**Project Name: 7-11 Meal Optimization**

**Team Name:** 7-11

**Members:**


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1. **Project Overview Diagram**

**Input:**

The input of this project separates to 3 inputs as the following:

1. 7-11 Product data which extracted nutrients such as calories, fat, carbohydrate and protein and categorize it from web scraping.
2. 7-11 Product Price from web scraping.
3. User preferences such as expectation cost, expectation for each nutrient.

**Product Category:**

We categorize 7-11 food products as the following categories. We are interested in only the food products category. Other categories are not included.

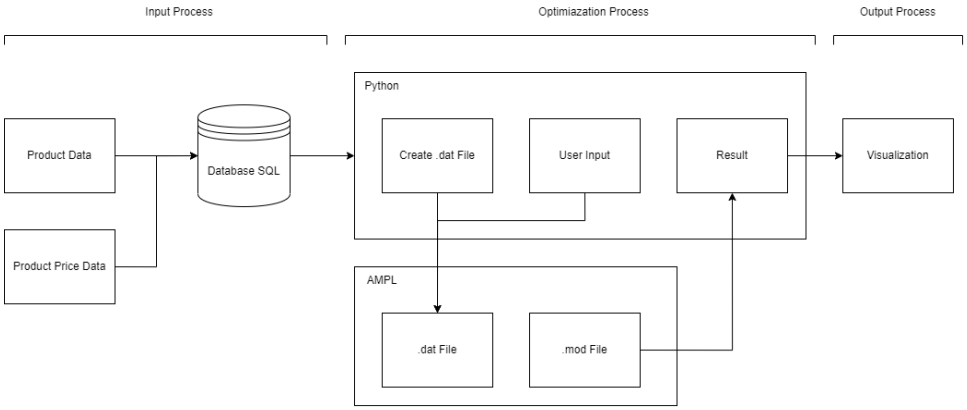
**Food product categories**

1. Frozen Food
2. Appetizer
3. Beverage
4. Milk
5. Bakery
6. Snack
7. Ice Cream
8. Instant Food

*Figures 1: 7-11 Product Categories*

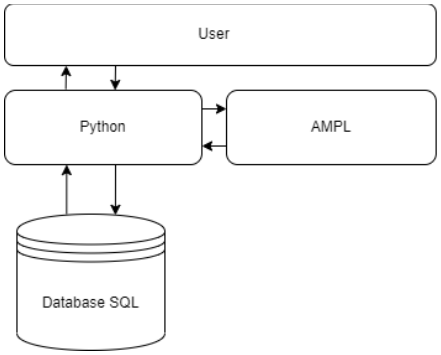
## Process

### Product data Extraction




*Figures 2: Project Overview Diagram*

In this project, we have extracted data from fit-d.com and 7eleven.co.th due to their availability for data scraping. These websites have information about the list of 7-eleven products, cost, and the nutrition of each product and we have extracted and transformed data into SQL database.




*Figures 3: Technology Stack Diagram*

After we transform data in database, we use Python to pull data from database, SQLite, receive user preferences about nutrients required and the maximum cost per meal to be constraints of the optimization model (.mod file) and create a data file (.dat file) which is a template for using AMPL simplex to solve optimization model.

### Output

Then, we create the optimization model using AMPL to find the sets of meal per day or per week (the optimal solution) depending on users with minimum cost (the objective function). After

getting the results, we send the results from AMPL back to Python to do the visualization and display the results, sequential of products sets to users.

## 2. Overview Description

We have known 7-11 is a most famous convenience store which have more than 13,000 branches in Thailand, average more than 900 person per day for each branch. From problem, what do we eat when coming to 7-11, it is a simple question but difficult to answer because 7-11 has a lot of kinds of products that look very tasty. Have you ever faced this situation when it is time to eat but you are unable to decide what to eat? Your stomach is dying out of hunger while your brain is like 'what should I eat?'. During that time, you wish someone, or something could help you make the right choice. Because you have no idea what exactly you want to eat.

Therefore, the objective of this project is to aim to solve this problem by recommending what customers should decide to eat with cost and nutrients condition using optimization model (simplex algorithm) to find optimal solutions which is the sets of meal per day or per week (the optimal solution) depending on users with minimum cost (the objective function).

