### Team Number: 7

**Meal Prep Service**

1 Problem Statement :

**What is the problem that you are focusing on?**

In the 21st century the most valuable resource is time. People are always wishing for more hours in the day. They wake up go to work for 8-10 hours, most likely rush home to help care for their family, tend to the constantly growing chore list, and many more tasks, all before preparing for the next day and getting too little hours of sleep to just wake up and repeat the cycle all over again. This vicious cycle leads to poor food choices since the food source must be mobile and instant.

The average person doesn’t have the time or the knowledge necessary to calculate their daily calorie intake and then prep the required quality food to reach that number. This is the reason why most people don't eat as healthy as they should. Everyone always has good intentions with their food choices but when other factors come into play, it’s hard to stay true to those goals. They prioritize other things such as work, school, personal relationships etc. ahead of their diet. This leads to people almost always choosing the most convenient meal available. Nine times out of ten, the most convenient meal is not a healthy and nutrition meal. It is typically a fast food meal that is calorically dense with no quality nutrients and vitamins. This leads to the average person’s everyday diet lacking essential nutrients and vitamins necessary for a healthy lifestyle. If this trend of constantly choosing a convenient but unhealthy meal is to continue, the individual will have a future full of health problems.

**Why is it an important problem to solve, now?**

This problem of lacking adequate time for the average person prepare and consume a quality diet has caused a major obesity epidemic (prominently in America). This trend of constantly choosing a convenient and unhealthy meal puts the average person into a vicious cycle that will lead to a future of healthy problems. People feel they get stuck in this negative loop that is impossible to get out of. This harmful trend is what our service wants to break.

In the average person’s day, they don’t have enough time to prepare and cook a healthy and tasty meal. Whether at home or at work, during the week or on the weekend this problem arises. People know that they have a problem of consuming an unhealthy diet, but feel as if they are drowning in it. This is where our service comes in to save them from their problem and help them flourish in their everyday life.

Within our service, each individual will input common variables in to our program such as age and gender and pair that with the average daily physical activity of a typical person to form a meal plan that is tailored to each individual. Our goal is to help busy people achieve the healthy/body goals that they've always wanted. Since people want a mobile and instant meal, our service is a perfect match. Our service sends people already prepared meals according to their current stats. Each individually prepared meal is distinctive and catered to the individual’s tastes allowing the individual to consume a healthy and tasty meal even during a busy schedule. It takes all the stress out of meal planning as they can just pick up a meal and go about their day. This puts them on the right track to a healthy lifestyle and their ideal body.

2 Dataset:

**Describe the dataset you chose for this project.**

We chose the data set “MyPyramid Food Raw Data.” This data set shows a set of nutritious facts on a plethora of foods. These nutrition facts include portion size, grains, saturated fats, and calories. In addition, we pulled from another data called MacronutrientData.csv because we needed macronutrient information such as protein, carbohydrates, and fats. This info was critical because most of how we calculate or measure a healthy diet is through the recording of macronutrient data. Finally we analyzed data from <https://www.cnpp.usda.gov> which provided average daily caloric intakes for men and women of ages ranging from one to seventy-six +. These three data sets will be able to combine to give the user a base level template of what their diet should look like based on age and gender. The decision support system will be able to understand what people in a certain age group are supposed to eat throughout the day regarding calories. Once we get that information we can have a meal inputted that meets the allotted amount of calories. This in turn will make the users life easier because they will know the exact amount of food they can intake at that specific sitting.

**What is your data resource?**

The source of the daily caloric average for people spanning one to seventy-six came directly from the United States Department of Agriculture. The caloric average ranges from one-thousand calories to two-thousand eight-hundred calories for males, and one-thousand calories to two-thousand calories for females. This data is based on the fact that the user is “somewhat active” which we decided to use simply because the largest amount of people would be classed in that category. One can see why this is key to help consumers meet dietary guidelines and manage their weight by understanding how many calories they consume.

This means that our Decision Support System will be as accurate as possible without having to ask for daily activity. In addition we have two other data sets which show us what the macronutrients (carbohydrates, proteins, and fats) are for a wide range of food. The caloric value of each food is also mapped out in a third data set that was specifically pulled from Data.gov, which is a government sponsored data archive encompassing a wide range of topics.

In conclusion, we can see that we have to take into account a couple of different factors using data from a couple different resources.

