MyMealPlan

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Project Summary:
MyMealPlan is a website designed to help students at Brown optimize their meal plan. It can be accessed at http://tinyurl.com/mymealplan

Project Description:
It includes the current menus for all Brown dining halls, whether or not a given one is open, and the specials of the day at each a listing of all Brown Dining facilities. It allows students to check their remaining credits and points and estimate whether or not they are on track to finish their meal plan early, on-time or late. By logging into the site through google authentication, a user is able to see more personal recommendations. They can rate items found in the dining halls and lookup prices. Additionally, students can add items to their cart, see the total price and receive suggestions on how to best fill up a meal credit.

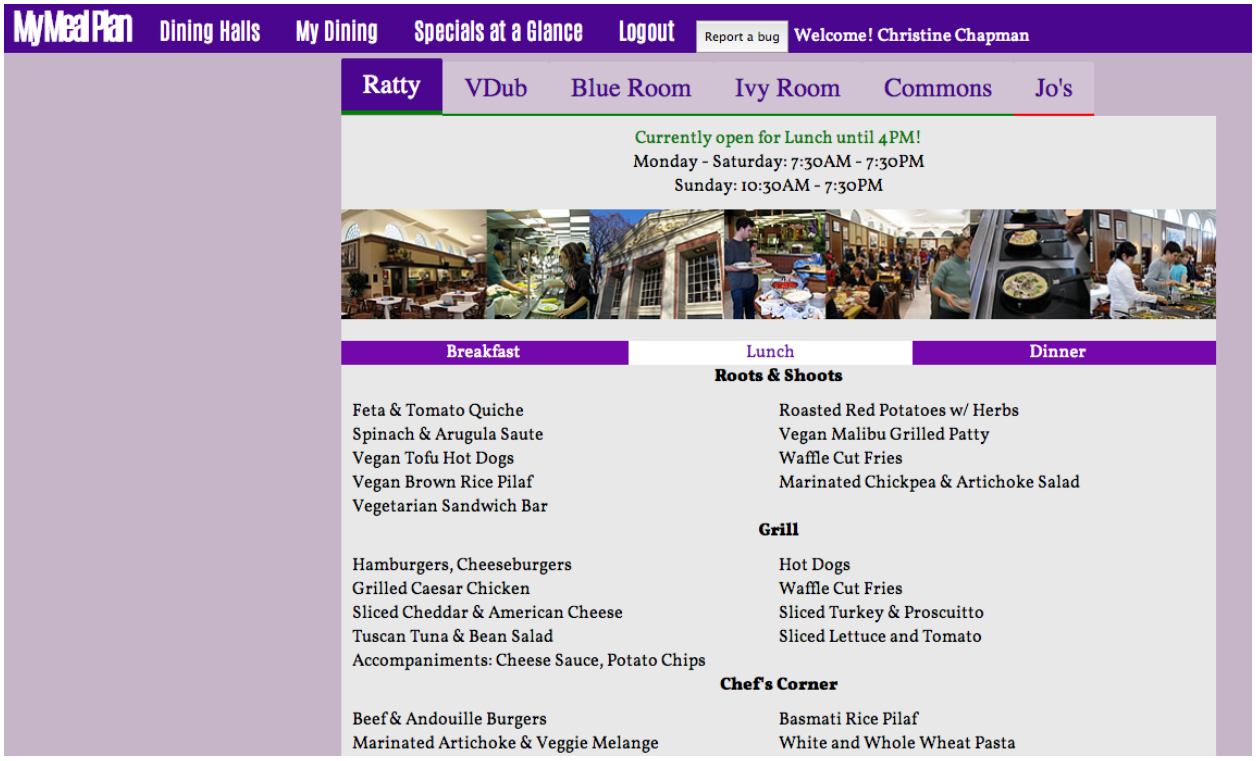
Mathematical Algorithms:
After working with the sample data we sourced, we decided the best scheme for making recommendations would be an online K-nearest-neighbors algorithm. We came to this conclusion because it is a fairly simple algorithm that will still be decently successful in making suggestions. The simplicity was a deciding factor because we did not want a significant development schedule overhead for the recommendation scheme, as it is ultimately not the most important function of the website. Because we constantly have people adding and modifying reviews, it would be extremely costly to regenerate all distances between all users every time a change occurred, as would be the case in an offline scheme. Given that it would compare each individual to each other individual, with P people in the database and F foods, the big O just for calculating the distances would be $O(F*P^2)$ before we would continue the KNN algorrithm. Instead, we serialize our client, so that the distance matrix is saved in between calls to the client. In this way, for each modification of a user's reviews, we need only spend $O(F*P^2)$ time calculating new distances. Note that this F is a loose bound, as it is highly unlikely that a user has reviewed all the foods. When guessing a review for a particular user for a particular food, the big O is O(P), where P is the number of users, as the algorithm goes through all users and finds the k closest to the user and then averages their reviews for that food. Getting suggestions is a longer operation that is essentially O(F*P), because it goes through every food and guesses the review for each. The Machine Learning is run through a main function called RunML that takes input from the command line concerning whether the server wants to add a user, modify a user, or ping for information. It opens the serialized client, does the command requested by the user, and then saves the modified client. We currently have the ML Client