## 3. Optimization Model

```
from amplpy import AMPL, tools
ampl = tools.ampl_notebook(
    modules=["cplex"],          # modules to install
    license_uuid="default",     # license to use
    g=globals())                # instantiate AMPL object and register magics
```

```
ampl.eval(
    r"""
    reset;
    option solver cplex;

    set nutr;
    set id;

    param price {id} > 0;
    param pdf >= 0;
    param m_min {nutr} >= 0;
    param m_max {i in nutr} >= m_min[i];

    param amt {nutr,id} >= 0;

    var Buy {j in id} integer >= 0;

    minimize Total_Cost:  sum {j in id} price[j] * Buy[j];

    subject to Diet {i in nutr}: m_min[i] <= sum {j in id} amt[i,j] * Buy[j] <= m_max[i];
    subject to const1 : sum {j in id} price[j] * Buy[j] <= pdf;""")
```

## 4. Result

After entering the necessary information as input information which are age, gender, the number of day(s) [1-7 days] and budget per meal as shown in figure 4.

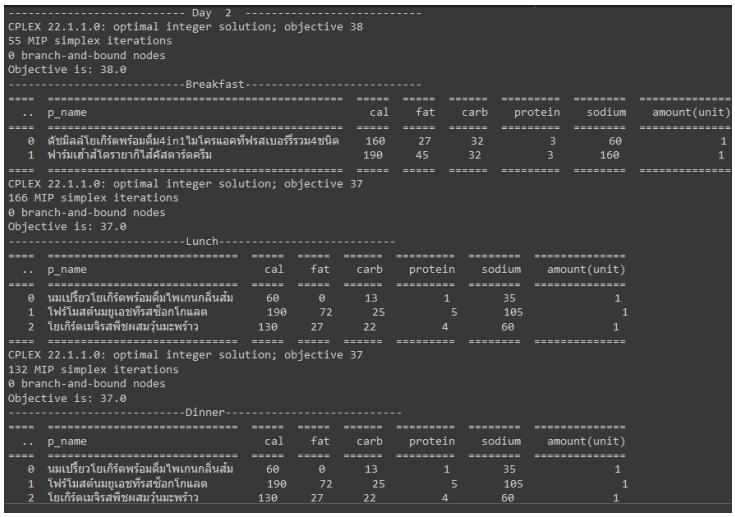
```
Please enter # of day: 7
Please enter your age: 0
Invalid age. Please enter an age between 0 and 120.
Please enter your age: 1
What is your name? : u
Hello u! To calculate your appropriate nutrition, PLEASE SUBMIT YOUR AGE AND YOUR GENER.
Please enter your sex (type 'm' or 'f' ): m
Please enter your budget: 200
```

*Figures 4: User Preference Input*

The program will find the optimal solution and find the value of the objective function (min cost) by calculating the cost of each food item as the objective function (min cost) and the nutrition of each meal to match o match with the constraints. Then, the program will generate the solution which is the food of each meal. In this scenario, we require a 7-day food menu which consists of three meals per day, so the program will generate 21 meals of this round. The results are shown as the following.

```
---------- Day  1 ----------
CPLEX 22.1.1.0: optimal integer solution; objective 37.25
70 MIP simplex iterations
0 branch-and-bound nodes
Objective is: 37.25
-------------------------Breakfast-------------------------
    ..  p_name                                  cal    fat    carb    protein    sodium    amount(unit)
    0   ไทย-เดนมาร์คนมยูเอชทีรสจืด              130     72       7          8        80               1
    1   เพียวริคุชาขาวน่ำเก๊กฮวยขาวพร้อมดื่มผสมชาขาว   80      0      20          0        30               1
    2   เมจินมพาสเจอร์ไรส์กลิ่นกล้วย            140     45      19          5       100               1
CPLEX 22.1.1.0: optimal integer solution; objective 35
32 MIP simplex iterations
0 branch-and-bound nodes
Objective is: 35.0
-------------------------Lunch-------------------------
    ..  p_name                        cal    fat    carb    protein    sodium    amount(unit)
    0   กูลิโกะป๊อกกี้รสคุกกี้และครีม    220     81      32          3        75               1
    1   โยเกิร์ตเมจิรสองุ่นผสมวุ้นมะพร้าว   130     27      21          4        65               1
CPLEX 22.1.1.0: optimal integer solution; objective 35
59 MIP simplex iterations
0 branch-and-bound nodes
Objective is: 35.0
-------------------------Dinner-------------------------
    ..  p_name                        cal    fat    carb    protein    sodium    amount(unit)
    0   กูลิโกะป๊อกกี้รสคุกกี้และครีม    220     81      32          3        75               1
    1   โยเกิร์ตเมจิรสองุ่นผสมวุ้นมะพร้าว   130     27      21          4        65               1
```

