BUS 735: Business Decision Making and Research
Instructor: Dr. James Murray
Fall 2013: Take Home Exam 2
Due on Thursday, December 19, 2013 at 9:00pm

1. 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 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) Sue can hire one hour of overtime labor for $42 / hour (sea shell collectors have a powerful union). Should she hire an additional hour of labor?

2. 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?

3. 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. To determine what tuition to charge its students, your boss would like you to investigate the total earnings Wisconsin workers make in the leisure and hospitality industry. The dataset `leisurehospitality.xls` contains the actual total earnings made in the Leisure and Hospitality industry in the state of Wisconsin for every quarter from 2001 through 2009. This data was obtained from the *Bureau of Labor Statistics*, `http://www.bls.gov`.

   (a) Does the data appear to have a seasonal component? If so, what time of year are earnings in the industry the highest? Which are the lowest? If you were in charge of setting up the academic calendar, during what time of year would you like your students to graduate? Show a graph to illustrate your result.

   (b) Does the data appear to have a trend? If so, describe the trend. Show a graph to illustrate your result.

   (c) Generate Adjusted Exponential Smoothing (AES) forecasts for the data using a smoothing constant equal to 0.8 and a trend smoothing constant equal to 0.1. What is the root mean squared error and the mean absolute percentage deviation? How does these compare to the naive forecast?

4. Suppose the Dahl brothers move down South to warmer climates and decide to open a car dealership in Sarasota, FL. They need to contract with an automobile manufacturer to sell cars. They have offers from Chevrolet, Volkswagen, and Toyota. The profitability of each type of dealership depends on price and availability of gasoline. Suppose the profits earned each year (in millions of dollars) from each kind of dealership are as follows:

	Gasoline Availability	
Dealership	Shortage	Surplus
Chevrolet	$150	$700
Volkswagen	$300	$500
Toyota	$200	$600

(a) Determine the best decision using the maximax criterion. How would you describe such a decision maker?

(b) Determine the best decision using the maximin criterion. How would you describe such a decision maker?

(c) Determine the best decision using the minimax regret criterion. How would you describe such a decision maker?

(d) Determine the best decision using the Hurwicz criterion with $\alpha = 0.8$. How would you describe such a decision maker?

(e) Suppose you could hire a research firm to forecast the likely path of gasoline prices in the future. What is the most that you would be willing to pay for this information?

(f) Suppose that you did hire a research firm to forecast the path of gasoline prices. They tell you that the gasoline market is likely to be in a surplus. Suppose they accurately predict surpluses 95% of the time, and accurate predict shortages 80% of the time. Suppose also that it is known from past history that the gasoline market experiences shortages 30% of the time, and surpluses 70% of the time. What decision do you make? What is your expected value?

5. Suppose a clothing company manufactures clothes in five stages. Each stage of the manufacturing process is conducted at a different plant. The network below shows the five different stages and the capacity for the routes over which partially completed products are shipped to various plants. Stage 5 is the distribution center in which final products are stored. There are multiple plants at stages two, three, and four. The plants at a single stage each perform the same operation, so clothing should only enter one plant at each stage. Determine the maximum number of units processed at each plant.