Linear Programming Practice Problems

Q1. The new brand manager for Najarian Investments must determine how much time t allocated between social media and internet search advertising during the next month. Market research has provided estimates of the audience exposure for each advertising view in each medium which it would like to maximize. Cost per view of advertising are also known and the manager has a limited budget of $250 per day. The manager has decided that because social media ads have been found to be more effective than internet search ads, at least 75% of the ad placements should be allocated to social media.

Suppose we have the following data:

Type of Ad	Views/Ad placement	Cost/Ad placement
Social Media	35	4
Internet Search	80	5

a. Identify the decision variables.
b. Formulate the objective function and constraints.
c. Use Excel to determine the optimal number of placements for each ad medium and the expected number of views.
d. How much is spent on social media ads? On internet search ads?

Q2. Source Office Equipment produces two types of desks, classic and logiflex. Logiflex desks are more elegant with heavier surfaces and stylish mouldings which require additional time for manufacturing. Classic desks require 70 board feet of pine and 10 hours of labour, whereas logiflex desks require 50 board feet of pine and 20 square feet of oak and 18 hours of labour. For the next week, the company has 5,000 board feet of pine, 750 square feet of oak, and 400 hours of labour available. Classic desks net a profit of $250, and logiflex desks net a profit of $350. All desks can be sold to national chains such as Staples.

a. Identify the decision variables.
b. Formulate the objective function and constraints.
c. Use Excel to determine the optimal number of each type of desk to produce.
d. If another company offered to buy the Logiflex desk business would you recommend that Source consider selling? Explain.

Q3. A business student has $2500 available to put into her self-directed brokerage account within her TFSA. She has identified three potential stocks in which to invest. The cost per share and expected return over the next two years is given in the table below.

Stock	A	B	C
Price/share	$12	$15	$30
Return/share	$6	$7	$15

a. Identify the decision variables.
b. Formulate the objective function and constraints.
c. Use Excel to determine the optimal number of share of each stock that she should purchase.

Q4 Renaissance Developments is a developer of condominiums in the southern United States. Renaissance has recently acquired a 40.625 acre site outside San Antonio, Texas. Zoning restrictions allow at most eight units per acre. Three types of condominiums are planned: one, two, and three bedroom units. The average construction costs for each type of unit are $450,000, $600,000 and $750,000, respectively. These units will generate a net profit of 10%. The company has equity and loans totally $180 million for this project. From prior development projects, senior managers have determined that there must be a minimum of 15% one bedroom units, 25% two bedroom units, and 25% three bedroom units.

a. Identify the decision variables.
b. Formulate the objective function and constraints.
c. Use Excel to determine the optimal number of type of condominium that the company should construct.
d. How many units should the company construct?
e. If more acreage were available for sale, would you recommend that the company buy more land? Explain.
f. If the company could arrange for more equity or loan financing, would you recommend that they do so? Explain.
g. What is the company's total profit? (be careful, lots of zeros)

Q5. Two Hills Theatre Ensemble performs in two venues: Two Hills Centennial Arena and Two Hills School. For the upcoming season seven shows have been chosen. The Ensemble needs to figure out how many performances of each of the seven shows should be scheduled. A business school summer student has conducted a financial analysis. She has estimated revenues for each performance of the seven shows. As a result of union agreements, the Ensemble must perform a minimum number of each show. The data is shown in the table below.

Show	Revenue	Cost	Minimum Number of Performances
1	2217	968	32
2	2330	1568	13
3	1993	755	23
4	3364	1148	34
5	2868	1180	35
6	3851	1541	16
7	1836	1359	21

Further, Two Hills Arena is available for 60 performances during the season, whereas Two Hills School is available for 150 performances. Shows 3 and 7 must be performed in Two Hills Arena and the other shows can be performed in either venue. The company wants to achieve revenues of at least $550,000 while minimizing its production costs.

a. Identify the decision variables.
b. Formulate the objective function and constraints.
c. Solve this problem using solver.
d. How much is expected revenue above the minimum amount required?
e. If there was not a minimum number of Show 2 required would expected minimum costs decrease? Explain.
f. If there was not a minimum number of Show 4 required would expected minimum costs decrease? Explain.