*Figures 5: Food Menu in First Day of Week*



```
------------------------- Day  2  -------------------------
CPLEX 22.1.1.0: optimal integer solution; objective 38
55 MIP simplex iterations
0 branch-and-bound nodes
Objective is: 38.0
---------------------------Breakfast---------------------------
====  ============================================  =====  =====  ======  ========  ========  ==============
  ..  p_name                                          cal    fat    carb    protein    sodium    amount(unit)
====  ============================================  =====  =====  ======  ========  ========  ==============
   0  ดัชมิลล์โยเกิร์ตพร้อมดื่ม4in1ไมโครแอคทีฟรสเบอรีรวม4ชนิด    160     27      32         3        60               1
   1  ฟาร์มเฮ้าส์ไดรายากิโส์ศัสตาร์ดครีม                  190     45      32         3       160               1
====  ============================================  =====  =====  ======  ========  ========  ==============
CPLEX 22.1.1.0: optimal integer solution; objective 37
166 MIP simplex iterations
0 branch-and-bound nodes
Objective is: 37.0
----------------------------Lunch----------------------------
====  ============================  =====  =====  ======  ========  ========  ==============
  ..  p_name                          cal    fat    carb    protein    sodium    amount(unit)
====  ============================  =====  =====  ======  ========  ========  ==============
   0  นมเปรี้ยวโยเกิร์ตพร้อมดื่มไฟเกนกลิ่นส้ม     60      0      13         1        35               1
   1  โฟร์โมสต์นมยูเอชทีรสช็อกโกแลต        190     72      25         5       105               1
   2  โยเกิร์ตเมจิรสพีชผสมวุ้นมะพร้าว         130     27      22         4        60               1
====  ============================  =====  =====  ======  ========  ========  ==============
CPLEX 22.1.1.0: optimal integer solution; objective 37
132 MIP simplex iterations
0 branch-and-bound nodes
Objective is: 37.0
----------------------------Dinner----------------------------
====  ============================  =====  =====  ======  ========  ========  ==============
  ..  p_name                          cal    fat    carb    protein    sodium    amount(unit)
====  ============================  =====  =====  ======  ========  ========  ==============
   0  นมเปรี้ยวโยเกิร์ตพร้อมดื่มไฟเกนกลิ่นส้ม     60      0      13         1        35               1
   1  โฟร์โมสต์นมยูเอชทีรสช็อกโกแลต        190     72      25         5       105               1
   2  โยเกิร์ตเมจิรสพีชผสมวุ้นมะพร้าว         130     27      22         4        60               1
```

*Figures 6: Food Menu in Second Day of Week*

The displayed results represent pre-divided daily menus, categorized into various meals.

## 5. Future of work

The result is not exactly complete. The daily menus from menu generator cannot become daily menus in reality because sometimes we do not want a lot of variety of foods, but the menu generator eliminates the menu eating in past, constraints did not effective enough and user preferences (user input) does not enough, we need more inputs like each nutrient requirement. Therefore, to improve the performance of the generator there are issues that need to be implemented. Constraints need to be thoroughly rethought to meet the customer's needs. Adding more user preferences and constraints to develop menus generator accuracy.

For the future work, we can use the logic of this project to completely create a menus generator program not only for 7-11 products, but we can use any data, which was separated from computational logic, to generate menus.

**Code:**

https://colab.research.google.com/drive/1zrB_dLdczhWImWMnS3n95PCDnixGr6wG?usp=sharing