

Mejoramiento Exam  
ADMG2022 Tr1 2020

- 1.) (20 points) Clara would like to have a dinner party for her friends, but she doesn't want to spend too much. She wants to make sure to make at least 3 pounds of some meat, 2 pounds of some vegetables, and at least on pound of some dessert. For meats, she is considering making chicken, beef, or pork. Chicken costs \$2 a pound, beef costs \$3 a pound, and pork costs \$2.50 a pound. For vegetables, she can choose between spinach salad at \$0.50 per pound and tomato salad at \$0.40. For dessert, she can choose between pecan pie at \$3.50 per pound and chocolate cake at \$4 per pound.

Below the following questions is the Excel Solver input and output.

The reduced costs and shadow prices are hidden in the output below. What are the hidden reduced cost and shadow price values? (Hint: You do not need to resolve the entire problem to find this number.)

Additionally, explain in the context of this problem one of the non-zero reduced cost values and one of the shadow prices.

Variables	Chicken	Beef	Pork	Spinach	Tomato	Pie	Cake			
Values to Change	1	1	1	1	1	1	1			
Cost per Unit	2	3	2.5	0.5	0.4	3.5	4			
	2	3	2.5	0.5	0.4	3.5	4			
Total Cost	15.9									
s.t.										
Total Meat	1	1	1							>= 3
Total Vegetables				1	1					>= 2
Total Dessert						1	1			>= 1
Total Meat	1	1	1	0	0	0	0	3		>= 3
Total Vegetables	0	0	0	1	1	0	0	2		>= 2
Total Dessert	0	0	0	0	0	1	1	2		>= 1

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$B\$2	Values to Change Chicken	3		2	0.5	2
\$C\$2	Values to Change Beef	0		3	1E+30	1
\$D\$2	Values to Change Pork	0		2.5	1E+30	0.5
\$E\$2	Values to Change Spinach	0		0.5	1E+30	0.1
\$F\$2	Values to Change Tomato	2		0.4	0.1	0.4
\$G\$2	Values to Change Pie	1		3.5	0.5	3.5
\$H\$2	Values to Change Cake	0		4	1E+30	0.5

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$I\$12	Total Meat	3		3	1E+30	3
\$I\$13	Total Vegetables	2		2	1E+30	2
\$I\$14	Total Dessert	1		1	1E+30	1

- (20 points) Oscar is considering the purchase of a new computer system consisting of five separate components. The components are arranged in series with identical reliabilities. The A system with component reliabilities of 90% costs \$1100, the B system with component reliabilities of 92% costs \$2200, and the C system with component reliabilities of 93% costs \$5300. The cost of a failure during a performance is \$45,000. Which system would you recommend given the reliability and cost information? What is your expected cost associated with each system?
- (10 points) An ice cream shop owner is trying to determine how many people to have work in each shift for Saturday. They would like to minimize the total number of people who are working. The shop is open from 8am to 8pm. Workers can start at 8am, 10am, 12pm, 2pm, and 4pm. Each employee must work for exactly 4 hours. Below is the demand in each period. Formulate the linear programming problem, but do not solve it.

Period	Workers Needed
8 am – 10 am	3
10 am – 12pm	5
12 pm – 2 pm	10
2 pm – 4 pm	3
4 pm – 6 pm	6
6 pm – 8 pm	2

4. (10 points) Annie Smith is a nurse on the evening shift from 10:00 P.M. to 6:00 A.M. at Community Hospital. She averages 5 calls from her patients every hour (Poisson distributed), and she must spend an average of 10 minutes (negative exponential distribution) with each patient who calls. Nurse Smith has indicated to her shift supervisor that although she has not kept records she believes her patients must wait about 10 minutes on average for her to respond and she has requested that her supervisor assign a second nurse to her area. The supervisor believes 10 minutes is too long to wait, but she does not want her nurses to be idle more than 40% of the time. Determine if the supervisor should hire another nurse to help. (You must have the correct average time a patient spends waiting in line to be served and probability that the nurse will be idle to get full points).
5. (20 points) The Taylor accounting firm has purchased a new computer system. Several activities need to be completed to make sure the system works properly before being used. The following gives information about this project. How long will it take to install the system and what is the critical path?

Activity	Immediate Predecessor	Time (weeks)
A	--	8
B	--	6
C	A	5
D	B	2
E	A	8
F	C	6
G	D, E	2
H	E, F	7

6. (10 points) Holly is considering playing a game in which she must pay \$20 to play. In this game, she can spin a wheel that has red and black sections. If it lands on a red section, she gets her \$20 back plus an additional \$20. If it lands on black, she gets nothing back. Holly says that she will only play the game if there is at least a 65% chance that she will win. If she doesn't play, she keeps her original \$20. Which of the following is Holly?
- Risk averse
  - Risk neutral (indifferent)
  - Risk loving
7. (10 points) Complete the sentence by selecting the correct answer from the choices below.
- \_\_\_\_\_ is the degree to which a nation can produce goods and services that meet the test of international markets while simultaneously maintaining or expanding the real incomes of its citizens.
- Strategy
  - Competitiveness
  - Order Qualifier
  - Balanced Scorecard