Optimization Problem To Get The Most Protein In One Week

* Background and Motivation:

1. Motivation:

In the modern world , people gradully pay attention to our health . Instead of eating whatever we want to eat , we begin to choose some healthy diet . Some people who like to exercise or even want to make themselves more stronger will definitely need a lots protein to make their muscles bigger an bigger . Although taking in whey protein is the quickest and the most efficient way , the price of it is a huge obstacle to normal students . So how to take in protein from our daily diets with the appropriate cost is very important to us .

1. Background:

Why we start to pursue more muscles now ?

According to many researchs , it is undoubtedly to say that having more muscles instead of fat is more benefitial to our body . The following are five main benefit for having more muscle :

1. Increase body’s basal metabolic rate(BMR),and it can make us lose weight more efficiently . Also , accumulating fat will be not easy .
2. Enhance athletic ability , and avoid getting injuries while doing exercise .
3. Increase bone density , make our bones stronger , and slow down aging .
4. Make life easier , and reduce the muscle fatigue caused by sitting or standing too long .
5. Reduce the risk of chronic diseases , like cardiovascular disease .
6. Problem Definition:

This study finds the most protein that we can take in within budget and plan to decide the diets that we are going to have in one week .

* Methodology

1. What is the method you choose to analyze your work?

Linear Programming

1. Why you choose this method? Is this method fit your problem?

Cause we want to find a optimal solution of diet in one week. And, there are too many contraints to predict a direction. Linear programing can provide us certainty of solve. By using Gurobi, we can also largely decrease calculating time of solving problem. So, we thought linear programing is the best method to solve the problem.

* Data Collection And Analysis Result

1. Data Collention

We recollect our experience of eating Tainan’s famous or delicious food beside NCKU . Trying to find the cost of food and using information on the internet to estimate the calories and proteins of these data . But it is not enough to satisfy 60 items. We went to find and taste food , collect the data by ourselves . Then, we use the address of these stores and Google map to get the distance from CSIE dep. Building to these stores . After that, we have cost, calories, proteins and distance of each food items to solve the problem .

1. Model Formulation

a.

b.

c.

d.

1. Analysis

# -\*- coding: utf-8 -\*-

"""

Created on Mon Nov 13 21:30:46 2017

@author: user

"""

#請拉長output console 不然看可能不到全貌XD

from \_\_future\_\_ import print\_function

from gurobipy import\*

m=Model("Best\_Protein\_Week\_Menu\_Near\_NCKU")

meal,type,prote,kcal,cost=multidict({#type:1=主餐 , 2=甜點

('蝦餃'):[1,2.09,54,75],('紅燒花枝羹'):[1,26,480,65],

('紅燒土魠魚羹米粉'):[1,25,596,80],('蝦捲'):[1,30,260,50,],

('烤雞腿便當'):[1,40,985,85,],('碗粿'):[1,20,6,435,30],('肉粽'):[1,12.8,381,30],

('乾炒鱔魚意麵'):[1,40,640,180],('炒羊肉'):[1,47,680,110],('魚皮湯'):[1,21.8,135,60],

('黑蛋奶'):[2,8,653,50],('牛奶泡芙'):[2,4.4,344,50],('甜甜圈'):[2,4.9,452,20],

('紅豆餅'):[2,6.25,200,15],('奶油車輪餅'):[2,7,253,15],('豬腳飯'):[1,30,815,70],

('番茄麵'):[1,20,500,50],('鴛鴦奶茶'):[2,1,462,55],

('豬心冬粉'):[1,16,260,45],('壽喜燒拉麵'):[1,24,790,60],('雞排便當'):[1,35,1040,60],('鴨肉飯'):[1,40,900,55],

('蘿蔔糕加蛋'):[1,11.6,290,30],('炭烤雞排飯'):[1,46,1060,85],('碎雞鐵板麵'):[1,37.6,850,70],('泰式豬排飯'):[1,29,770,60],

('大麥克買一送一'):[1,27.1,1078,79],('義式香草紙包雞餐'):[1,45,832,129],('水餃(20個)'):[1,32,968,70],('鮪魚蛋誁'):[1,14,389,30],

('招牌鍋貼(10個)'):[1,50,640,60],('地瓜球'):[2,0.5,467,20],('鵝香飯(大)'):[1,26.5,653.5,35],

('牛肉湯麵'):[1,16.8,563.2,50],('皮蛋豆腐'):[1,10.5,199.5,30],('咖哩飯'):[1,28.5,644,50],('金萱茶+椰果(微糖)'):[2,0,145,30],

('阿薩姆紅茶'):[2,0,60,30],('四季春茶'):[2,0,80,30],('燒仙草'):[2,2.21,94,45],('叉燒飯'):[1,30,70,800],

