

DIRECTIONS:

- The following exercises have been carefully selected to provide a thorough and intuitive introduction to correlation and regression — in the context of interesting business applications such as stock portfolios.
- Some exercises call for you to use MINITAB as a computing aid. Others direct you to use your calculators only. Of course, on quizzes and exams you'll need to rely on your calculators.

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## Part 1: Scatterplots, Correlation, and Regression

- Exercise 2.42 (page 98) **Substitute the following directions for textbook directions:**

1. It's generally easier to use MINITAB to make scatterplots than plotting by hand. There are two ways to access MINITAB, choose whichever method you prefer:
  - Go to an ITC (computing lab) on campus where MINITAB is installed. These include 41 Schaeffer Hall, the computer lab C220 in the College of Business, and the College of Business library (on the third floor.)
  - Use any web browser to access MINITAB remotely using the university's Virtual Desktop. If you're using Virtual Desktop for the first time from home on a PC or Mac computer you'll need to install Citrix software first:

▲ Instructions for PC:

[http://helpdesk.its.uiowa.edu/virtualdesktop/instructions/pc/pc\\_install.htm](http://helpdesk.its.uiowa.edu/virtualdesktop/instructions/pc/pc_install.htm)

▲ Instructions for Mac:

[http://helpdesk.its.uiowa.edu/virtualdesktop/instructions/osx/mac\\_osx\\_install.htm](http://helpdesk.its.uiowa.edu/virtualdesktop/instructions/osx/mac_osx_install.htm)

▲ **Tip:** We recommend that you answer Yes followed by Don't ask again when prompted about local drive access during Citrix installation.

▲ After installation, log onto [virtualdesktop.uiowa.edu](http://virtualdesktop.uiowa.edu) with Hawk ID and password. Click the MINITAB icon to start MINITAB remotely on the university's computer.

2. Enter the data to the MINITAB worksheet: First enter column titles **Price** and **Deforestation**, then enter the column numbers.
3. Make a scatterplot with these steps:

Graph > Scatterplot > Simple > OK > (Enter Deforestation as the  $y$  variable, Price as the  $x$  variable) > OK

(continued)

4. Let's use MINITAB to get the correlation, too:

Stat > Basic Statistics > Correlation > (Select both variables) > OK

**Answer these questions:**

- (a) Provide an English description of the  $x$  variable. (Include units of measurement.)
- (b) Provide an English description of the  $y$  variable. (Include units of measurement.)
- (c) Provide the correlation  $r$  between  $x$  and  $y$ .
- (d) Calculate the other four “ingredients” for the regression equation:  $\bar{x}$ ,  $s_x$ ,  $\bar{y}$ ,  $s_y$ .
- (e) Calculate  $\hat{\beta}_1$ . (Use the formula from the Topic 10 Notes.)
- (f) Calculate  $\hat{\beta}_0$ . (Use the formula from the Topic 10 Notes.)
- (g) Provide the sample regression equation.
- (h) Interpret the slope  $\hat{\beta}_1$ .
- (i) Interpret the intercept  $\hat{\beta}_0$ .
- (j) Consider the laws of supply and demand, either from a Microeconomics course that you're taking, or just from your general knowledge.  
Briefly provide an economic reason why the two variables are either positively or negatively correlated.
- (k) Suppose that in 2013 the price per pound of coffee is 88¢. Predict deforestation in 2013.

• Exercises 2.35, 2.36, 2.69, 2.70

- These data compare the carbs and alcohol in 86 brands of beer. Probably that's too much data to hand-type into a MINITAB worksheet. So open the **Beer** data file from the **Homework** page of the main Stats website.

Depending on whether you're at an ITC or using Virtual Desktop, the method to open the data file differs:

- ▲ From an ITC, navigate to the **Homework** page of the Stats website and click the **Beer** file to open.
- ▲ From Virtual Desktop:

Since the data file resides on the university's computer (not yours), you'll need to use different steps on Virtual Desktop. (Otherwise your computer will show gibberish.)

From Virtual Desktop, use:

- Web Browsers > Firefox
- > Open course website (it may be easiest to google “Blake Whitten”)
- > Go to Homework page, click the **Beer** file to open.