**Define every variable in your dataset**

The first variable we are taking is the persons age. From that age we can derive the recommended amount of daily calories using Estimated Energy Requirements (EER) equations. Since we are just learning how to use python we have decided to limit the factors as to not go too far outside of what were capable at this time. That being said we are utilizing reference heights (average) and reference weights (healthy) to try and get the most accurate data for the most amount of people. The second variable in our data set is gender which is actually an input by the user. This information is entangled in the first data set with the age to recommended caloric intake. Moreover, the other variables in the data set are the caloric value for different portions of different foods. Finally, there is a data set with macronutrients which illustrates the value for carbs, protein, and fats for a portioned amount a bunch of different foods. As one can see, the final product will be able to take all of those variables and use the input information we give it to generate a meal which will represent one third of your nutrients for the day in terms of calories spread out in different percentages of carbs, fats, and proteins that will be determined by the national averages for a healthy diet.

**Reference for your dataset.**

Our data sets are made up of different information that will come together to form a Decision support system capable of generating a meal that is on par with the amount of calories that you as an individual are recommended to eat on that day. Our data is taken from a couple of different (but credible) sources that include but are not limited to the United states department of agriculture, health.gov, and the president's council on sports, fitness, and nutrition. Some of the data in these locations is data that is based on averages which was calculated based surveys done of one thousand plus people. For example, the data set that gives us the recommended calorie count for all the different types of ages is utilizing average height, average weight, and average physical activity (one to three miles per day) of a male and female. As I stated before, the people who created that data set surveyed one thousand plus men and women to come up with a standard that can be applied to the masses. In conclusion, one can see that our data is from a very reliable and trusted source. We are confident this will show true in the outcome of our Decision support system.

3 Modeling Type and Technique :

**Explain precisely the modeling techniques that you chose for this project.**

The model will be broken down by age group and gender. It is assumed that each user will have a moderately active lifestyle, in addition an average height and weight is taken for each of the groups. Once the user in puts their gender and age the model then locates what their caloric intake needs to be. Food options will be organized into a list, from there the user selects what they prefer based their own taste or possible allergies. The system will then use our database of food and organize them into options for each meal, and again the user can select what they prefer for each meal. Each week the user will have to opportunity to change meals in order to avoid eating the same options each day. The database will use the daily caloric intake facts mainly to select the portion sizes and types of food in order to correctly meet the range for each user. An equation will be made to multiply each amount of food in grams, multiplied by the percent of calories for each, to be able to easily break down the macronutrients. For example nine calories from one gram of fat, 4 calories from one gram of carbohydrate and 4 calories for one gram of protein as well. This equation will be formulated with these variables within it to be able to properly reach the specific caloric intake for each user, it will be simple for users to easily input multiple entries and quickly calculate based on the input. The plan is to further investigate the effects of each macronutrient and then be able to create the most accurate formula to reach the desirable goal.

The model will take the form of a recommender system, meaning our support system will generate a recommended meal plan for breakfast, lunch, and dinner for each user including portion size, satisfying their specific caloric and macronutrient needs, and abiding by food allergy constraints entered and our assumptions listed in our design. This recommender system will be structured similar to a linear programming model, meaning our output will maximize the nutrition for our users, and will be constrained such that caloric and macronutrient needs are meet at a minimum. For example, for a male who is 37 years old, the daily caloric need according to the USDA is 2,600 calories. This translates to roughly 1,170 calories coming from carbohydrates, 715 calories from proteins, and 715 calories from fats. Our system would generate 3 meals, a breakfast, lunch and dinner, each including unique food combinations that sum together to satisfy the set nutrition constraints.

**What is your modeling methodology?**

In the modeling methodology we will take input from the user based upon their preferences on the foods that will be available in our system. Once they have input this three meals for each day will be generated to meet the daily caloric intake. The process will follow a simple series of questions and write the data into arrays for each day. Before they begin they will have the option to select foods they would prefer in each food group, these selections create the constraints for the model, and remove options that the user does not wish to consume. In addition the user will input any food allergies, which will remove certain choices from our database. The model will first categorize the user into a gender group which will automatically have a predetermined height and weight average based on our database. The model then access the database to bring in the daily caloric need and input it into the formula. Once this has been made meals will be randomly selected in are written into the columns of our array.

