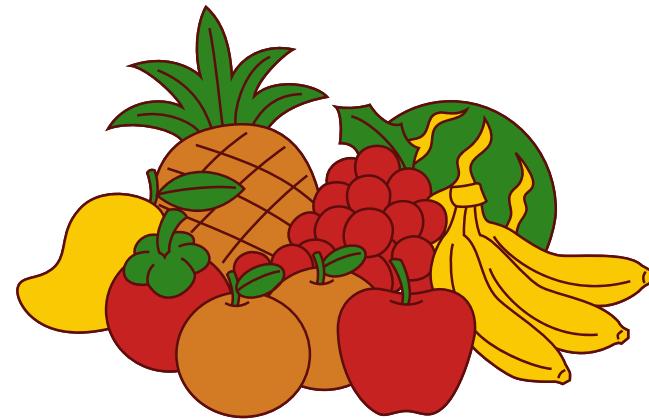


OPTIMIZING GROCERY LISTS: TRADER JOE'S ESSENTIALS FOR STUDENTS

Presented by: Bennett Blanco, Rohit Devanaboina,
Sofia Lopez-Somohano, Jose Salerno

PROJECT BREAKDOWN



1 2 3 4 5 6 7

Problem Statement Data Collected Mathematical Model Results User Interface Challenges Conclusion



PROBLEM STATEMENT



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Objective : Design a cost-effective, meal plan using Trader Joe's products to satisfy nutritional needs based on different budgets.

Significance: As students, managing grocery shopping within limited budgets is a challenge.

Solution: Our team developed a model to ensure adherence to dietary restrictions while staying cost effective.





ORIGIN OF THE PROJECT IDEA

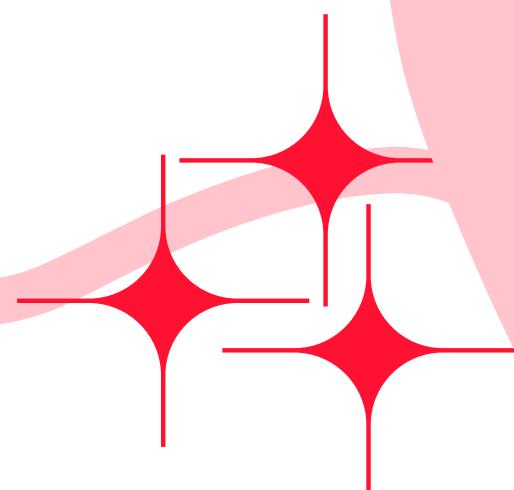
Student Challenges : Balancing tight budgets while maintaining a healthy lifestyles and meeting our nutritional requirements. Our team was inspired in streamlining the process of grocery shopping.

Trader Joe's Focus: Trader Joe's is a team favorite grocery store, known for its affordable, high quality and diverse products. TJ's also does not have a loyalty program, making it difficult to provide personalized recommendations to shoppers.

Broader Impact: This model serves as a guide for families, students, and communities offering solutions to improve meal planning with specific items and real prices (unlike more generic models).



