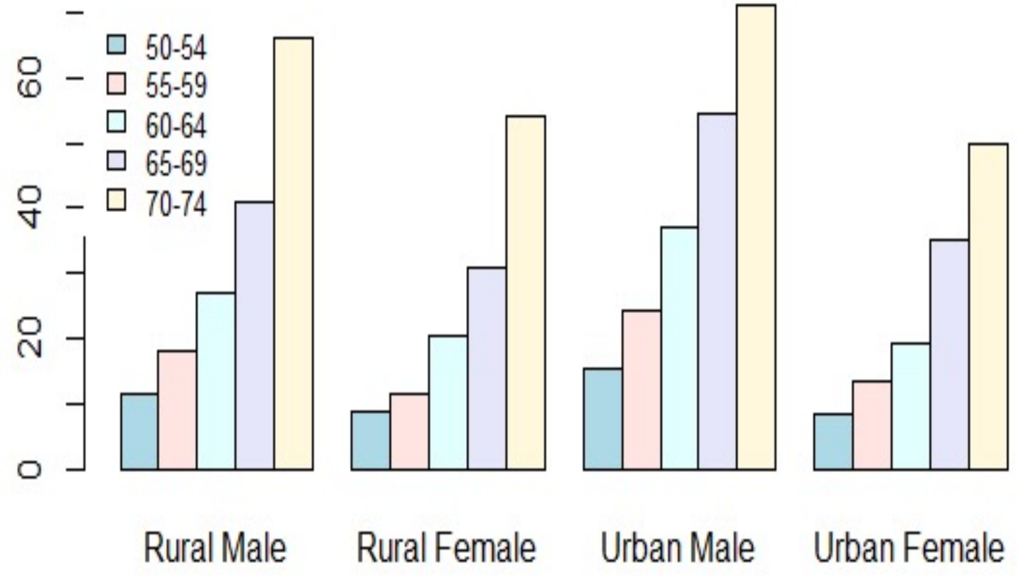
```
• barplot(gdm,
        col = c("lightblue",
"mistyrose", "lightcyan",
                "lavender", "cornsilk"),
        legend = rownames(gdm),
beside = T)
```



Note: Adding beside – TRUE will produce the multiple bar chart!

Multiple/Group Bar Diagram with change in legend values:

```r
# Define a set of colors
my_colors <- c("lightblue", "mistyrose", "lightcyan", "lavender", "cornsilk")
# Bar plot
barplot(gdm, col = my_colors, beside = TRUE)
# Add legend
legend("topleft", legend = rownames(gdm), fill = my_colors, box.lty = 0, cex = 0.8)
```



Histogram, Q-Q and Density plots:

- This is use to represent “**continuous**” variable graphically

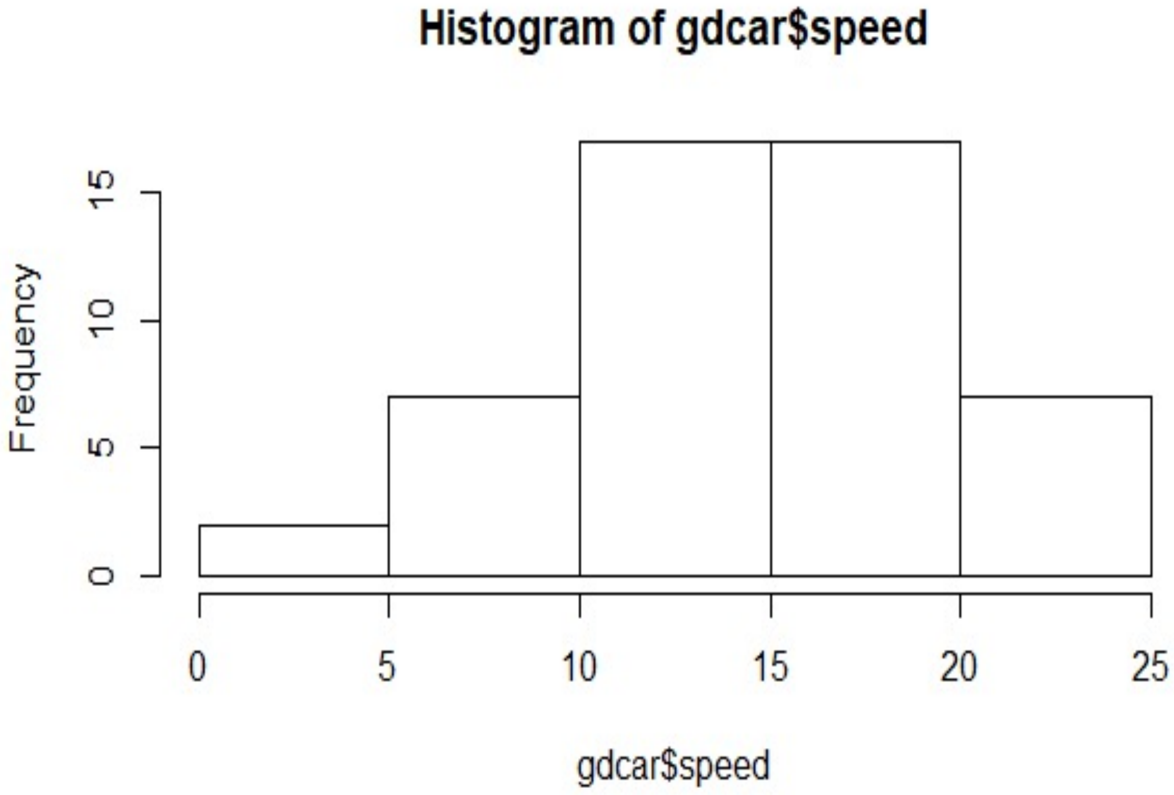
- Histogram is created after converting the continuous data into class intervals, which R calls “breaks”