For example a day could be formed as below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Meats/Poultry | Vegetables | Fruits | Dairy | Grains |
| Breakfast | 2 eggs | 1/2 cup Spinach | 1/2 cup blueberries | None | 1/2 cup oatmeal |
| Lunch | 1 8oz Chicken Breast | 1 cup Asparagus | 1 Apple | 1 cup 2% milk | None |
| Dinner | 8oz skirt steak | 1 cup Broccoli | None | None | 1/2 cup rice |

Below the array the caloric information will be displayed to show the breakout of calories and show where the macronutrients are coming. The quick printout can simply be repeated as well if the user would like to choose different options. Once the user is satisfied with the plan, the model will then send the information for the meals to be made and shipped to the user.

**Explain all the steps involved in the design and code.**

Overall design of meal selection process takes the form of an array, each cell containing a nested array with common foods and their respective nutritional facts, such as calorie and macronutrient counts. Calories are listed as kcal(s), which is the standard unit of energy found on most nutritional labels, each macronutrient is listed as gram(s). The overall array takes the form of a 6x3 matrix, the columns (6) representing 6 food groups listed below and the rows (3) representing the three standard meals in a day

* + The following 6 basic food groups make up the columns of the array
    - Meats/Fish, Vegetables, Fruits, Dairy, Grains, Others
  + The foods in these food groups are then categorized by meal, which make up the rows of the array
    - Breakfast, Lunch, Dinner

Our Decision Support System is designed to receive input from our users, including information regarding their age, gender, and any food allergies they may have, such as a peanut of pork allergy. Once the user’s inputs are recorded, our system will place the user into a specific category that specifies a daily caloric requirement, with subsequent macronutrient requirements, based on the user’s age and gender. Another nested array included in our system categorizes user’s by gender and age. This array has the following 2x12 structure:

* The 2 gender groups represent the columns of the array
  + Male and Female
* The 12 age groups, which begin at 18 and range to 66+ represent the rows of the array
  + 18
  + 19-20
  + 21-25
  + 26-30
  + 31-35
  + 36-40
  + 41-45
  + 46-50
  + 51-55
  + 56-60
  + 61-65
  + 66+

\*The age groups above were taken from our USDA.gov and Health.gov resources

Once the user is classified by gender and age group, the system will recognize the specific daily caloric need for the user and will generate 3 example meals that would that need while abiding by our constraints and assumptions, which are listed below.

* + All users assume a moderate activity level
    - We define a moderate activity level as 3-5 hours of exercise per week
    - In parallel, we assume moderately active means a lifestyle that includes physical activity equivalent to walking about 1.5 to 3 miles per day at 3 to 4 miles per hour
  + Macronutrient ratios of 45:27.5:27.5 for Carbohydrates, Proteins, and Fats, respectively.
  + Constant macronutrient ratio requirements for each age group
  + User weight is negligible
  + Average male is 154 lbs @ 5"10
    - Assumption pulled from USDA.gov and Health.gov resources listed in references
  + Average Female 126 lbs @ 5"4
    - Assumption pulled from USDA.gov and Health.gov resources listed in references
  + All users have no eating deficiencies
    - To make our system simpler, we normalized our user population with the assumption that all users have no eating disorders or deficiencies that may affect their eating patterns
  + Daily caloric intake is broken into 3 meals per day (Breakfast, Lunch and Dinner)
  + All foods are raw, or uncooked
  + All portion sizes are representative of standard servings recommended by USDA

**What visualization method is used to portray your results?**

Once all of the data is input by the user the plan is display the food by each meal of the day, in this case three portions each day for breakfast, lunch and dinner. Each meal will have a breakdown of the overall calories, saturated fats and portion sizes. This method makes it simple for the user to understand what is going into their bodies for each meal. At the end of each week the user will be able to see each day their daily caloric intake is met. In addition to this if a user is unable to eat the meal provided they have an understanding of what amount of food they will need for their meal rather than blindly choosing a meal. The user will have the option to view the nutritional facts on the computer as well as a print out with each meal for the day. Results will be displayed based on weight changes, and goals of the user. After a certain amount of time users can weigh themselves and put in their weights to possibly change their needs for their caloric intakes if necessary. These changes are important because again we want to make it very simple for the user and the system will make the changes automatically without extra effort from the user.

