ch13print

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Contents

Chapter 13

- Correlation and Regression
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Prologue

Regression and Correlation evaluate the strength of a relationship between variables. This time we are looking at interval or ratio levels of measurement. Our question of interest is: "What is the strength of t he relationship between the variables" for at least two variables. This time, we are looking at making a prediction. We do this using the techniques presented in Chapter 13 and Chapter 14.

First we introduce a correlation coefficient, to ascertain the magnitude of relationship between two variables. If the value is large enough, we generate a linear regression equation. The larger our correlation coefficient, the more accurate the predictions will be.

For example, does variable x have a relationship with variable y? Can we make a prediction about the variable from given information?

Setting up

When is correlation-regression analysis used?

Info.	Outcome
Given	Two individual (raw score) variables measured by interval/ratio scales
Task	Measure the strength of the relationship between variables
Output	If that relationship is sufficiently strong, describe the nature of the relationship between the two variables in suc

---

Example of data used for Regression

```
data(iris)
head(iris)
```

```
##   Sepal.Length Sepal.Width Petal.Length Petal.Width Species
## 1          5.1         3.5          1.4         0.2  setosa
## 2          4.9         3.0          1.4         0.2  setosa
## 3          4.7         3.2          1.3         0.2  setosa
## 4          4.6         3.1          1.5         0.2  setosa
## 5          5.0         3.6          1.4         0.2  setosa
## 6          5.4         3.9          1.7         0.4  setosa
```

Example from textbook pg. 445

We might be interested in other data besides Iris information. For example, we might want to look at political corruption:

Employee	x	y
1	80	160
2	70	95
3	52	97
4	45	85

- x = Annual income (in thousands of US dollars)

- y = Mean Monthly contribution in US dollars
- Question: does a relationship exist between annual income and mean monthly contribution?
- Question: how strong is the relationship?
- Question: can we make a prediction?
- Question: what is the prediction?

Introduction of terms:

- Correlation Coefficient [page 446]:
  - Measure of strength of a relationship in which data are not grouped in tables but are individual raw scores.
- Pearson's Product-Moment Correlation Coefficient (a.k.a. Pearson's r) [page 446]:
  - Coefficient that is used when both variables are an interval or a ratio level of measurement.
- Coefficient of Determination (r^2) [page 446]:
  - Indicates the proportion of variation in the dependent variable (y) that can be explained by variation in the independent variable (x).
- Regression Equation [page 447]:
  - the mechanism for estimating a y score from the respective x score.
- Correlation-regression Analysis [page 447]:
  - The presentation of correlation and regression techniques together.

Graphs

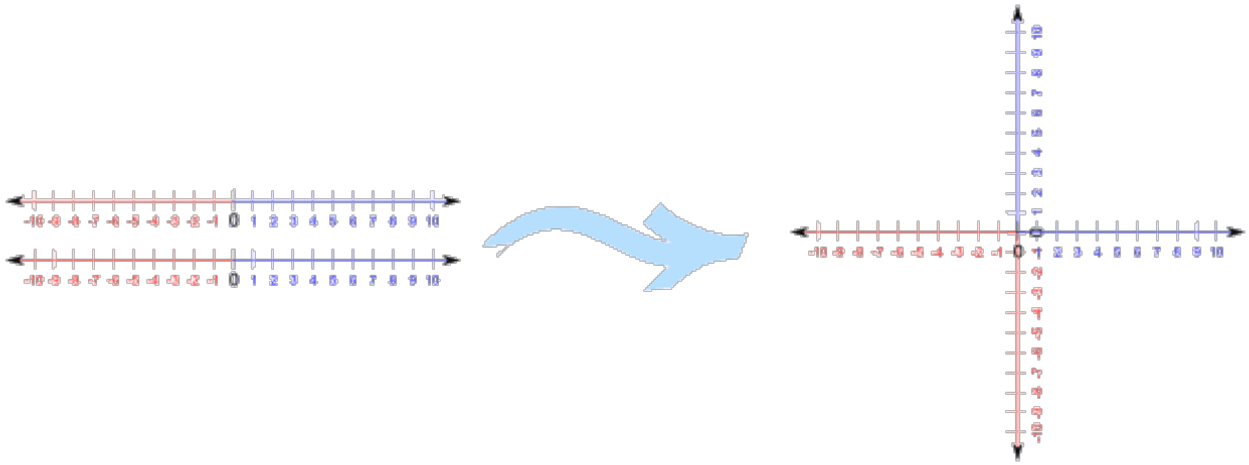
Cartesian coordinates

Sometimes we need to plot the data and we have some key terms that we need to understand:

- Cartesian Plots and Coordinates [page 447]:
  - A pictoral representation of the relationship between two or more variables under study. This method was developed by Rene Descartes.
- Origin of a Graph [page 448]:
  - The point of a graph where the two axes intersect indicating a value of zero on each axis.
- x-axis [page 448]:
  - the axis that extends horizontally.
- y-axis [page 448]:
  - the axis that extends vertically.

- Ordered Pair [page 450]: a set of two numbers in parentheses separated by a comma, indicating a point on a graph.
- x-coordinate [page 450]:
  - the first number in an ordered pair
- y-coordinate [page 450]:
  - the second number in an ordered pair

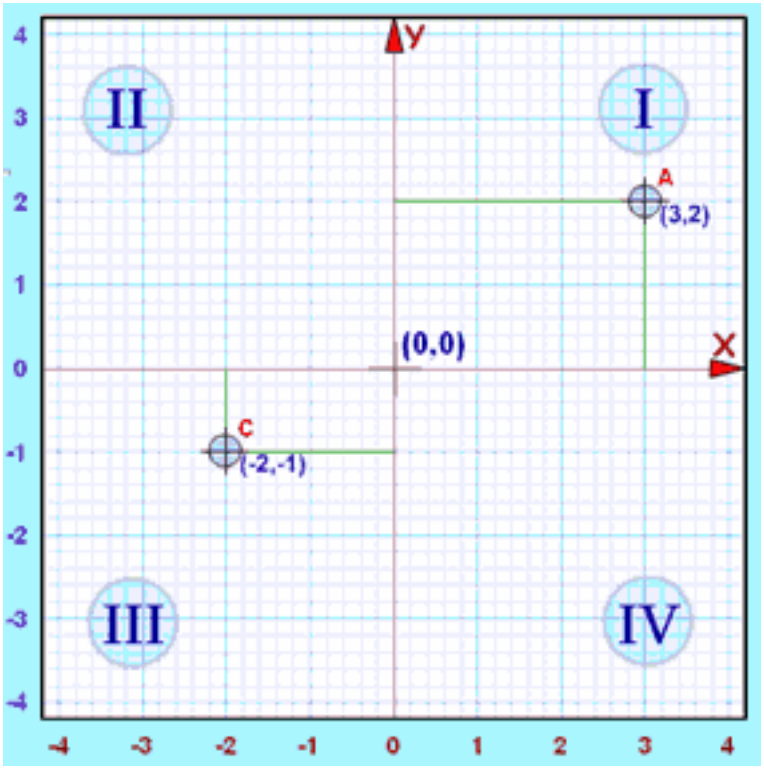
Cartesian Coordinates Review



We put two number lines together in a single plot.

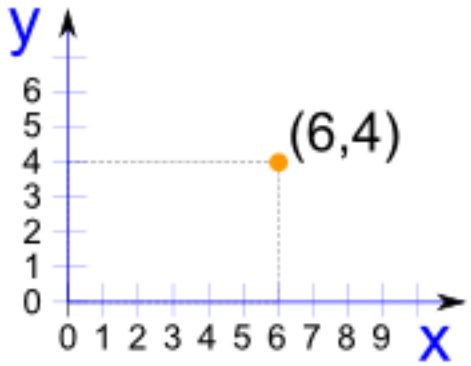
- x = horizontal
- y = vertical

Cartesian Coordinates Review



- Quadrant I: x is positive and y is positive
- Quadrant II: x is negative and y is positive
- Quadrant III: x is negative and y is negative
- Quadrant IV: x is positive and y is negative

Cartesian Coordinates Review



Look at the origin and the coordinates.