- Histogram is based on the “density” rather than frequencies

- Histogram, Q-Q plot and density plots are effective to check the “distribution” of the data, which in turn provides cues to use correct descriptive statistics and tests!

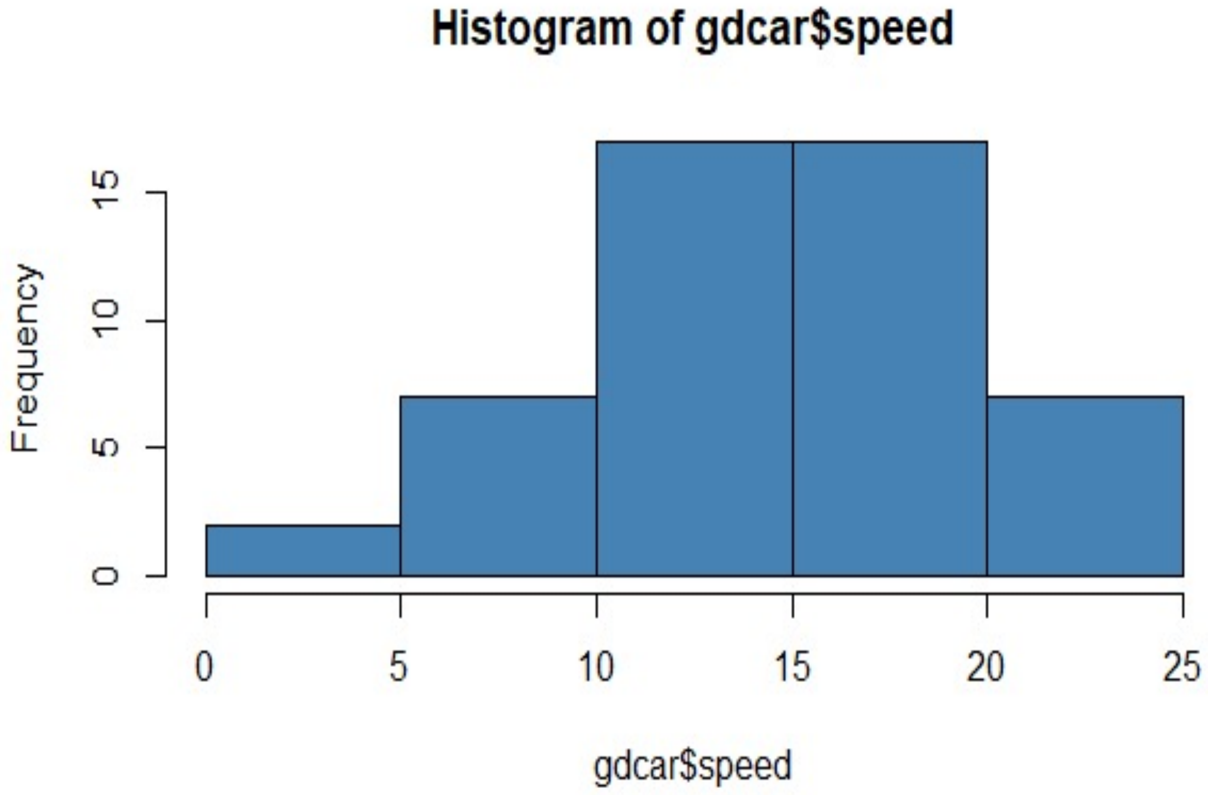
Histogram using built-in “cars” data:

- gdcar <- as.data.frame(cars)
- hist(gdcar$speed)



