Case Study #3 Linear Programming

Submit an Excel document with the answers to the following questions. Each question should have its own sheet in the Excel document. Each question needs a sentence summarizing the solution. Round answers to 2 decimal places where applicable.

Part 1: Linear Programming and Pollution Reduction

SDG #13 – Climate Action: Improve institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

1. Trees in urban area help keep air fresh by absorbing carbon dioxide. A city has $2,100 to spend on planting spruce and maple trees. The land available for planting is 45,000 square feet. How many of each tree should the city plan to maximize carbon dioxide absorption?

    Facts for a Single Tree:

	Spruce	Maple
Planting Cost	$30	$40
Area Required	600 square feet	900 square feet
Carbon Dioxide Absorption	650 lb/yr	300 lb/yr

2. A personal garden can help reduce carbon dioxide as well. You have 600 square feet for your garden. You want to use two types of plants: blue lagoon sedum and raspberry red sedum. Each blue lagoon sedum will cover 1.2 square feet, and each raspberry red sedum will cover 2 square feet. Each plant costs $2.50 and you only have $1000 to spend on your garden. You want to maximize the amount of carbon dioxide the plants in your garden absorb. Blue lagoon sedum absorbs 1.4 lb of carbon dioxide a year and raspberry red sedum absorbs 2.1 lb of carbon dioxide a year. How many of each type of plant should you plant? How much carbon dioxide will your garden absorb?

3. A chemical company must use a new process to reduce pollution. The old process emits 7 g sulfur and 12 g of lead per liter of chemical made. The new process emits 6 g of sulfur and 6.7 g of lead per liter of chemical made. The company makes a profit per liter of $19 under the old process and $25 under the new process. No more than 14,466 g of sulfur and no more than 11,181 g of lead can be emitted daily. How many liters of chemical could be made under the old process and under the new process to maximize profits? What is the maximum profit?

Part 2: Linear Programming in your Life

4. You have no more than $5,000 to invest in stocks and you want to make an annual return of at least $1200. You also want to minimize your risk. Pick two of the stocks below and find the number of each stock you should buy.

    **Note: If your first choice does not yield a feasible solution, alter your choices until you find stocks that will work.

Stock Name	Price per share	Average Annual Return per share	Beta Value
Apple	$218	$62	1.2
Netflix	$895	$438	1.4
Amazon	$199	$29	1.2
Starbucks	$98	$11	1.0
Nike	$74	$7	1.0
McDonald's	$299	$20	0.7

5. You have no more than $8,000 to invest in two mutual funds. You must deposit a minimum of $3,000 into each mutual fund. You want to spend no more than $200 on fees. Determine the amount to invest in each account to maximize interest. What is the maximum interest?

    **Note: If your first choice does not yield a feasible solution, alter your choices until you find accounts that will work.

Account Type	Interest	Fee
Fidelity 500 Mutual Fund	10.33%	$0.003 per dollar
Vanguard 500 Mutual Fund	7.67%	$0.004 per dollar
Blackrock 500 Mutual Fund	9.91%	$0.025 per dollar
J.P. Morgan Equity Mutual Fund	7.64%	$0.065 per dollar

6. You want to optimize your snacking for the best nutrition, but also minimize the amount of money you are spending on snacks. You want your snacks to provide you with at least 10 grams of protein and allow you to consume no more than 500 calories. Pick two snacks that you would eat and find the amount of each snack you should eat to minimize the cost. What is the minimum cost?

    **Note: If your first choice does not yield a feasible solution, alter your choices until you find two snacks that will work.

Snack Name	Grams of protein per serving	Calories per serving	Cost per serving
Almonds	4	100	$0.80
Pretzels	2	100	$0.50
Apple	1	95	$0.93
Cheez Its	3	140	$0.67
Potato Chips	2	160	$0.70
Banana	1	105	$0.45
Granola Bar	1	100	$0.65