- We have x = 6
- We have y = 4

The concept of linearity

Key terms:

- Function [page 452]:
  - The case where a score on the dependent variable (y) may be predicted from a score on the independent variable (x). The value of (y) is obtained either graphically or by an equation.
- Linearity (linear related) [page 452]:
  - Relationship that is shown as an exact straight line.

Example of a linear relationship

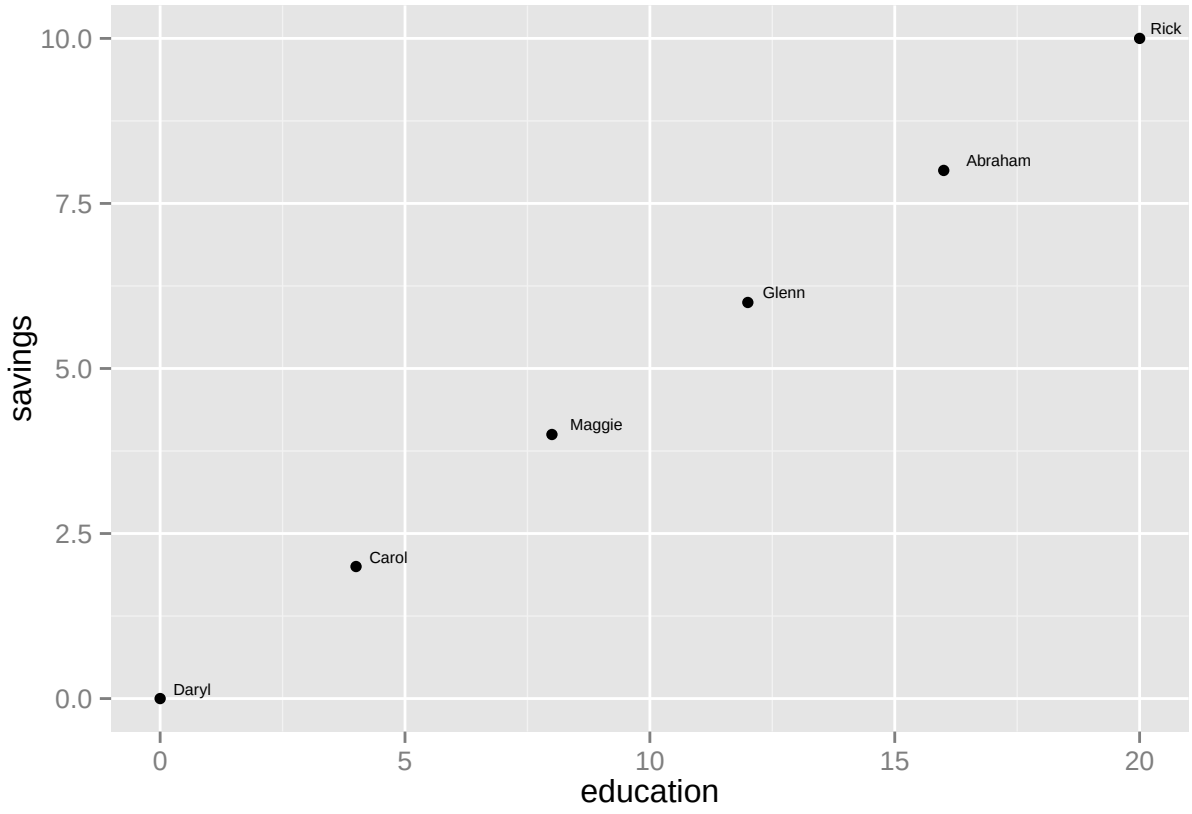
Respondents	x	y
Daryl	0	0
Carol	4	2
Maggie	8	4
Glenn	12	6
Abraham	16	8
Rick	20	10

x = Education and y = Total Savings in thousands of dollars

```
library(ggplot2)
education=as.numeric(c(0,4,8,12,16,20))
savings=as.numeric(c(0,2,4,6,8,10))
row.names=c("Daryl", "Carol", "Maggie", "Glenn", "Abraham", "Rick")
walking=data.frame(cbind(row.names,education, savings))
walking
```

```
##   row.names education savings
## 1     Daryl         0       0
## 2     Carol         4       2
## 3    Maggie         8       4
## 4     Glenn        12       6
## 5   Abraham        16       8
## 6      Rick        20      10
```

```
w=qplot(education, savings)
w+ annotate("text", x=education, y=savings, label=c("Daryl", "Carol", "Maggie", "Glenn", "Abraham", "Ri
```