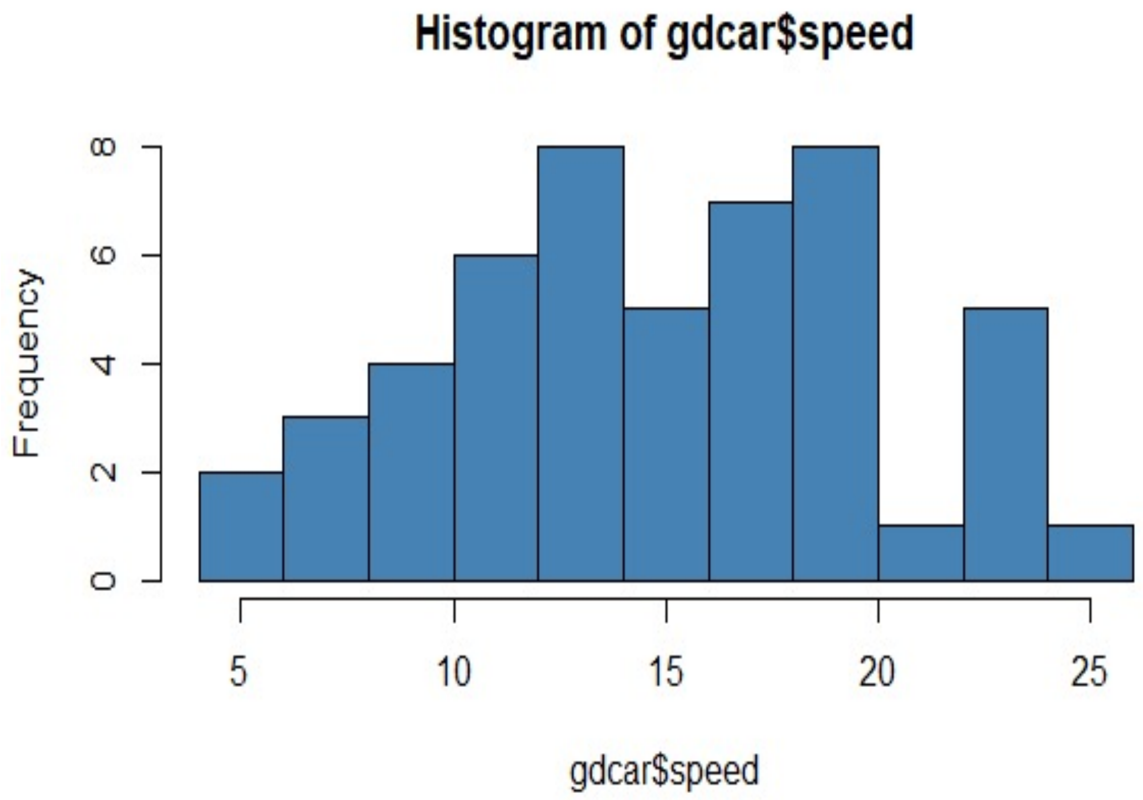
Histogram using built-in “cars” data:

- gdcar <- as.data.frame(cars)
- hist(gdcar$speed, col = "steelblue")



Histogram using built-in “cars” data:

- gdcar <- as.data.frame(cars)
- hist(gdcar$speed, col = "steelblue", breaks = 10)

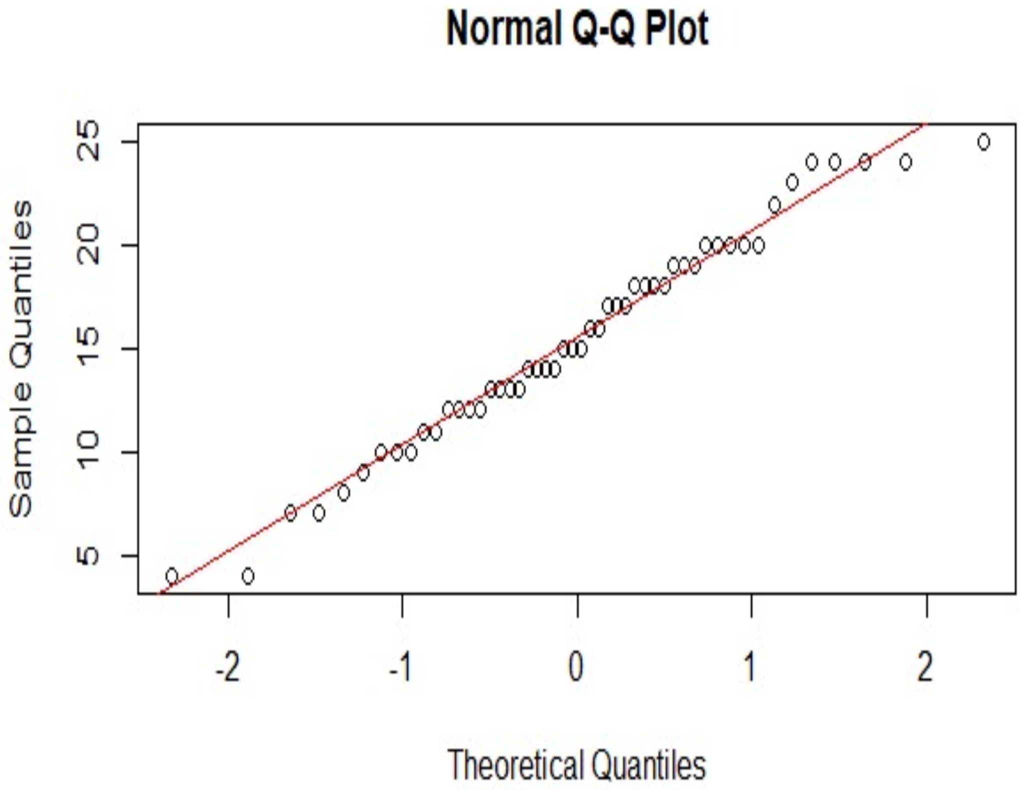


- Is there any rule on how many “breaks” should be used in a histogram?
- **How to change title and x-axis label in this diagram?**

Q-Q plot with Q-Q line: Always use this plot to assess normality!

