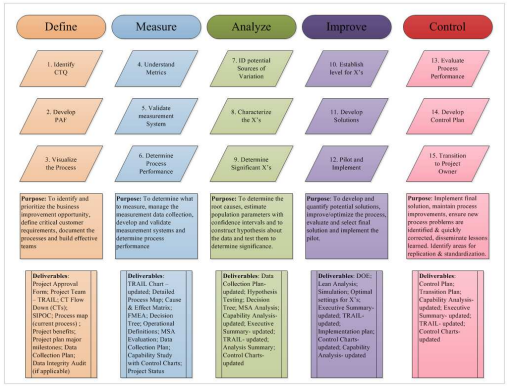
LEANOhio

Transforming the Public Sector

Green Belt

Simple Regression: Reading the Graphs

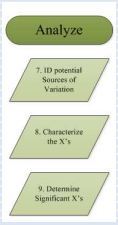
SIMPLER. FASTER. BETTER. LESS COSTLY.



DMAIC Flow

- Analyze:
  - ID Potential Sources of Variation
  - Characterize the X's
  - Determine Significant X's

Analyze Purpose: To determine the root causes, estimate population parameters with confidence intervals and to construct hypothesis about the data and test them to determine significance.



SIMPLER. FASTER. BETTER. LESS COSTLY. LEANOhio

Course Agenda

- Introduction of Regression
  - Scatterplots
    - Characteristics of Scatterplots
  - Correlation
  - Simple Regression
- Reading the Graphs

SIMPLER. FASTER. BETTER. LESS COSTLY. LEANOhio

Regression

- Regression used to describe the relationship between variables
- Continuous Y and Continuous X
- Can be used to:
  - Make predictions about one variable based on values of another variable
  - Determine what value of X will get you a desired value of Y

SIMPLER. FASTER. BETTER. LESS COSTLY. LEANOhio

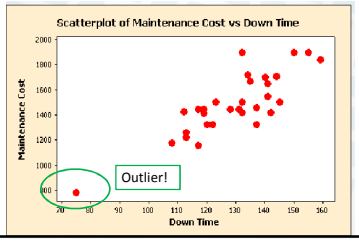
Regression Tools

- First Tool: **Scatter plot** used to evaluate these relationships (see patterns)
- Second Tool: **Correlation** – single value to quantify the strength and direction of linear association
- Third Tool: **Simple Regression** – provides an equation between two variables to predict future events – minitab is used for this step

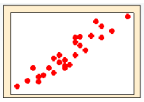
SIMPLER. FASTER. BETTER. LESS COSTLY. LEANOhio

Scatter plot

- Scatter plot illustrates the relationship between two variables
- Each point on the plot represents one observation
- Scatterplots can point out outliers



Scatter plots



- Using continuous data – first plot the data
- When we believe one variable may influence another variable, we need to think about which variable is explaining the other (helps determine axis)
  - Mileage explains sales price? **OR**
  - Sales prices explains mileage?
  - Mileage = Explanatory Variable
  - Explanatory variable on the X Axis
  - Sales Price = Response Variable
  - Response variable on the Y-Axis

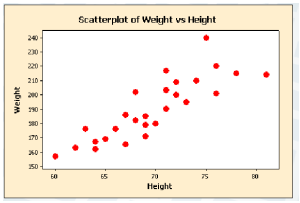
Scatter Plot Characteristics

- Characteristics of Scatter plot
  - Direction
  - Form
  - Strength

Scatter Plots: Direction

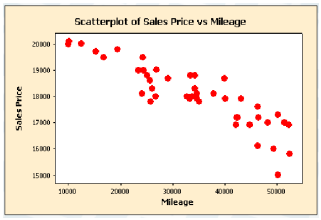
Direction of the relationship is the easiest to spot on a scatter plot.

- Consider the relationship between height and weight for men.
- Generally speaking, the taller the man is, the more he weights showing a positive relationship



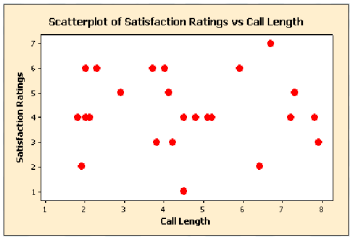
Scatter Plots: Direction

- Consider plot of mileage and sales price, which demonstrates a **negative relationship** between the variables

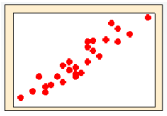


Scatter Plots: Directions

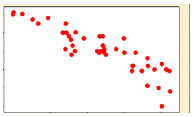
- Sometimes, no clear relationship exists between variables. The points fall randomly and no pattern in either directions.

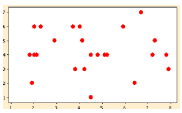


Scatter plot Direction



- Direction:
  - Positive
  - Negative



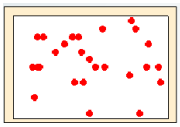


- or No Relationship

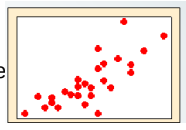
Scatter plot Characteristics: Form

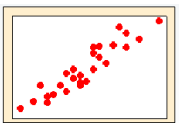
Form – Pattern of that the data follow when we fit a line to the data (straight line indicates a linear relationship)

Scatter plot Characteristics: Strength



- Strength: how closely the data points follow a straight line and the degree of the slope of that line
  - Weak
  - Moderate





  - Strong.

Correlation

- The relationship between the two variables may illustrate: Correlation
- Correlation is the relationship between the two variables

Correlation

- Correlation:
  - Can indicate whether a linear association exists
  - Quantifies the strength of linear association

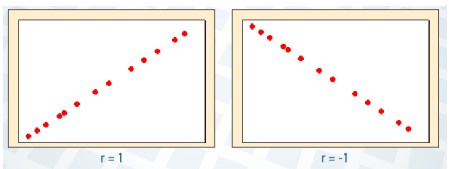
Correlation Coefficient (r) quantifies the linear association between variables:

: $-1 \leq r \leq 1$

: Value reflects the strength and direction of the relationship.

Correlation

- The sign of the correlation indicates the direction of the relationship
- Correlation near zero indicates a weak linear relationship
- For a stronger relationship between variables, the correlation is closer to positive or negative one
- Perfect correlation is equal to negative or positive one
- Correlation coefficient is not affected by manipulating the parameters of the scatter plot



Regression Warnings

- DO NOT assume that a relationship means that one variable causes the other factor
- To determine the degree of associations calculate the correlation coefficient
- Correlation is **NOT** Causation

SIMPLER. FASTER. BETTER. LESS COSTLY. LEANOhio

Simple Regression

- Minitab and other statistical programs can perform **Simple Regression.**
- Simple Regression provides an equation between two variables to predict future events.
- If you have a scenario that would require Minitab's simple regression analysis – contact LeanOhio or your Mentor!

SIMPLER. FASTER. BETTER. LESS COSTLY. LEANOhio

Questions?

SIMPLER. FASTER. BETTER. LESS COSTLY. LEANOhio