**Why do you think chosen visualization method is apt for your case?**

This model is chosen to simplify the calculations that are made within our model, by viewing a breakout for each meal the user does not have to worry about making their own calculations for what they eat. In addition they can be able to see multiple options for meals in case allergies or other factors may change what they are able to consume. If people have to constantly record what they are eating and have to constantly count up calories, it will make it much more difficult to sustain over time. The process is meant to make it effortless for each user to meet their goals by simply using the meals provided each day. In addition the user will be able to learn during this process and discover the amount of calories in each food, which will hopefully help to teach them how to choose foods if they are on the run and have to grab something quick. The system will have charts to easily be able to tell where the calories are coming from based on proteins, carbohydrates and fats. The goal is also to ensure that the calories are meeting the need of each macronutrient and in this way it will make it simply to see that the daily meals are helping users to meet their goals.

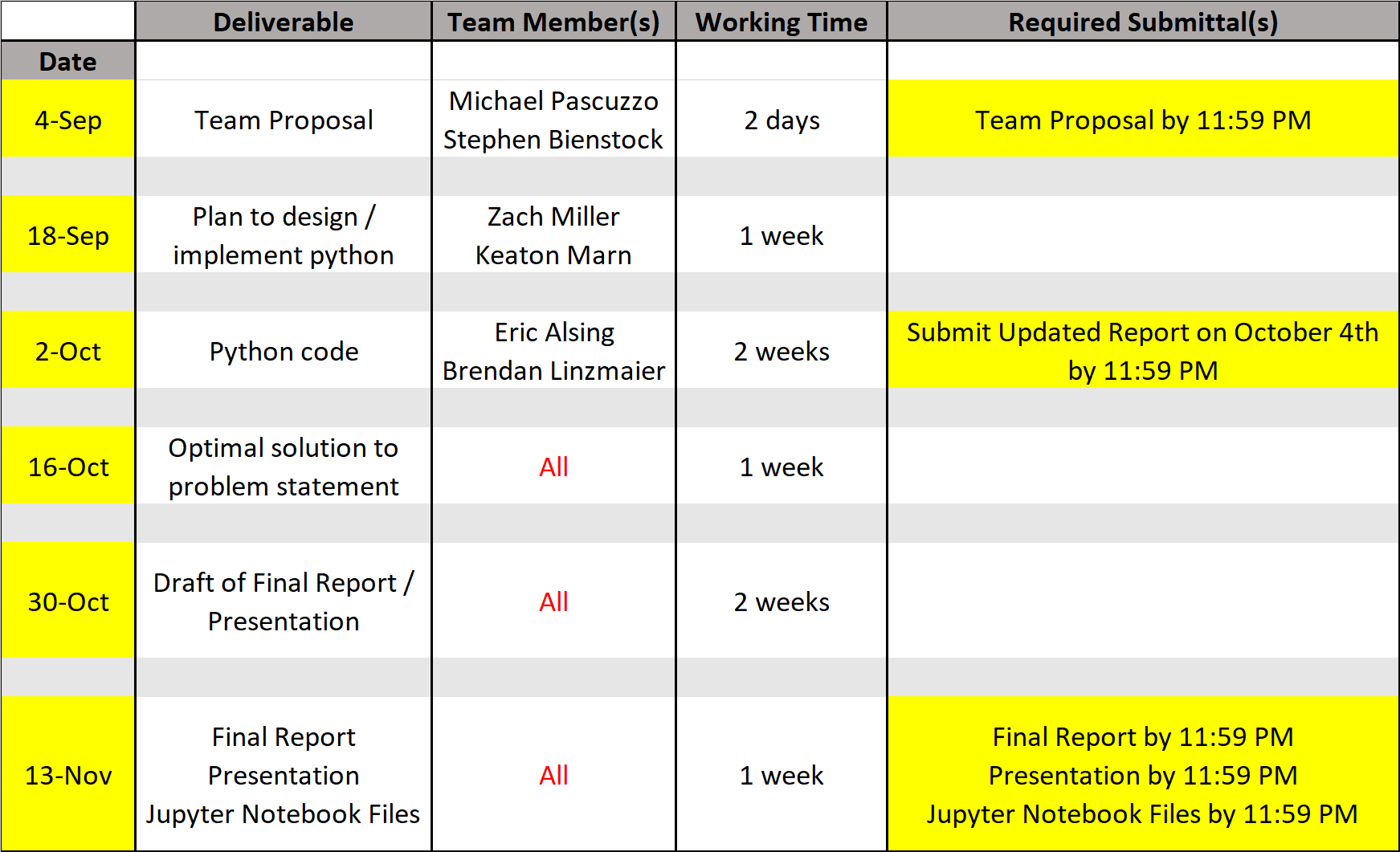
**How do you measure the performance of your model?**