- #Q-Q plot
- qqnorm(gdcars$speed)
- #Q-Q line
- qqline(gdcars$speed, col="red")

- Note: The observed values do not lie in the theoretical normal distribution quintiles. It can be considered as “robust” though!



Density plot (freq. polygon): Speed variable
This is better than histogram!

#Density plot using cars dataset

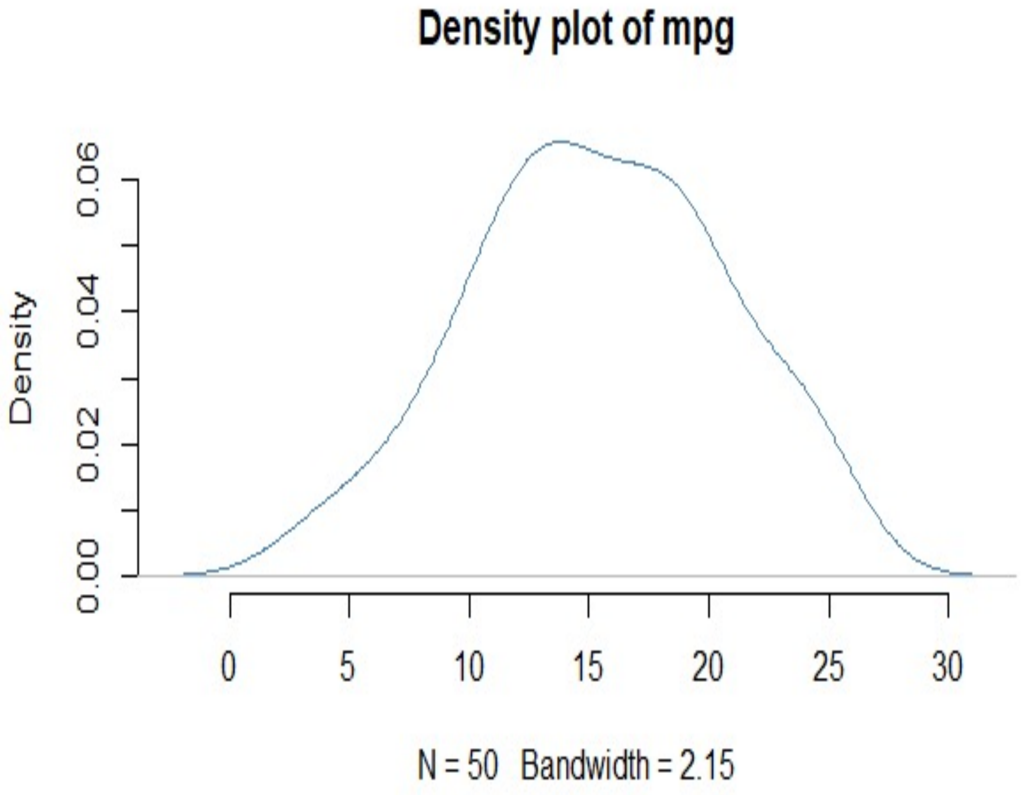
# Compute the density data

- dens <- density(cars$speed)

What is the density?

# plot density

- plot(dens, frame = FALSE, col = "steelblue", main = "Density plot of mpg")