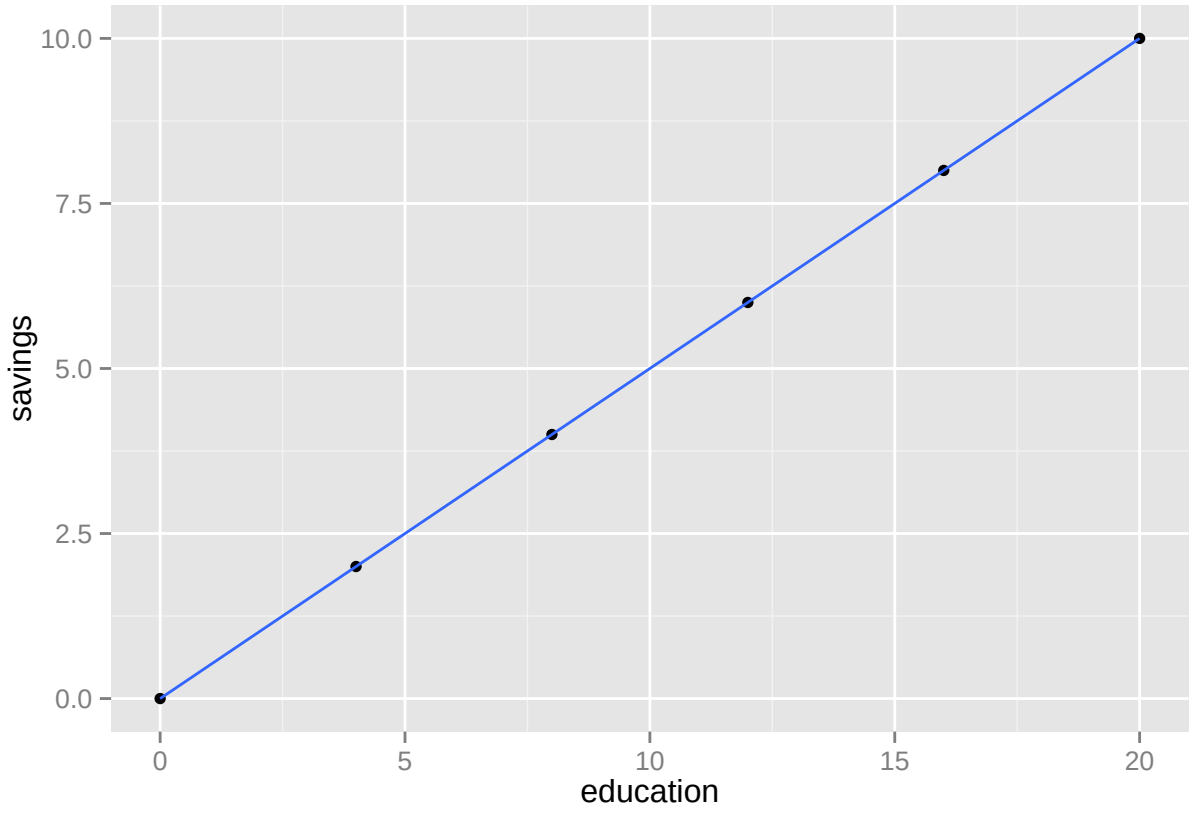


Add a line to the graph

```
library(ggplot2)
education=as.numeric(c(0,4,8,12,16,20))
savings=as.numeric(c(0,2,4,6,8,10))
row.names=c("Daryl", "Carol", "Maggie", "Glenn", "Abraham", "Rick")
walking=data.frame(cbind(row.names,education, savings))
walking
```

```
##   row.names education savings
## 1     Daryl         0       0
## 2     Carol         4       2
## 3    Maggie         8       4
## 4     Glenn        12       6
## 5   Abraham        16       8
## 6      Rick        20      10
```

```
w=qplot(education, savings)
w+stat_smooth(method="lm")
```



