R Visualizing Data

Fall 2016

mtcars Data Frame

- R has a built-in data frame called mtcars
- Useful R functions
  - length(object) # number of variables
  - str(object)   # structure of an object
  - class(object) # class or type of an object
  - names(object) # names
  - dim(object) # number of observations and variables
- In the console, call each function using mtcars as the object

mtcars Data Frame

The data was extracted from the 1974 *Motor Trend* US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973–74 models).

[1]	mpg	Miles/(US) gallon
[2]	cyl	Number of cylinders
[3]	disp	Displacement (cu.in.)
[4]	hp	Gross horsepower
[5]	drat	Rear axle ratio
[6]	wt	Weight (1000 lbs)
[7]	qsec	1/4 mile time
[8]	vs	V/S
[9]	am	Transmission (0 = automatic, 1 = manual)
[10]	gear	Number of forward gears
[11]	carb	Number of carburetors

Recoding Variables

- Copy mtcars to tempMtcars to protect mtcars data

  ```
  > tempMtcars = mtcars
  ```

- Recode am variable as amCategorical

  ```
  > tempMtcars$amCategorical = as.factor (mtcars$am)
  ```

- Results

  ```
  > str(tempMtcars)
  $ amCategorical: Factor w/ 2 levels "0","1": 2 2 2 1 1 1 1 1 1 …
  ```

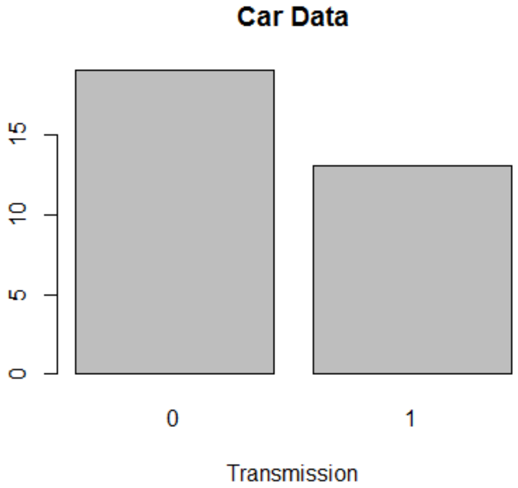
- Remember that qualitative data is treated differently than quantitative data

Bar Chart

http://statmethods.net/graphs/bar.html

- A **bar chart** or **bar graph** is a chart that presents grouped data with rectangular bars with lengths proportional to the values that they represent.
- function table returns a vector of frequency data

```
> barplot(table(tempMtcars$amCategorical
main = "Car Data",
xlab = "Transmission")
```



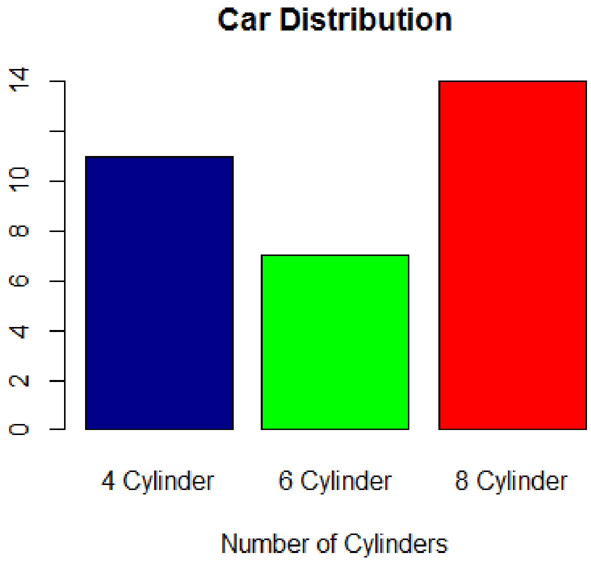
Recoding Variables

- Create a new variable mpgClass where mpg<=25 is “low”, mpg>25 is “high”

```
> tempMtcars$mpgClass[tempMtcars$mpg <= 25] = "low"
> tempMtcars$mpgClass[tempMtcars$mpg > 25] = "high"
> tempMtcars$mpgClass
[1] "low" "low" "low" "low" "low" "low" "low" "low"
[9] "low" "low" "low" "low" "low" "low" "low" "low"
[17] "low" "high" "high" "high" "low" "low" "low“ "low"
[25] "low" "high" "high" "high" "low" "low" "low" "low“
> typeof(tempMtcars$mpgClass)
[1] "character"
```

Bar Chart

```
> barplot (table(mtcars$cyl),
main = "Car Distribution",
xlab = "Number of Cylinders",
col = c("darkblue", "green", "red"),
names.arg = c("4 Cylinder", "6 Cylinder", "8 Cylinder"))
```

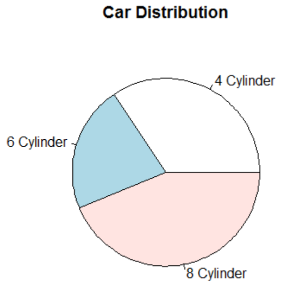


Pie Chart

http://statmethods.net/graphs/pie.html

- A pie chart is a circular graphical representation of data that illustrates a numerical proportion
- A pie chart gives a better visualization of the frequency of occurrence as a percent

```
> pie(table (mtcars$cyl),
labels = c("4 Cylinder", "6 Cylinder", "8 Cylinder"),
main="Car Distribution")
```



Problem

- For the given CS100 class information, create a data frame, cs100DataFrame.R that displays pie and bar chart representations of the Year data properly labeled.