Density plot with polygon fill: Speed variable

#Density plot using cars dataset

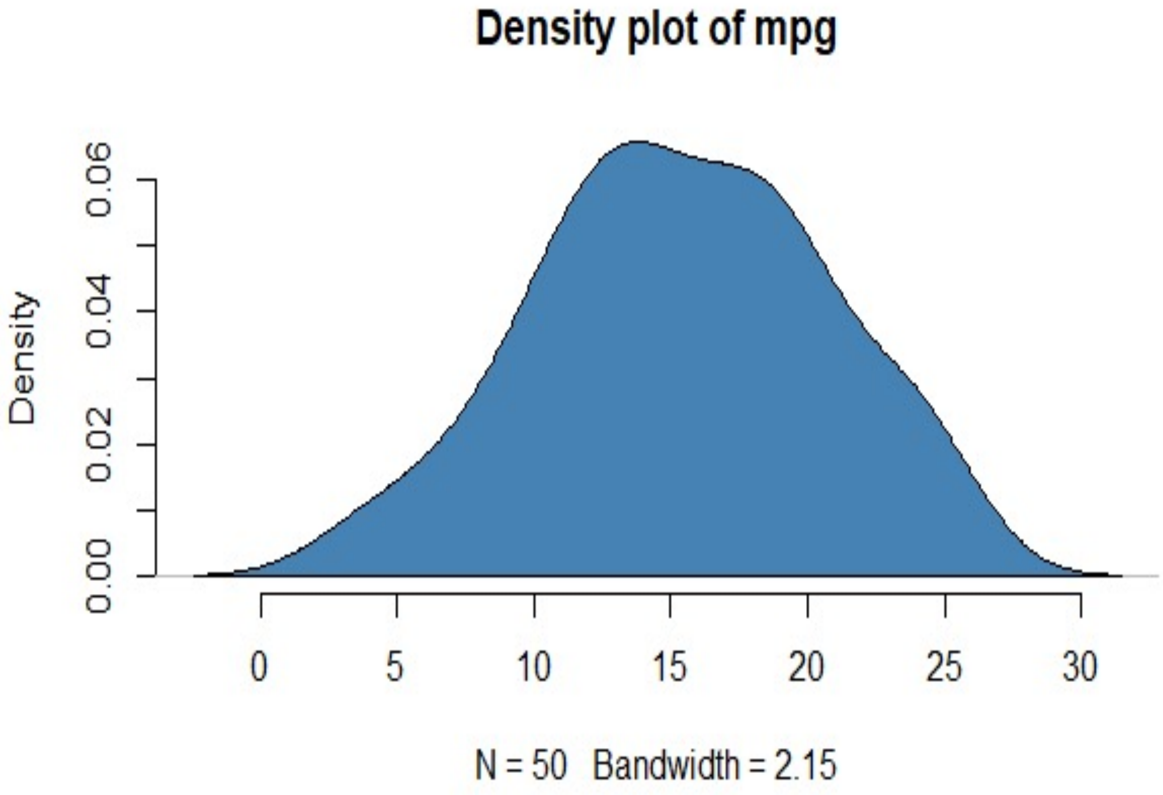
# Compute the density data

- dens <- density(cars$speed)

# plot density

- plot(dens, frame = FALSE, col = "steelblue", main = "Density plot of mpg")

polygon(dens, col = "steelblue")

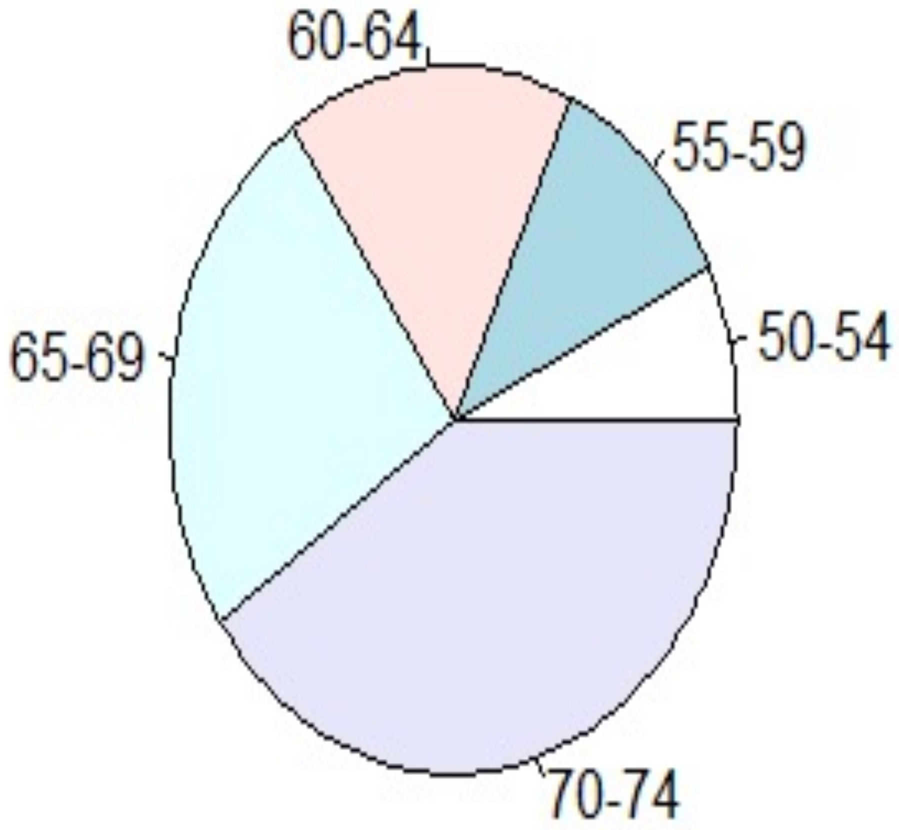


Pie chart:

- It is used to represent “categorical” variable in a circular diagram
- Sometime pie chart is more meaningful than the bar diagram for the categorical variable
- We can create Pie chart using “pie” command in R
- We can change the color of the Pie chart sections