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- An outlier is a data point which is markedly different from the other data points. (To “delete” an outlier just right-click and delete the entry from the spreadsheet.)
- Use MINITAB to plot the data as well as to calculate correlations.
- To save typing ( $86 \times 2$ ) numbers into your calculator, let’s also use MINITAB to calculate  $\bar{x}$ ,  $s_x$ ,  $\bar{y}$ ,  $s_y$  for these data:
  - Stat > Basic Statistics > Display Descriptive Statistics
  - (Be sure to use all decimal places from the MINITAB output for accuracy.)
- **Add parts (c) and (d) to Exercise 2.70:**
  - (c) Describe how carbs change as alcohol content changes in alcoholic beers.
  - (d) Predict the carbs in a beer which is 6% alcohol.

• **Additional Exercise**

The *Ventura County Star* newspaper reported the following election results in California in 1998 for Proposition 227. The proposition declared English to be the official language of California and sought to outlaw bilingual education in public schools.

City	Percent in City Who Voted Yes	Percent of City’s Students With Limited English Speaking Skills
Thousand Oaks	71.5	7.4
Simi Valley	71.0	6.0
Oxnard	47.9	40.4
Ventura	61.7	11.9
Ojai	57.4	6.5
Fillmore	48.4	36.1

The correlation between the variables is  $= -0.866$ .

**Questions:**

- (a) Provide an English description of the  $x$  variable.
- (b) Provide an English description of the  $y$  variable.
- (c) Calculate the other four “ingredients” for the regression equation:  $\bar{x}$ ,  $s_x$ ,  $\bar{y}$ ,  $s_y$ .
- (d) Calculate  $\hat{\beta}_1$ . (Use the formula from the Topic 10 Notes, show your work.)
- (e) Calculate  $\hat{\beta}_0$ . (Use the formula from the Topic 10 Notes, show your work.)
- (f) Provide the sample regression equation.
- (g) Interpret the slope  $\hat{\beta}_1$ .
- (h) Interpret the intercept  $\hat{\beta}_0$ .
- (i) In 1998, 7.8% of students in the California city of Camarillo had limited English-speaking skills. Predict the voting outcome in Camarillo for Proposition 227.

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## Part 2: Regression and Stock Portfolios

The data below show the percentage monthly return (percentage increase of the stock's ending monthly price compared to the stock's beginning monthly price) for two companies (Infosys Technology and Pearson Education) and the overall market (S&P 500) for five selected Januaries:

Month	Infosys Tech	Pearson Education	S&P 500
January 2004	-7.97	1.49	1.70
January 2005	-4.97	-3.58	-2.59
January 2006	-6.09	8.83	2.48
January 2007	5.93	4.25	1.39
January 2008	-9.57	-4.62	-6.51

Set

- $x$  = S&P 500 percentage monthly return
- $y_1$  = Infosys Tech stock percentage monthly return
- $y_2$  = Pearson Education stock percentage monthly return

Financial analysts give the regression slope  $\beta_1$  which relates the return of a specific company's stock to the overall market a special name and meaning:

$\beta_1$  is known as the Beta Measure of Financial Risk  
and

- $\beta_1 < 1$  shows the company's stock to be relatively *insensitive* to market changes and so likely to be a (relatively) low-risk/low-return investment.
- $\beta_1 > 1$  shows the company's stock to be relatively *sensitive* to market changes and so likely to be a (relatively) high-risk/high-return investment.

### Questions

- Use the formulas in the Topic 10 Notes to find the regression equation of  $y_1$  on  $x$ .
- Interpret the slope of the regression in (a).
- Use the formulas in the Topic 10 Notes to find the regression equation of  $y_2$  on  $x$ .
- Interpret the slope of the regression in (c).
- Which stock, if either, is considered a low-risk investment compared to the overall stock market, and why? Which is considered a high-risk investment?

### Prof. Whitten's Notes:

- Many students who take Business Stats are business majors who go on to take the course Introductory Financial Management (FIN 3000.) In Finance you'll encounter a theory called the Capital Asset Pricing Model (CAPM) which uses regression to explain and predict stock prices. These exercises provide a brief introduction to that financial theory.
- Much larger data sets than these are typically needed to provide *realistic* measures of stock risk (for example, several years of monthly data, at least.)

(end of assignment)