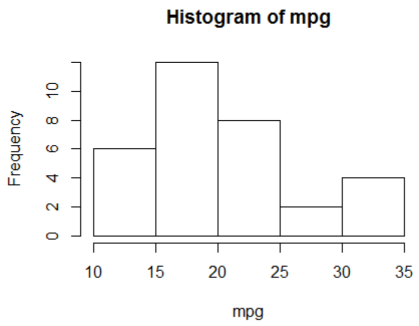
ID	Year	Age
0001	FR	18
0002	FR	18
0003	SR	22
0004	JR	22
0005	SO	19
0006	FR	19
0007	SR	23
0008	SO	19
0009	SR	22

Histogram

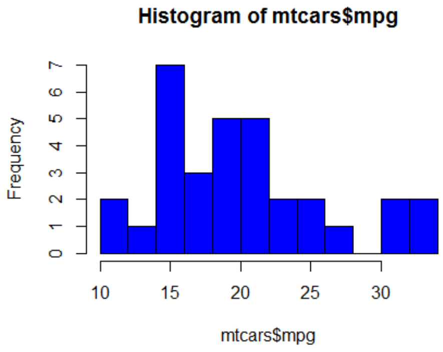
http://statmethods.net/graphs/density.html

- A histogram is a graphical representation of the distribution of numerical data
- Bin – are adjacent intervals usually of equal size
- Notice: breaks <> number of bins

```
>hist (mtcars$mpg)
```



```
> hist (mtcars$mpg, breaks=10, col="blue")
```



Boxplots

http://statmethods.net/graphs/boxplot.html

- A boxplot is a way of graphically showing numerical data through quartiles
- A box-and-whisker plot is a boxplot that shows variability outside the upper and lower quartiles
- Quartile – the three points that divide the ranked data values into 4 equal groups

Quartile Definitions

https://en.wikipedia.org/wiki/Quartile

- **first quartile** (designated Q_1) also called the **lower quartile** or the **25th percentile** (splits off the lowest 25% of data from the highest 75%)
- **second quartile** (designated Q_2) also called the **median** or the **50th percentile** (cuts data set in half)
- **third quartile** (designated Q_3) also called the **upper quartile** or the **75th percentile** (splits off the highest 25% of data from the lowest 75%)
- **interquartile range** (designated IQR) is the difference between the upper and lower quartiles. ($IQR = Q_3 - Q_1$)

Quartile

https://www.mathsisfun.com/data/quartiles.html

- No universal agreement on computing quartile values.
- We will use the TI-83 method

1. Use the median to divide the ordered data set into two halves.
   - If there are an odd number of data points in the original ordered data set, do not include the median (the central value in the ordered list) in either half.
   - If there are an even number of data points in the original ordered data set, split this data set exactly in half.
2. The lower quartile value is the median of the lower half of the data. The upper quartile value is the median of the upper half of the data.

Problem

- Find Q1, Q2, Q3, and IQR for: 6, 7, 15, 36, 39, 40, 41, 42, 43, 47, 49 by hand

- Find Q1, Q2, Q3, and IQR for: 7, 15, 36, 39, 40, 41 by hand

Problem Continued

- Using R, show the box-and-whisker plot for each of the previous data values.

Paint Problem

- Let’s put everything together
- A paint manufacturer tested two experimental brands of paint over a period of months to determine how long they would last without fading. Here are the results:

BrandA	**BrandB**	Report on the following
10	25	-Mean
20	35	-Median
60	40	-Mode
40	45	-Std Deviation
50	35	-Minimum
30	30	-Maximum

Paint Problem

1. Using Rstudio, create an R script on your desktop called paintDataFrame.R that creates a data frame paintData for the paint data.
   a) Name the variables brandAPaint and brandBPaint
2. Enter the data
3. Output the data frame
4. Save and run the script. Show me.

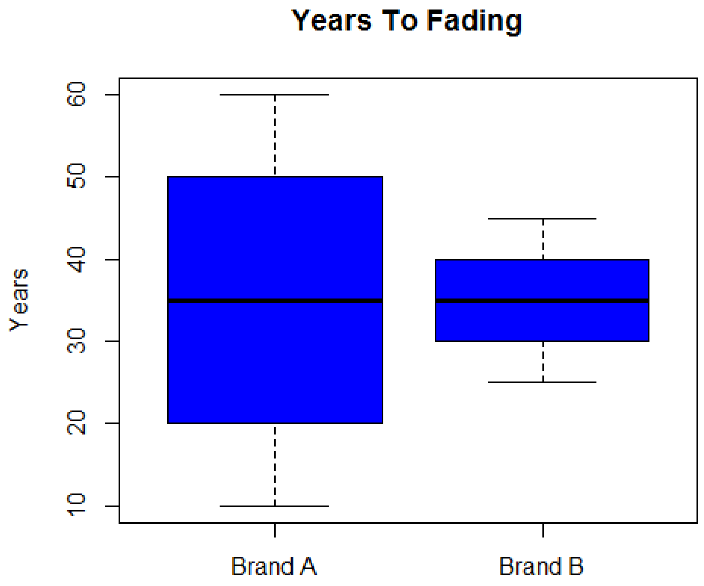
Paint Problem Continued

5. Compute and output the mean, median, std deviation, minimum, and maximum for each brand of paint

```
[1] "Brand A Mean = 35"
[1] "Brand A Median = 35"
[1] "Brand A Std Dev = 18.7082869338697"
[1] "Brand A Minimum = 10"
[1] "Brand A Maximum = 60"
[1] ""
[1] "Brand B Mean = 35"
[1] "Brand B Median = 35"
[1] "Brand B Std Dev = 7.07106781186548"
[1] "Brand B Minimum = 25"
[1] "Brand B Maximum = 45"
```

Paint Problem Continued

5. Output a Box-and-Whisker Plot for each brand of paint as follows. Get as close as possible. This isn't easy but give it a try.
6. What do the descriptive statistics tell us?
7. Which paint would you buy? Justify your answer



]