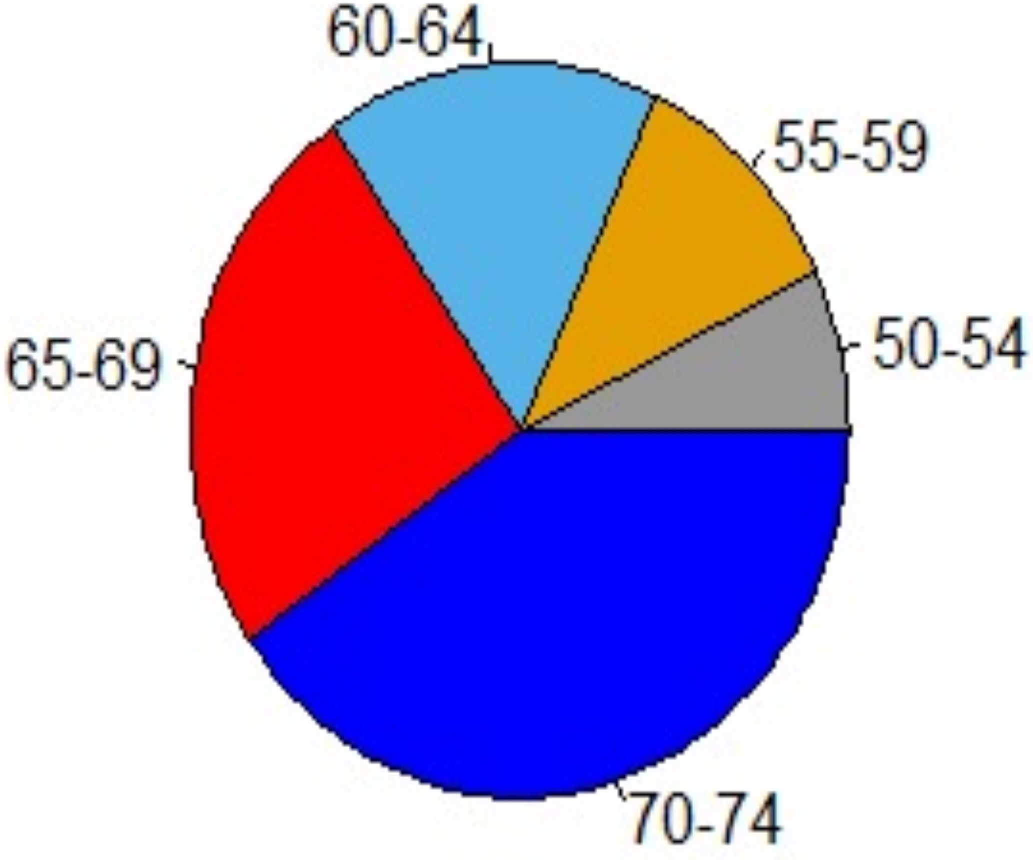
Pie chart: In-built “VADeaths” data

- gd <- as.data.frame(VADeaths)
- pie(gd$`Rural Male`, labels = rownames(gd), radius = 1)



