(COMM 290) REVIEW SESSION

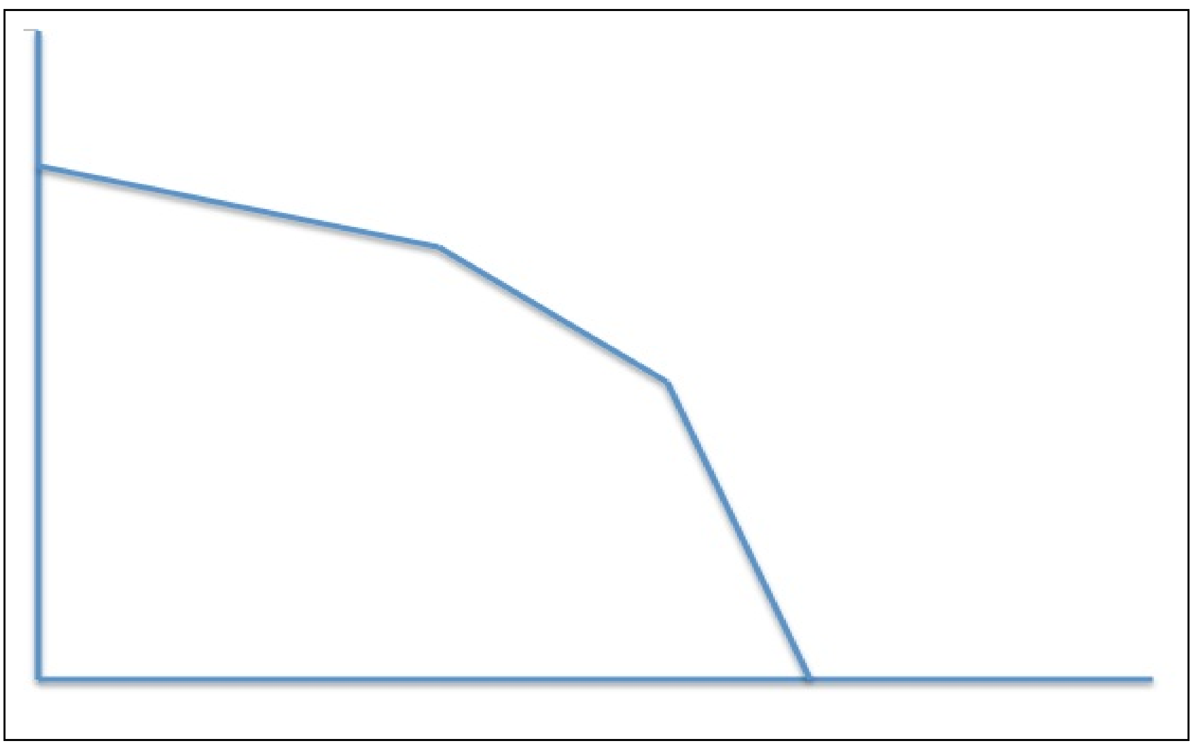
BY (LEONA & ALBINA)

1) **Solve the sensitivity analysis by hand, using Par Golf example**

Production	Standard	Deluxe	Max # of Hours	$/Hour
Cutting	7/10	1	630	$40
Sewing	1/2	5/6	600	$36
Finishing	1	2/3	708	$24
Inspection	1/10	1/4	135	$20
Revenue	$82	$100	--	--

a) Draw and label the appropriate functions,as well as solving for the optimal solution and value:

Cutting:	**Sewing:**
Finishing:	**Inspection:**
Revenue:	Cost:
Objective: Profit Maximization	
Solution:	**Value:**



b) Solve for Shadow Price for Finishing:

c) Solve for the Allowable Increase for Finishing and Sewing:

d) Solve for the Allowable Range for the coefficient of Standard bags:

e) Define Redundancy:

Define Binding:

Problem 1 (30 marks)

Note: The story below is a slightly modified version of the Lucky Strike problem done in class this term. The only difference is that Lucky now has 3 products, Regular, Mid-Grade and Ultra gasoline compared to the 2 product problem that was discussed in class.

This week, the Lucky Strike Oil Company has the opportunity to purchase up to 500,000 litres of OilA at a cost of $0.32 per litre 275,000 litres of OilB at a cost of $0.38 per litre and 425,000 litres of OilC at a cost of $0.34 per litre. With this oil, Lucky can produce 3 grades of gasoline - Regular, Mid-Grade and Ultra.
Regular gas must be at least 45% OilA, not over 25% OilB with the remainder being OilC. Mid-Grade gas must be at least 40% OilA, at most 20% OilC with the remainder being OilB. Ultra Gas must be at least 35% OilB, not more than 35% OilC and the remainder being OilA. The selling price of Regular gas is $0.42 per litre; Mid-Grade sells for $0.44 per litre and Ultra sells for $0.51 per litre.
The company would like to know how to blend the ingredients in order to maximize profits.

