BUS 735: Business Decision Making and Research
Instructor: Dr. James Murray
Fall 2017: Take Home Exam 2
Due on Friday, December 15 at 9:00pm

1. The dataset `http://murraylax.org/datasets/teacherratings.csv` contains data on actual average course evaluations (`eval`) on a continuous scale from 0.0-5.0 for 463 courses for the academic years 2000-2002 at the University of Texas at Austin. The dataset includes a dummy variable for whether the instructor identified himself or herself and a racial minority (`minority=1` if a minority, `minority=0` otherwise), age (in years), gender (`female = 1` if female and `female = 0` otherwise, whether or not the course was a one-credit course (`onecredit=1` if one credit, `onecredit=0` otherwise), a rating of instructors' physical appearance (`beauty`) based on the average rating of a panel of six students from another university on a continuous scale from 1-10, and whether or not the course was an introductory course (`intro=1` if introductory, `intro=0` otherwise).

   (a) Without accounting for the influence of any of the other variables, test the hypothesis that minority instructors have different average evaluation scores on average than non-minority instructors.

   (b) Estimate a regression that uses all of the given instructor and course characteristics to predict an instructor's expected evaluation score. Write down the estimated regression equation.

   (c) Using the regression results in question (b), test whether or not the physical appearance of the instructor affects his or her evaluation score.

   (d) Describe whether and how instructor age influences evaluation scores.

   (e) What percentage of the variability in course evaluation is predicted by your explanatory variables. Note that none of your explanatory variables should capture anything about teacher quality. Can you draw a recommendation for university policy makers using instructor evaluations for personnel decisions?

   (f) Test the hypothesis that at least one of these explanatory variables that should be unrelated to teaching quality help explain teacher evaluations.

   (g) What would you predict would be the evaluation score for your BUS 735 instructor, someone who is a male, non-minority instructor, 38 years old, is not teaching a one-credit course or introductory course, and is *incredibly* good looking (beauty=10)?

2. *Sue sells six selections of sea shells on the sea shore.* Her selections include large-cone shells, medium-cone shells, small-cone shells, large-flat shells, medium-flat shells, and small-flat shells. The time it takes to collect and inventory each type of shell and the profits for each type are as follows:

Shell-Type	Time (minutes)	Profit
Large-cone	5	\$3.00
Medium-cone	7	\$4.50
Small-cone	3	\$2.50
Large-flat	4	\$4.00
Medium-flat	8	\$3.50
Small-flat	2	\$1.25

Sue hires shell collectors and has 6 labor hours (360 minutes) available. *Sue's sea shells sales slump with a small selection of shells* so she must have an equal number of cone shaped shells and flat shaped shells, and each type of shell must number no more than twice the amount of any other shell. Also, broken sea shells don't get sold, so you cannot sell a fraction of a shell.

(a) Express the objective function and all the constraints.

(b) How many of each type of shell should she keep in inventory to maximize profits? What is her total profit?

(c) Are any of the constraints non-binding? Which ones?

(d) Suppose Sue can hire an additional *hour* of labor. What is the maximum that she would be willing to pay for an additional hour of labor?

3. Suppose MacroFoods is a major producer of microwave-ready dinners. It buys agricultural output from four supplier cities (Sacramento, Bakersfield, Jacksonville, and Ocala), and processes it with preservatives and plastic wrapping in five manufacturing facilities (Denver, St. Paul, Louisville, Akron, and Topeka). The shipping cost (in $1,000 per ton) between each supplier and each manufacturing facility is given below. Suppose that it is possible to transport fractions of one ton of agricultural products.

	Processing Plants				
Suppliers	Denver	St. Paul	Louisville	Akron	Topeka
Sacramento	$3.7	$4.6	$4.9	$5.5	$4.3
Bakersfield	$3.4	$5.1	$4.4	$5.9	$5.2
Jasksonville	$6.1	$5.1	$3.8	$2.5	$4.1
Ocala	$6.6	$4.8	$3.5	$3.6	$4.5

The total supply (in tons) from each supplier is given by:

Supplier:	Sacramento	Bakersfield	Jacksonville	Ocala
Available supply:	30	15	10	20

The capacity (in tons) for each processing plant is given by:

Processing Plant:	Denver	St. Paul	Louisville	Akron	Topeka
Capacity:	20	15	25	10	15

(a) Is this a balanced or unbalanced model? Describe.

(b) What is the least-cost schedule of transporting food from suppliers to processing plants? What is the total cost?

(c) If it was possible to move 1 ton of processing capacity from one plant to another plant, what would you move? What is the decrease in total cost?

4. Suppose you work for a for-profit university called Spherical-Map University that sells easy, low-workload 1-year and 2-year college degrees in Hospitality Management, Graphic Design, and Legal Assistant. Spherical-Map University wants to heavily advertise one of their programs of "study" and they want you to figure out which program to advertise, based on which program generates the most revenue over the next five years. The expected revenue for each field depends on economic conditions over the next five years. Suppose the expected revenue over the next five years for each of the four programs, conditional on economic conditions, are given by,

Degree	**Recession**	**Slow Growth**	**Expansion**
Graphic Design	\$745,000	\$1,175,000	\$2,520,000
Hospitality	\$930,000	\$1,200,000	\$1,855,000
Legal Assistant	\$1,175,000	\$1,200,000	\$1,290,000

(a) Suppose you want to make a choice that yields the maximum possible income. What criterion is this called? What is your decision?

(b) Suppose you are very pessimistic about the future. What criterion should you use? What is your decision?

(c) You have worked for your particular boss at Spherical-Map for a long time. You know that he is absolutely clueless when it comes to making decisions and understanding his own job. Furthermore, he convinces himself that he always had knowledge that he only learns in hindsight. As a consequence, he will blame you for any decision that turns out not to be the best decision after economic conditions are already known. What criterion should you choose? What is your decision?

(d) Suppose the an economic research firm estimates probabilities for each economic condition is given in the table below. Using this information, what criterion should you use? What is your decision?

Economic Condition	**Probability**
Recession	15%
Slow Growth	50%
Expansion	35%

(e) Suppose you could pay a research firm to determine the most likely economic conditions over the next five years. Compute a maximum price that you would be willing to pay for this information, given perfect confidence in whatever recommendation is made.