The performance of our model will be based and measured primarily from user satisfaction. The simplicity and the ability of the user to compare the different alternatives presented, directly correlates to modeling success. A successful model would indicate that the user has identified and considered every possible option available to them based on their age and gender, before a decision is made. The complexity of the support system is crucial, because as a system becomes more complex, humans are limited by their own cognitive capabilities. Cognitive limitations would result in a dependence of the user on the decision support system, thus making the complexity of the model a measure of success as well. As the user begins to rely more heavily on the system for decision support, the perceived success of the system increases and the performance of the model moves towards an optimal state. An optimal level of complexity is ideal, because the quality of the outputs and the decisions made must rely heavily on the design of the model and not the proper use of the system by the individual. To elaborate, if we grow the complexity of the model and the user become dissatisfied with the system, we are able to hypothesize that our model is not performing its functions successfully, and would result in a support system failure. To make the system successful and invaluable to the user, we aim limit the user input as much as possible while also allowing the user to make easily calculated decisions for the end result they desire.

4 Progress :

**How far did you make progress in your project?**

At this point in the project, we have planned all the necessary steps for formulating and implementing the code and have begun the necessary actions to test it. We have narrowed down the constraints and the variables we will use in the code to make our overall support system successful. Our next step is to finish the initial draft the python code. After the code is completed we will be able to finalize and perfect our system, while also increasing its complexity. We have also narrowed down our data to fit our constraints, without sacrificing its variety, and have begun loading the data into the system.

**Define the tasks accomplished by every team member in a table clearly**

**How can you justify your solution to the mentioned problem statement?**

Our justification of the solution lies within the support it is providing to reduce the time and thought needed to come up with a healthy meal that fits every individual’s bodily requirements. Saying that our most valuable resource is time, most people don't eat as healthy as they should due to improper time management. They prioritize other things such as work, school, personal relationships etc. ahead of diet. With our support system, they will be able to effortlessly choose meal options without having to take the time to figure in portion size. Our service will take common variables such as, average daily physical activity, age, gender, and caloric intake to form a meal plan that is tailored to each individual. Providing a DSS that creates a path of ease to a task that an individual would normally ignore because of complexity, will make the individual want to rely heavily on the system for support. Our solution will help busy individuals maintain healthy eating habits while going about their daily routine and eliminate laziness as an excuse. This solution also does not guarantee, but gives the user the opportunity to lose weight, thus showing that our solution will also combat the universal problem of obesity.

**Why do you think your model is better than the other similar models that are in the market today?**

Our decision support system is better than similar models in the market today because our system’s data storage and access capabilities, machine-learning potential, and quick and easy to use interface that generates unique meal plans that incorporate all food groups and list out specific portion sizes to reach each user’s specific intake needs.

Since our decision support system is code based, we are able to access multiple data sources at once stored in files. We currently have a list of over 8000 foods with their respective nutritional facts that we are able to utilize to create meal combinations for our users. Of course, we will refine this list to only include raw foods, and remove any and all sauces, dressings, seasons, etc.. This differs from most models on the market today because they are not designed to access so much nutritional information.

We have been developing a machine-learning portion of our code so that our decision support system can pick up on user input patterns and select certain meal combinations that cater to our user’s taste preferences. This is something that is completely unique to any models out on the market today, as many do not cater to the taste of their users, but rather focus on achieving a certain goal (i.e. weight loss or weight gain) and structure a meal plan accordingly, or rather just a suggested caloric intake and macronutrient breakdown.

Most importantly, the our decision support system is better than most models on the market today because it does not require the user to have any knowledge regarding macronutrients or nutritional facts of the meals they eat, as the generated output of this system will outline exactly what each user is suggested to eat, with portion sizes, caloric intake, macronutrient ratios, and food allergy constraints all considered. Essentially, this removes the need of a standard “plug and play” method of meal prep planning.

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**Websites:**

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