DATA COLLECTION





DATA COLLECTED

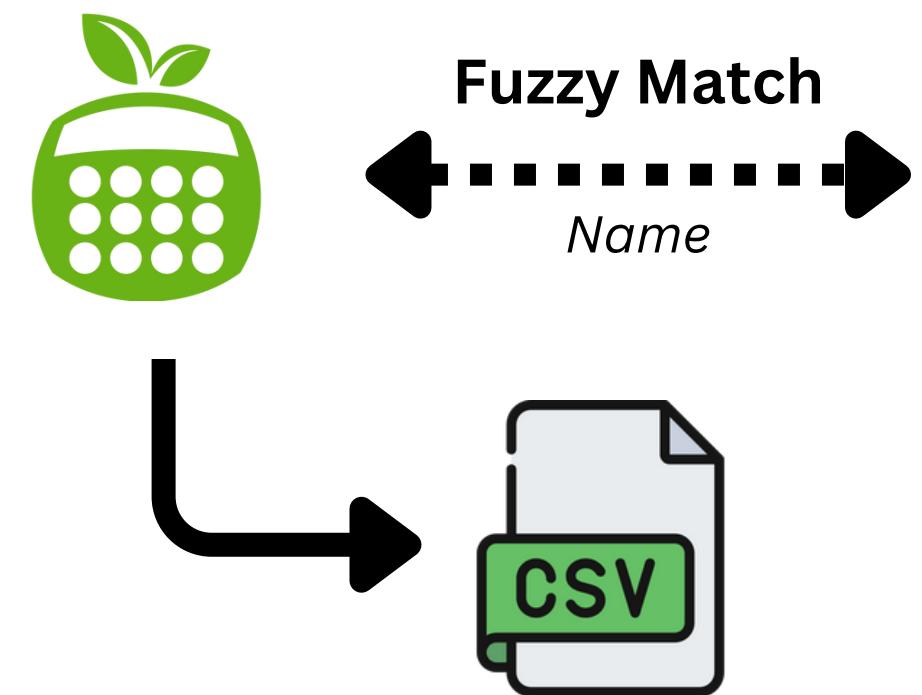


Nutrionix:

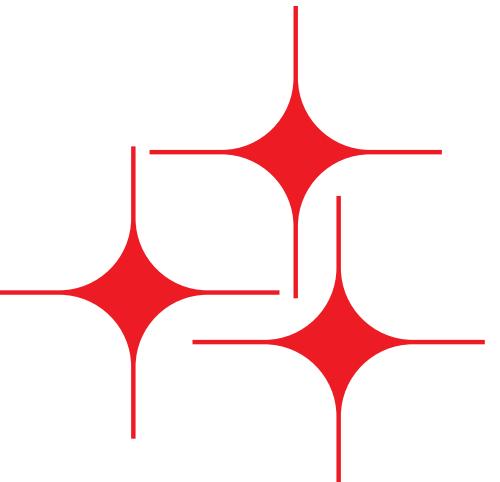
- Public nutrition database
- 5,800+ Trader Joe's products
- 14 key nutrients per product
- Collected via webscraping

Github:

- Public repository with historical Trader Joe's price data
- Descriptive data for products (name)
- Collected via csv



Products with
nutrition and prices



MATHEMATICAL MODEL



MATHEMATICAL MODEL

INTEGER PROGRAMMING

Objective Function:

$$\text{Minimize } Z = \sum_{i \in N} p_i * x_i$$

where:

Z = Total Cost

p_i = Price of item i

x_i = Quantity of item i

Decision Variables:

$i \in N$ (Item Set): Non-negative Integer, representing the quantity of item 'i'

Item Set has 200 Trader Joe's products, with detailed nutrition facts
and latest price (as of November 29)





MATHEMATICAL MODEL CONTINUATION: CONSTRAINTS

1. Budget Constraint

$$\sum_{i \in N} rpi \times xi \leq B, B = \text{Weekly Max. Budget}$$

rpi = retail price of item i

2. Calories

$$\sum_{i \in N} ci \times xi \geq C \times 7, C = \text{Daily Min. Calories}$$

ci = calories of item i

3. Protein

$$\sum_{i \in N} pi \times xi \geq P \times 7, P = \text{Daily Min. Protein}$$

pi = protein (g) in item i

4. Fat

$$\sum_{i \in N} fi \times xi \leq F \times 7, F = \text{Daily Max. Fat}$$

fi = Fat (g) in item i

5. Carbohydrates

$$\sum_{i \in N} chi \times xi \geq Ch \times 7, Ch = \text{Daily Min. Carbs}$$

chi = carbs (g) in item i

6. Sodium

$$\sum_{i \in N} si \times xi \leq S \times 7, S = \text{Daily Max. Sodium}$$

si = sodium (mg) in item i



MATHEMATICAL MODEL CONTINUATION: CONSTRAINTS

7. Fiber

$$\sum_{i \in N} dfi \times xi \geq DF \times 7, \text{DF = Daily Min. Fiber}$$

dfi= Fiber (g) in item i

8. Sugar

$$\sum_{i \in N} sgi \times xi \leq SG \times 7, \text{sgi= Sugar (g) in item i}$$