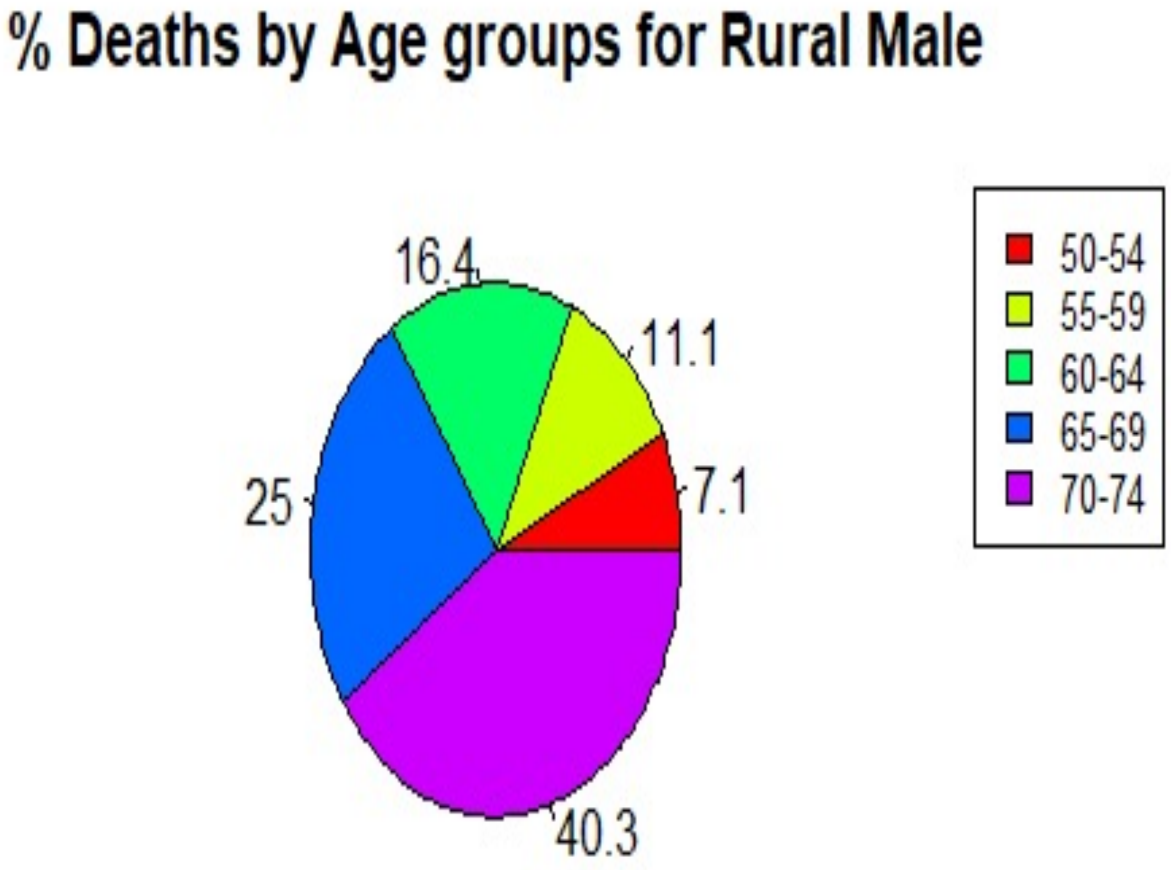
Pie chart: Changing colors

- gd <- as.data.frame(VADeaths)
- pie(gd$`Rural Male`, labels = rownames(gd), radius = 1, col = c(“#999999”, “#E69F00”, “#56B4E9”, “red”, “blue”)
- **How to show value or % inside the Pie chart slices?**
- **How to place a legend on the “topright” of this graph?**



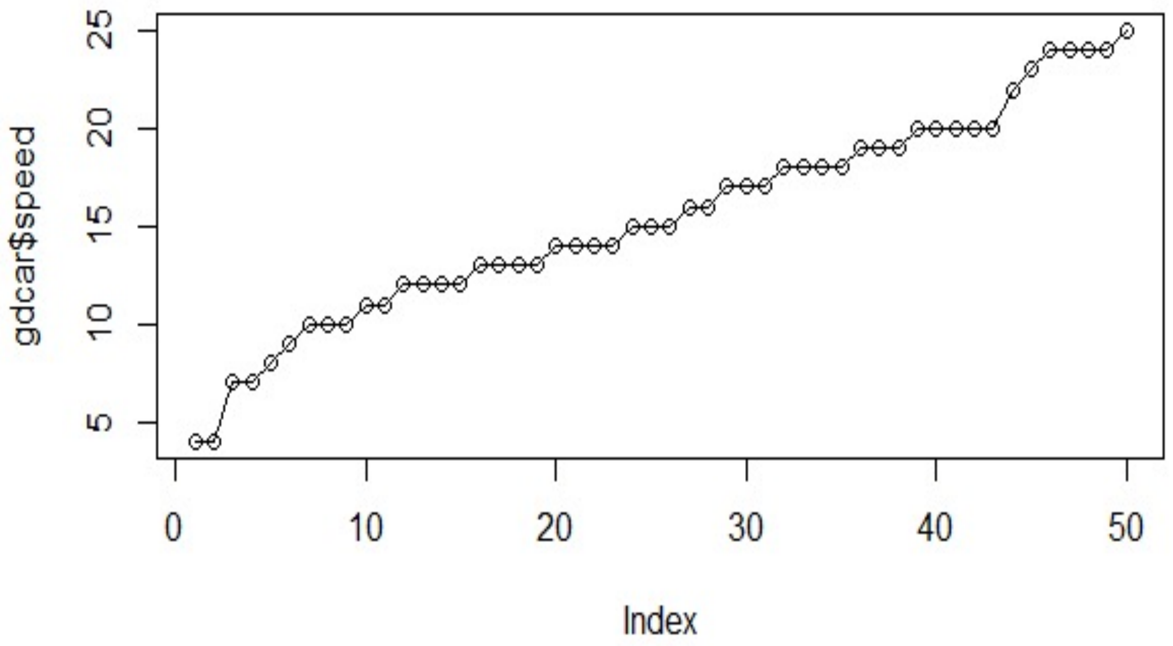
Pie chart with

```
#Adding % and legend
gd$piepercent<- round(100*gd$`Rural Male`/sum(gd$`Rural Male`), 1)
#Pie chart
pie(gd$`Rural Male`, labels = gd$piepercent, main = "% Deaths by Age groups for Rural Male",col = rainbow(length(gd$`Rural Male`)))
legend("topright", c("50-54","55-59","60-64","65-69", "70-74"), cex = 0.8, fill = rainbow(length(gd$`Rural Male`)))
```



Line chart: We have already discussed it! Can you interpret this graph? If not its GIGO!

- **Useful for time series data**
- plot(gdcars$speed)
- plot(gdcars$speed, type = “o”)
- Here R automatically created an index variable for x-axis starting from 1 and ending in 50!

