Hannah Graham Assignment 1: Linear Programming – The Diet Problem MSDS460, Fall 2024

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Part 1: Chosen Foods and Their Nutrition Facts

Food	Nutrition label	Price per serving:
Juanitas		\$5.99 (whole cost) /
Tortilla		24 servings = \$0.25
Chips		per serving

	Nutrition Facts 24 serving per container serving size 1 oz (28 g/about 13 chips) Anount per serving Calories 150 Total Frt 10g 55 Dably Yahar Total Frt 10g 55 Dably Yahar Total Frt 10g 56 Dably Fabr Collection of Total Colle	
Bitchin' Sauce	Nutrition Facts Total Fat 99 Saturated Fat 19 Servings Per Contlainer Serving Size 2 test (1997) Calories Product of USA. Family owned and opening Make John Bitchin Sairing, LLC - Carlsbad, CA 2004 Certified Organic by Oregon Tab.	\$11.69 (whole cost) / 24 servings = \$0.487 per serving
	Total Carbohydrate 29 1% to the first of the	
Kirkland Plain Greek Yogurt	Nutrition Facts 8 servings per container Serving size 2/3 cup (170g) Amount per serving Calories 1000 Not Fet 00 Caudistand fet 00 One To 00 Caudistand 1000 Caudistand 10000 Caudistand 1000 Caudistand 1000 Caudistand 1000 Caudistand	\$7.36 (whole cost) / 8 servings = \$0.92 per serving
Kirkland canned		\$17.42 (whole cost) / 6 cans = \$2.90 per can / 2 servings per

pink Salmon	Rutrition Facts Servings per container about to (85g), Amount per serving: Calories 80, Total Fat 15g (2) iras Fat 0g, Polyunsat. Fat 0.5g, Monounsat. Fat 0g, Cholest 5g, 10% DV), Total Carb. 0g (0% DV), Fiber 0g (0% DV), Total Symbol 17g, Vit. D 11 mcg (60% DV), Calcium 9ing (80% DV), Total Symbol 17g, Vit. D 11 mcg (60% DV), Calcium 9ing (80% DV), Total Symbol 17g, Vit. D 11 mcg (60% DV), Calcium 9ing (80% DV), Total Symbol 17g, Vit. D 11 mcg (60% DV), Total Symbol 17g, Vit. D 11 mcg (can = \$1.4516 per serving
	Cibres 80, Total Fat 1.5g (2% DV), Sat. Fat 0.5g (3% DV), Libres 80, Total Fat 1.5g (2% DV), Sodium 240mg Libres 100, Calcium 9mg (0% DV), Iron 0mg (0% DV), Potas. White 100 hells you how much a nutrient in a serving of food Libres 2 day is used for general nutrition advice.	
Kirkland Organic Black Beans	Nutrition Facts Food 5 servings per container Serving size 1/2 Cup (130g) Calories 110 Sabily Year Total Fat Q; Tyrac Fat Q; Cholesteral Cng. Ob. Sabily Store Serving	\$10.28 (whole cost) / 6 cans = \$1.71325 per can / 3.5 servings per can = \$0.4895 per serving
	Total Carbohydrate 21p 5% Detay Four 10g Detay Four 10g Total Super 5 to	

Part 2: Linear Programming Problem Parameters

Goal: Given specific dietary constraints for sodium, energy, protein, vitamin D, Calcium, Iron, and Potassium, calculate the amounts needed for each of the 5 foods (tortilla chips, Bitchin' sauce, Greek Yogurt, canned salmon, and Black Beans) over the course of the week to satisfy the constraints, while minimizing costs.

GitHub Repo Link: https://github.com/hannah-r-graham/MSDS460_BusinessAnalytics_Assignment1_TheDietProblem.git

Decision Variables:

Food	Price	Sodium	Energy	Protein	Vitamin	Calcium	Iron	Potassium
	per serving	(mg)	(cal)	(g)	D (mcg)	(mg)	(mg)	(mg)
Juanitas	0.25	160	150	1	0	0	0.5	0
Tortilla								
Chips								
Bitchin'	0.487	105	90	2	0	15	1	77
Sauce								
Kirkland	0.92	60	100	18	0	190	0	190
Plain								
Greek								
Yogurt								
Kirkland	1.45	240	80	17	11	9	0	320
canned								
pink								
Salmon								
Kirkland	0.4895	85	110	7	0	40	1.7	410
Organic								
Black								
Beans								

Functions for each nutritional element:

#sodium

prob += 160*Chips + 105*Sauce + 60*Yogurt + 240*Salmon + 85*Beans <= 35000

#Energy

prob += 150*Chips + 90*Sauce + 100*Yogurt + 80*Salmon + 110*Beans >= 14000

Protein

prob += 1*Chips + 2*Sauce + 18*Yogurt + 17*Salmon + 7*Beans >= 350

Vitamin D

Calcium

Iron

Potassium

Objective Function with Cost Coefficients:

Units = servings

Weekly Nutritional Constraints:

Component	Max/Min	Daily Amount and Measure	Weekly Conversion
Sodium	Maximum	5,000 milligrams	35,0000
		(mg)	milligrams (mg)
Energy	Minimum	2,000 Calories	14,000 Calories
		(kilocalories, kcal)	(kilocalories, kcal)
Protein	Minimum	50 grams (g)	350 grams (g)
Vitamin D	Minimum	20 micrograms	140 micrograms
		(mcg)	(mcg)
Calcium	Minimum	1,300 milligrams	9,100 milligrams
		(mg)	(mg)

Iron	Minimum	18 milligrams (mg)	126 milligrams (mg)
Potassium	Minimum	4,700 milligrams	32,900 milligrams
		(mg)	(mg)

Part 3: Solution and Results

Results (number of servings in the week):

status=Optimal

Beans = 70.175

Chips = 13.405

Salmon = 12.727273

Sauce = 0.0

Yogurt = 32.518182

Objective = 86.07318579 (dollars)

Results Review:

Seems very boring but very cheap. Being able to have the sauce would be nice. That is an excessive amount of beans - 10 servings a day!

Part 4: Revised Problem: Diversity – At Least One Serving Of Food Item In The Week

Results (servings per week):

status=Optimal

Beans = 69.6575

Chips = 13.1645

Salmon = 12.727273

Sauce = 1.0

Yogurt = 32.548182

Objective = 86.27434454 (dollars)

Results Review:

At least this has a bit more diversity. Program really doesn't like the sauce as it gave it the bare minimum. Still quite a bit of beans

Part 5: LLM Exploration: Microsoft Copilot

Link to chat (doesn't work I don't think): Microsoft Copilot: Your AI companion

Conversation link: https://github.com/hannah-r-

graham/MSDS460_BusinessAnalytics_Assignment1_TheDietProblem/blob/main/GPTConv

o_dietProblem.txt

Results Review

Results are close but slightly different than what I got in my part 3.

Optimal servings:

beans: 70.175

chips: 13.405

salmon: 12.727273

sauce: 0.0

yogurt: 32.518182

Total cost: 86.07318579

Results Review:

GPT first wanted to use the daily allotment and not week, so had to redo those. It also defaulted to maximize function when we are trying to minimize costs so I had to manually modify that. Otherwise, for part 3 the results were identical when using GPT code, however, they were not correct right out of the gate. The AI generated code still needed human intervention.