('腿蒸蛋飯'):[1,45,65,308],

('肉燥飯'):[1,17,30,413],('麻將乾麵(大)'):[1,6.2,25,175],

('咖哩飯'):[1,13,70,415],('鮪魚蛋餅'):[1,19,25,384],

('玉米蛋餅'):[1,12,20,291],('豆漿'):[2,6,15,60],('蔥餅'):[1,7.2,15,240],('嫩骨飯'):[1,21.4,55,298],

('豬排飯'):[1,30,85,471],('牛肉湯麵'):[1,8.8,70,291.2],

('草莓大福'):[2,3.6,25,310],('日式熔岩蜂蜜蛋糕'):[2,6.25,60,320],('綠豆薏仁湯'):[2,3,35,182],('阿華田'):[2,2,30,60],

('奶茶'):[2,1.2,20,186],('麥香雞'):[1,14,49,380],('勁辣雞腿堡'):[1,27,69,560],('陽春麵(湯)'):[1,14,40,223.5]

})

num\_main=0 #主餐個數

num\_dessert=0 #甜點個數

weekkcal=0

weekcost=0

x={}

#設定x[d]為d餐點有選或沒選

for d in meal:

x[d]=m.addVar(vtype=GRB.BINARY,name="x\_%s"%(d))

#目標函數

m.setObjective(quicksum(x[d]\*prote[d] for d in meal),GRB.MAXIMIZE)

#一周28餐(包括甜點)

for d in meal:

m.addConstr(quicksum(x[d] for d in meal)<=28)

#算出主餐和甜點個數

for d in meal:

if type[d] == 1:

num\_main+=x[d]

if type[d] == 2:

num\_dessert+=x[d]

#算出本周花費及攝取熱量大卡

weekcost=(quicksum(x[d]\*cost[d] for d in meal))

weekkcal=(quicksum(x[d]\*kcal[d] for d in meal))

#限制一周主餐21餐 甜點7餐

m.addConstr(num\_main==21)

m.addConstr(num\_dessert==7)

#限制一周的花費<=1500

m.addConstr(weekcost<=1500)

#限制一周攝取熱量範圍

m.addConstr(weekkcal>=15000)

m.addConstr(weekkcal<=16000)

#最佳化並印出結果及菜單

m.optimize()

m.write("Best\_Protein\_Week\_Menu\_Near\_NCKU.lp")

print ("本周最高蛋白質攝取: %g g"%(m.objVal))

print ("本周熱量攝取: %g 大卡"%(weekkcal.getValue()))

print("本周消費金額: %g 元"%(weekcost.getValue()))

print("")

print("本周菜單:")

print(" 一 二 三 四 五 六 日")

count=0

cnt=0

if m.status == GRB.Status.OPTIMAL:

solution = m.getAttr('x', x)

print("早 ",end='')

for d in meal :

if solution[d] == 1:

if (type[d]) == 1:

course\_type='主餐'

count+=1

print("%s " %d,end='')

if len(d)<27:

for k in range(0,(27-len(d))/3):

print(" ",end='')

if count==7:

print("")

print("")

print("中 ",end='')

if count==14:

print("")

print("")

print("晚 ",end='')

print("")

print("")

print("甜 ",end='')

for d in meal :

if solution[d] == 1:

if (type[d]) == 2:

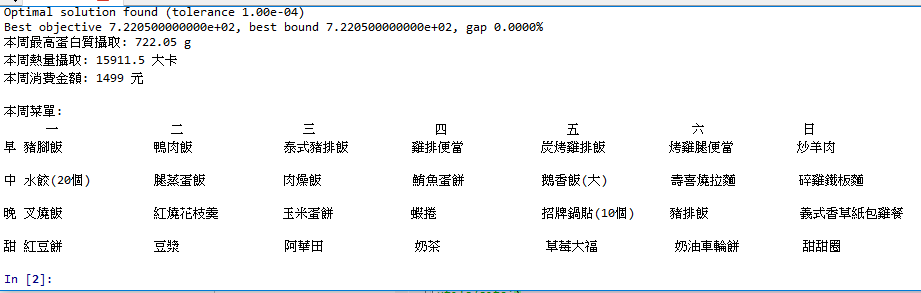
course\_type='甜點'

print("%s " % (d),end='')

if len(d)<27:

for k in range(0,(27-len(d))/3):

print(" ",end='')



* Conclusion

All in all , we found the best menu for one week to someone who are pursueing muscle or even bodybuilder . Through our own experience and a lot of field research , we got several data of food’s information beside NCKU . We used these data , set some constraints , and then used python + gurobi to find the optimal solution . Finally , we got the most suitable menu for a week for protein pursuer . For normal students like us , the most troubling thing is deciding what to eat each meal . This menu can also help us choosing what to eat instead of being disturbed by deciding what to eat .

We think that we can expand the scope of our project , maybe not for a week , a month or even a year . And we can add more constraints , like avoid choosing too large ratio of protein and calorie , expand the number of data … etc .