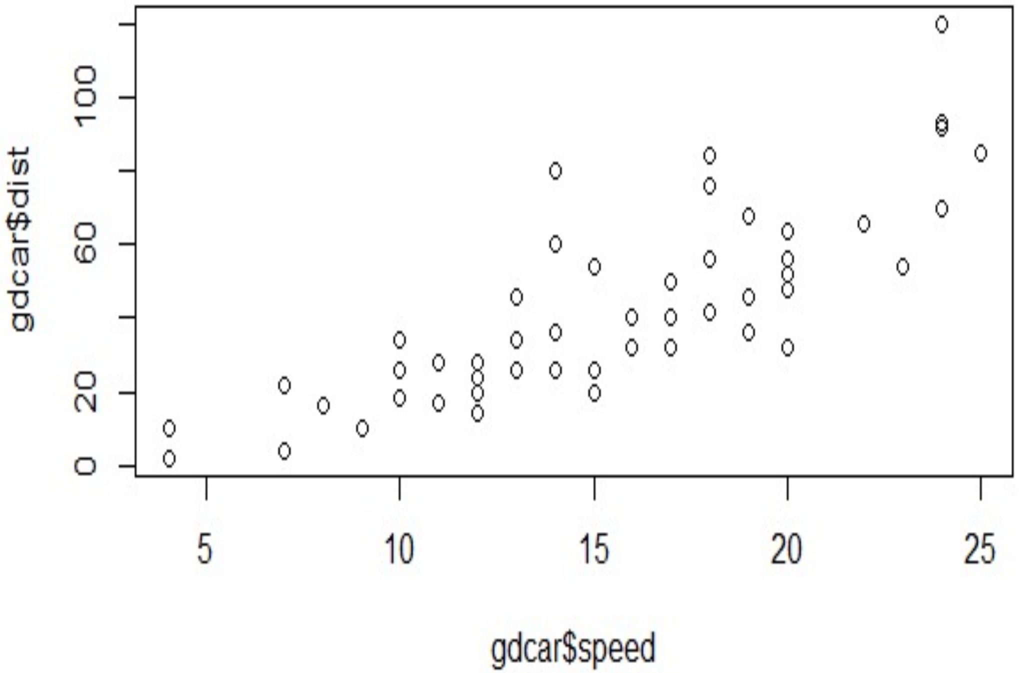


Scatterplot: We have already discussed it!

- plot(gdcar$speed, gdcar$dist)

- How to add title?
- How to change x-axis label?
- How to change y-axis label?

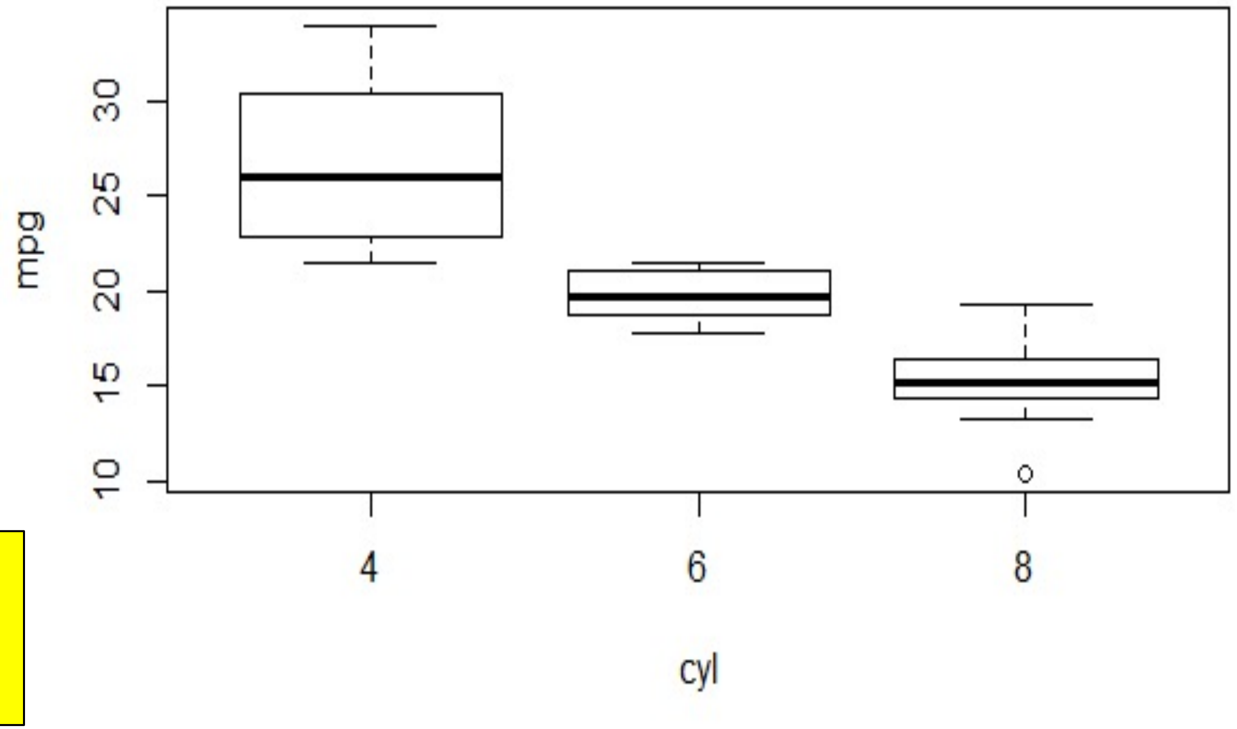
- **Which correlation coefficient is appropriate here?**



Boxplot: We have already discussed it!

- boxplot(mpg ~ cyl, data = mtcars)

- boxplot(mpg ~ gear, data = mtcars, xlab = "Number of cylinders, ylab = "Miles Per Gallon", main "Mileage Data"



Which statistical test or model must be used to confirm the differences in "mpg" by "cyl" variable?

Question/Queries?

Thank you!

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