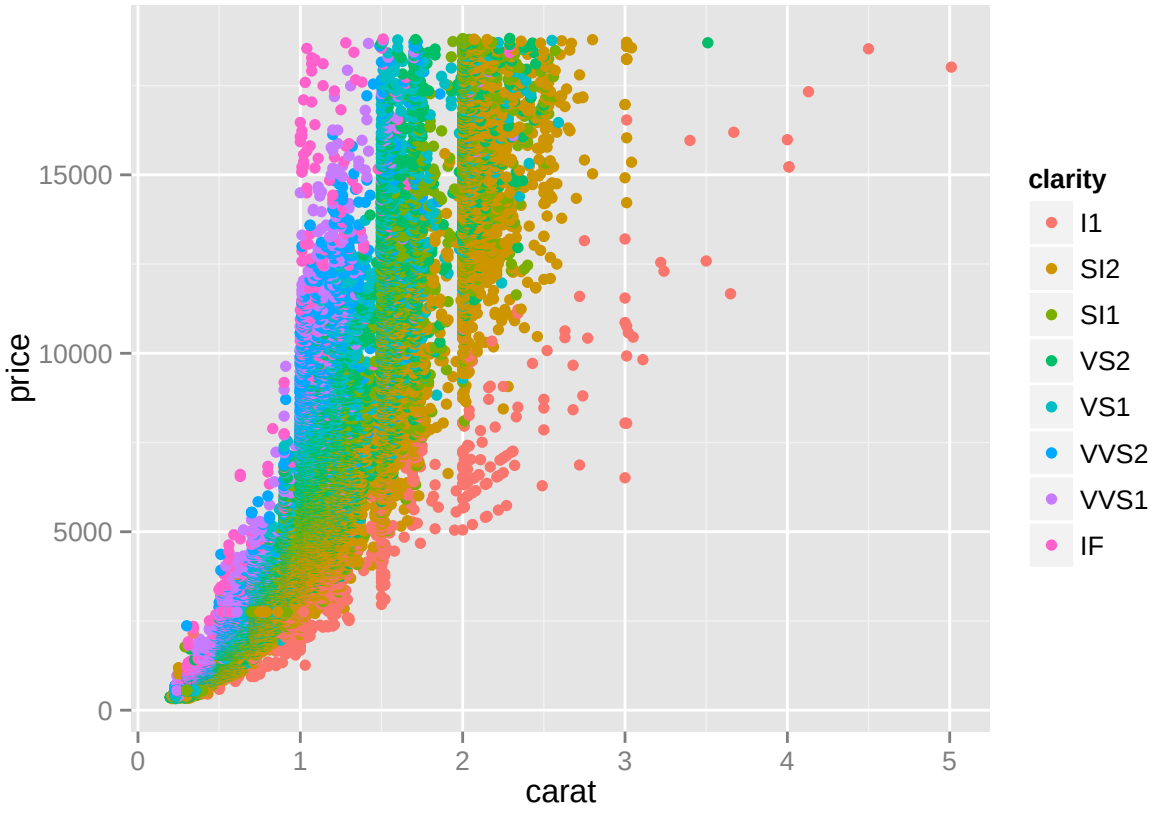
Examples: Diamonds

```
library(ggplot2)
data(diamonds)
head(diamonds,4)
```

```
##   carat     cut color clarity depth table price    x    y    z
## 1  0.23   Ideal     E     SI2  61.5    55   326 3.95 3.98 2.43
## 2  0.21 Premium     E     SI1  59.8    61   326 3.89 3.84 2.31
## 3  0.23    Good     E     VS1  56.9    65   327 4.05 4.07 2.31
## 4  0.29 Premium     I     VS2  62.4    58   334 4.20 4.23 2.63
```

Cartesian Plots

```
qplot(carat, price, data=diamonds, color=clarity)
```


price
15000
10000
5000
0
0
1
2
3
4
5
carat
clarity
I1
SI2
SI1
VS2
VS1
VVS2
VVS1
IF