9. Cholesterol

$$\sum_{i \in N} coli \times xi \leq COL \times 7, \text{COL = Daily Max. Chl.}$$

coli= Chol (mg) in item i

10. Saturated fat

$$\sum_{i \in N} sfi \times xi \leq SF \times 7, \text{SF = Daily Max. Sat Fat}$$

sfi= Sat Fat (g) in item i

11. Vitamin D

$$\sum_{i \in N} di \times xi \geq D \times 7, \text{D = Daily Min. Vit. D}$$

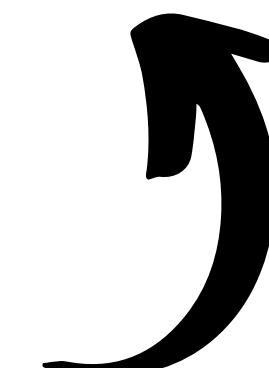
di = Vit. D (IU) in item i

12. Fruits

$$\sum_{i \in N} fri \times xi \geq FR, \text{FR = Weekly Min. Servings of}$$

fresh fruit

fri = 1/0 if item is fruit (Binary)



FEEDBACK FEATURE



RESULTS



SAMPLE USER FOR RESULTS

User Persona:

- Gender: Female
- Age: 20
- Height: 5'7
- Weight: 120 lbs
- Student Athlete



- Calories: 2200 daily
- Protein: 60g
- Fat Maximum: 80g
- Sodium Maximum: 3000mg
- Fiber: 20g
- Sugar Maximum: 60g
- Cholesterol Maximum: 300mg
- Saturated Fat Maximum: 20g
- Vitamin D: 10IU
- Budget Maximum per Week: \$100
- Fruits Minimum per Week: 7 servings





OPTIMAL GROCERY LIST

Total Cost: \$72.78

Daily MACROS: Calories: 2229 | Protein: 60 | Fat: 78 | Carbs: 353

Breakfast

- 0% Greek Yogurt, Nonfat, Plain x 3.0
- 100% Pure Florida Grapefruit Juice, Ruby Red x 3.0
- Almond Butter Chia Overnight Oats x 2.0
- Ancient Grain & Super Seed Oatmeal x 2.0



Lunch & Dinner

- 90% Lean 10% Fat Heirloom Ground Chicken x 3.0
- Alaskan Wild Sockeye Salmon Fillet Portions x 3.0
- Albacore Tuna x 3.0
- Albacore Tuna in water x 3.0
- Angus Beef Chili, with Pinto Beans x 3.0



Snacks

- 12 Grain Mini Snack Crackers x 3.0
- Almonds, Dark Chocolate Covered x 1.0
- Chocolate Wafer Cookie with Peanut Butter x 1.0
- The Dark Chocolate Lover's Chocolate Bar x 1.0
- Apricot, Banana , Passion fruit





SENSITIVITY ANALYSIS

1. Calorie Intake Constraint:

- a. Shadow Price = 0.0
- b. Slack = -261.86

2. Protein Constraint:

- a. Shadow Price = 0.0
- b. Slack = -1.54

3. Fat Constraint:

- a. Shadow Price = 0.0
- b. Slack = 3.34

4. Carbohydrates Constraints

- a. Shadow Price = 0.0
- b. Slack = -503.72

5. Sodium Constraint:

- a. Shadow Price = 0.0
- b. Slack = 8663

6. Fiber Constraint:

- a. Shadow Price = 0.0
- b. Slack = -1686.6

7. Sugar Constraint:

- a. Shadow Price = 0.0
- b. Slack = 213.21

8. Cholesterol Constraints

- a. Shadow Price = 0.0
- b. Slack = 593.5

9. Saturated Fat Constraint:

- a. Shadow Price = 0.0
- b. Slack = 64.33

10. Vitamin D Constraint:

- a. Shadow Price = 0.0
- b. Slack = -7.90

11. Budget Constraint:

- a. Shadow Price = 0.0
- b. Slack = 175.55

12. Fruits Constraints

- a. Shadow Price = 0.0
- b. Slack = -2



FEEDBACK FEATURE



GENERATING ALTERNATIVES

We looped the model to generate the top K alternatives to the optimal list

REMOVE	ADD
Almonds Dark Chocolate Covered	3 Seed Sweet Potato Crackers
Chocolate Covered Wafer Cookie with Peanut Butter Filling, Almonds Dark Chocolate Covered	3 Seed Sweet Potato Crackers, Passion fruit
Chocolate Covered Wafer Cookie with Peanut Butter Filling, Almond Butter Chia Overnight Oats, Almonds Dark Chocolate Covered	Ahi Tuna Steaks
Angus Beef Chili with Pinto Beans, Almonds Dark Chocolate Covered	0% Milkfat Strawberry Greek Nonfat Yogurt, 1% Low Fat Milk