This problem was correctly formulated as a linear programming problem on Excel and solved using Solver. **The solved model, with an optimal solution and Sensitivity Report, are attached. Use only these printouts to answer the following questions.**

A very important note on reporting answers and units:
In Connect, students are reminded to input answers without including units. So, if the answer is $7,500, the required input to Connect would be 7500. In this practice homework, the posted solution will include units and explanations which should help with your understanding of course material but would not be included in a Connect answer format.
QUESTIONS ARE INDEPENDENT.

(a) (1 mark) How many litres of Regular Gas should be produced?

Your Answer:__________________

(b) (1 mark) Determine the total number of litres to produce.

Your Answer:__________________

(c) (2 marks) Suppose management had an opportunity to purchase exactly 1,000 additional litres of either OilA or OilB or OilC at the regular cost. Which of these 3 (if any) should they purchase? Explain.

(d) (2 marks) Which of the 3 products, REG, MID or ULTRA contributes more to profit on a per litre basis? Provide convincing evidence.

Your Answer:__________________

(e) (1 mark) One requirement in this model is that REG Grade gasoline must not have more than 25% OilB in its composition. Is this constraint binding or non-binding?

Your Answer:__________________

(f) (1 mark) Show how the value of 0.10 found in cell F47 on the Sensitivity Report was determined.

(g) (4 marks). Suppose management could purchase an additional 100,000 litres of OilB at the regular cost. What can you say about the effect this change will have on:
(i) the corresponding total profit ?

(ii) the optimal solution ? Explain.

(h) (4 marks) Suppose management could obtain 100,000 additional litres of OilA at $0.35 per litre.
(i) What would be the value of the Target Cell ?

(ii)What effect would this have on the optimal solution? Explain

(i) (3 marks) Suppose the engineers at Lucky suggest that the current MID Grade requirement that OilA be at least 40% of the composition of MID Grade gas be increased from 40% to 50%. What can you say about the effect this change will have on:
(i) the corresponding total profit ?

(ii) the optimal solution ? Explain

(j) (2 marks) In the Sensitivity Report, the row identified as OilB Reg shows an Allowable Decrease of 1E+30. Provide a meaningful and correct interpretation to management.

(k) (5 marks) Suppose Lucky could purchase an additional 200,000 litres (or nothing) of OilC at the regular cost. What can you say about the effect this change will have on:
(i) the corresponding profit?

(ii) the optimal solution ? Explain.

(l) (4 marks) If the cost of OilB increased to \$0.40 per litre from its current value of \$0.38 per litre, then the optimal solution ...

A. Will change
B. Will not change
C. Can't tell with the information provided.

Your Answer:__________________

because: *{Choose the best answer:}*

(A) the change is within the allowable increase and this change is binding
(B) the change is within the allowable decrease and this change is binding
(C) the change is within the allowable decrease and this change is non-binding
(D) the change is within the allowable increase and this change is non-binding
(E) the change is within the allowable increase
(F) the change is within the allowable decrease

Your Answer:__________________

Lucky Strike

Input Data

	Cost per litre ($)	Amount Available
OilA	0.32	500000
OilB	0.38	275000
OilC	0.34	425000

Selling Price Regular	$	0.42	litre
Selling Price Mid Grade	*$*	*0.44*	litre
Selling Price Ultra	$	0.51	litre

Action Plan

	Reg	*Mid*	Ultra	Amount Used		Amount Available	*units*
OilA	86,327	*177,959*	235,714	500,000	<=	500,000	*litres*
OilB	0	*0*	275,000	275,000	<=	275,000	*litres*
OilC	105,510	*44,490*	275,000	425,000	<=	425,000	*litres*
Total	191,837	222,449	785,714				

Additional Constraints

			Output		Req't	*units*
Regular gas must be at least	0.45	OilA	86,327	>=	86,327	*litres*
Regular Gas not more than	0.25	OilB	0	<=	47,959	*litres*
Mid Grade must be at least	*0.40*	*OilA*	*177,959*	>=	*88,980*	*litres*
Mid- Grade not more than	*0.20*	*OilC*	*44,490*	<=	*44,490*	*litres*
Ultra Gas must be at least	0.35	OilB	275,000	>=	275,000	*litres*
Ultra Gas not more than	0.35	OilC	275,000	<=	275,000	*litres*

Revenue/Cost Data

Selling Price Regular	$	0.42	*litre*
Selling Price Mid Grade	*$*	*0.44*	*litre*
Selling Price Ultra	$	0.51	*litre*

	Cost per litre ($)
OilA	0.32
OilB	0.38
OilC	0.34

		Reg	Mid Grade	Ultra	Total
Total Revenue		$ 80,571.43	$ 97,877.55	$ 400,714.29	$ 579,163.27
Total Costs					
	OilA	$ 27,624.49	$ 56,946.94	$ 75,428.57	$ 160,000.00
	OilB	$ -	$ -	$ 104,500.00	$ 104,500.00
	OilC	$ 35,873.47	$ 15,126.53	$ 93,500.00	$ 144,500.00
Total Profit		$ 17,073.47	$ 25,804.08	$ 127,285.71	$ 170,163.27