STREAMLIT DEMO



Enter your daily intake Preferences:

Max. Calories (kcal): 2300

Min. Protein (g): 60

Min. Carbohydrates (g): 250

Max. Fat (g): 60

Daily Macro Preferences:

Max. Sodium (mg): 3000

Min. Fiber (g): 30

Max. Sugar (g): 60

Max. Cholesterol (mg): 300

Max. Saturated Fat (g): 25

Max. Vitamin D (mcg): 15

Item	Description	Calories	Protein	Fat	Carbs
I.1.	Angus Beef Omelet with Potato Pancakes	1 5.29 11.04 (250g)	2.8	2.8	20
I.2.	Chocolate Covered Water Cookies with Peanut Butter Filling	1 6.09 Unknown	4.2	4.2	0
I.3.	Mixed Mushroom & Spinach Quiche	1 3.09 16.8	6.2	0	0
I.4.	Reserve	0 0.00 0.00	0.0	0.0	0.0

Total Cost: \$71.87 | Total Calories - 15762

MACROS: Protein - 420 | Fat - 547 | Carbs - 2493

Substitutions

Swap these items from the generated list with any set of alternatives to create a meal plan more suited to your taste. Alternatives are nearly identical in Macros, and only \$0-4 more expensive than the original item.

Remove (Swap Item)	Add (New Item)
1. Mixed Mushroom & Spinach Quiche	2. Sweet Potato Pancake
1. Chocolate Covered Water Cookies with Peanut Butter Filling	1. Chocolate Covered Water Cookies with Peanut Butter Filling
2. Chocolate Covered Water Cookies with Peanut Butter Filling	1. Chocolate Covered Water Cookies with Peanut Butter Filling
3. Chocolate Covered Water Cookies with Peanut Butter Filling	1. Mixed Mushroom Quiche
4. Chocolate Covered Water Cookies with Peanut Butter Filling	1. Mixed Mushroom Quiche

Macronutrient Distribution



CHALLENGES



CHALLENGES

- **Data Collection:**
 - Utilized APIs and web-scraping techniques to collect accurate and relevant data Trader Joe's products.
- **Missing values & Duplicates:**
 - Key attributes required replacement as many values were missing or incorrect (Protein, Calories, and Retail Price).
 - Duplicated entries in the data were removed to ensure accurate optimization model.



CHALLENGES

- **Constantly updating prices and inventory:**
 - Trader Joe's changes prices daily, and items are discontinued seasonally (no central database for up to date information).
- **Scope of Model:**
 - Could have a model with 100s of parameters, difficult to capture all edge cases and nutritional nuances.

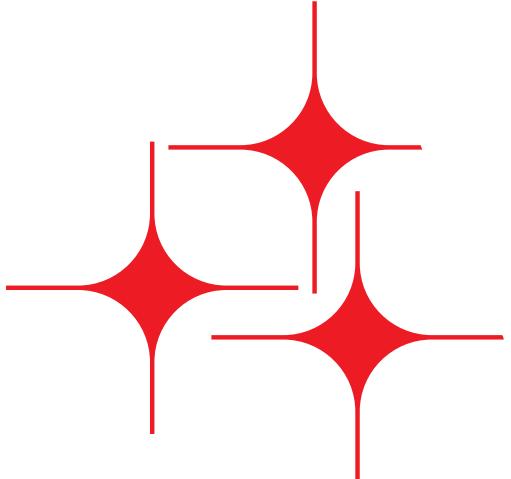




GENERATIVE AI USE

Used to create Streamlit UI over our model

- Generated a step-by-step guide to convert our model into an app, personalized for our code.
- Helped transform a static, hardcoded solution into a dynamic, user-friendly, visual tool.



CONCLUSION



CONCLUSION - PROJECT IMPLICATIONS

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- 1. Individual and family benefits:** Provides practical solution for maintaining a healthy diet on a budget.
 - 2. Institutional application:** Could be scaled follow dietary guidelines organizations and serve institutions such as schools, hospitals, and nursing homes.
 - 3. Public health impact:** Provides a foundation for government or non-profit programs focused on improving food access.
 - 4. Future research:** The model can be expanded and adapted to other grocery stores that provide features like discounts, loyalty programs, and coupon usage.



THANK
YOU