Sensitivity Report

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
C14	OilA Reg	86,327	0	0.10	0.0250	0.0528
D14	OilA Mid	177,959	0	0.12	0.0528	0.0250
E14	OilA Ultra	235,714	0	0.19	0.0571	0.1209
C15	OilB Reg	0	-0.282	0.04	0.2816	1E+30
D15	OilB Mid	0	-0.224	0.06	0.2245	1E+30
E15	OilB Ultra	275,000	0	0.13	1E+30	0.2245
C16	OilC Reg	105,510	0	0.08	0.0364	0.0432
D16	OilC Mid	44,490	0	0.10	0.2111	0.0364
E16	OilC Ultra	275,000	0	0.17	1E+30	0.0571

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
F14	OilA Used	500,000	0.1314	500,000	335714.29	141558.44
F15	OilB Used	275,000	0.2959	275,000	106818.18	275000
F16	OilC Used	425,000	0.0543	425,000	173015.873	83928.57
G21	OilA Outpu	86,327	-0.0571	0	77857.14	37767.86
G22	OilB Outpu	0	0.0000	0	1E+30	47959.18
G25	OilB Outpu	275,000	-0.2245	0	126923.08	136250
G26	OilC Outpu	275,000	0.0571	0	67142.86	77857.14
G23	OilA Outpu	177,959	0.0000	0	88979.59	1E+30
G24	OilC Outpu	44,490	0.0571	0	67142.86	28311.69

Random Variables:

3.1) The probability of having a certain number of storms per year in Delta are as follows:

# of Storms	0	1	2	3	4	5	6
Probability	0.25	0.33	0.24	0.11	0.04	0.02	0.01

a) What is the likelihood of more than 2 but less than 5 storms?

b) If 1 storm has been observed, how likely will there be at least 2 more storms for the year?

c) If 2 storms have already occurred, what is the conditional probability that 4 or more storms will happen in Delta?

3.2) Alice tries to decide what she will eat today for breakfast. Y is the number of pancakes, while X is the number of eggs. Please help Alice solve the next 6 questions knowing this Joint Probability Table:

		Y	Y	Y
		1	2	3
X	1	0.2	0.1	0.2
X	2	0.3	0.2	0

Solve for the Following:

a) What are marginal probabilities of X and Y

b) Calculate E(X), E(Y), Var(X), Var(Y)

c) Calculate probability of X=1 and Y=2

d) Calculate probability of X=2 and Y<=2

e) Calculate E(X+Y), Var(X+Y)

f) Calculate E(10X+5Y), Var(10X+5Y)

3.3) A construction project consists of four jobs - A, B, C, and D. Jobs B and C cannot be begun until A is completed, and D cannot be begun until C is completed. The project is completed when all four jobs are completed. The completion times of the four jobs are uncertain. The completion time of job A is independent of the completion times of B, C, and D, and the completion time of B is independent of the completion times of A, C, and D. The distributions of the completion times of job A and B are as follows:

Job A

Completion Time	**1 week**	**2 weeks**
Probability	0.4	0.6

Job B

Completion Time	**3 weeks**	**4 weeks**
Probability	0.5	0.5

The completion times of jobs C and D are dependent on one another but independent of the completion times for A and B. The joint probabilities of these two are given in the following probability table:

		Job C	**Job C**
		1 week	**2 weeks**
Job D	**2 weeks**	0.2	0.4
Job D	**3 weeks**	0	0.4

a) What is the probability distribution for the total project completion time?

The firm undertaking this project will receive $10,000 for completing the job, unless it takes more than 5 weeks, in which case they get only $9,500. Total costs will be $4,000, plus $500 for every week that it takes to complete the project (labor costs), plus $500 for every week that it takes to complete job C (because C requires the rental of machinery).

b) What is the probability distribution of the firm's net contribution for this project?

Decision Tree

4) The Gorman Manufacturing Company must decide whether to manufacture a component part or purchase the component from a supplier. The resulting profit is dependent upon the demand for the product. The following payoff table shows the projected profit (in thousands of dollars).

	Low Demand	**Medium Demand**	**High Demand**
Manufacture	-20	40	100
Purchase	10	45	70

The state-of-nature probabilities are P(L)=0,35, P(M)=0,35, and P(H)=0,3.

a) Create a decision tree and calculate the EMVs

b) Calculate EVPI to determine whether Gorman should attempt to obtain a better estimate of demand

c) A new study of the potential demand for the product is expected to report either favorable (F) or unfavorable condition (U). The relevant conditional probabilities are as follows: $P(F \mid L) = 0{,}1$; $P(F \mid M) = 0{,}4$; $P(F \mid H) = 0{,}6$; $P(U \mid L) = 0{,}9$; $P(U \mid M)= 0{,}6$; $P(U \mid H)=0{,}4$. What's the probability that the market research will be favorable?

d) What's the Gorman optimal decision strategy?

e) What's the expected value of market research information?

f) What's the efficiency of the information?

Decision-Making Criteria

5) The following payoffs for constructing buildings, depending on economic conditions, are:

Type:	**Good Times**	**Bad Times**
Apartment	$50 000	$30 000
Office	$100 000	($40 000)
Warehouse	$30 000	$10 000

a) What is the optimistic approach?

b) What is the conservative approach?

c) What approach has the least regret?