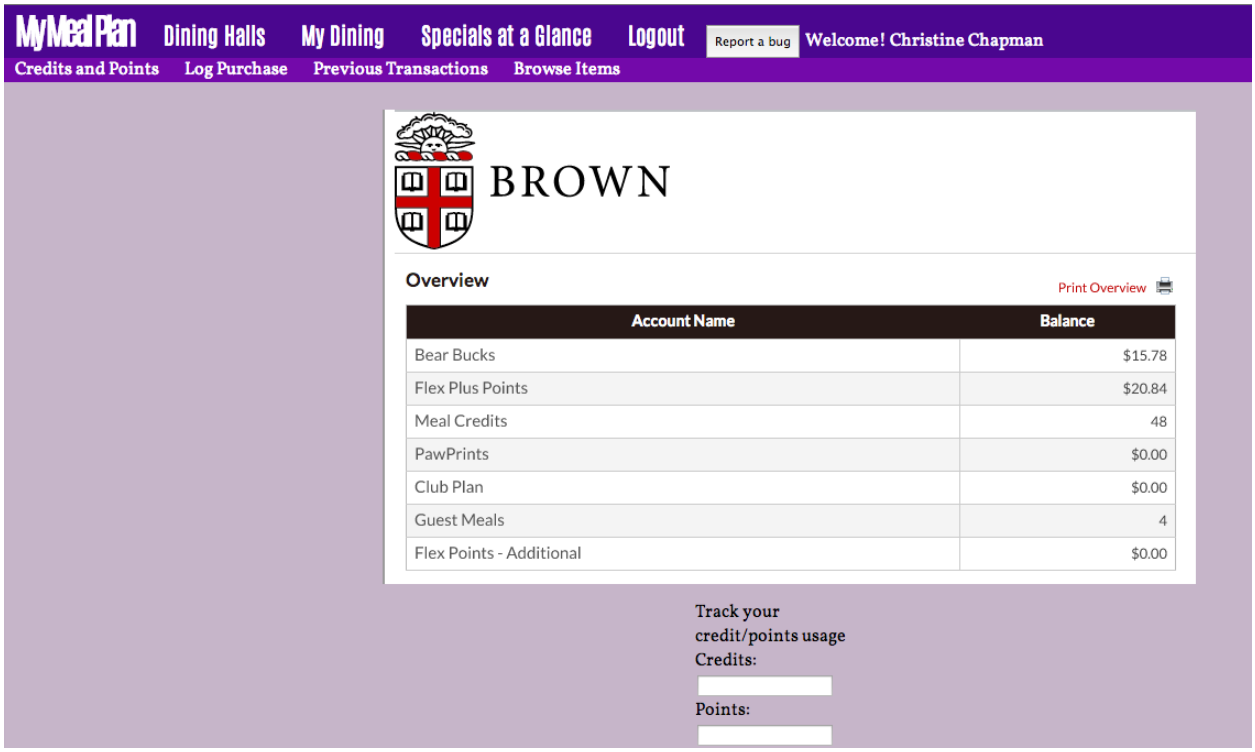
partially working for the surprise me button, but it still needs to be hooked up for the rest of the ML utilities on the website.

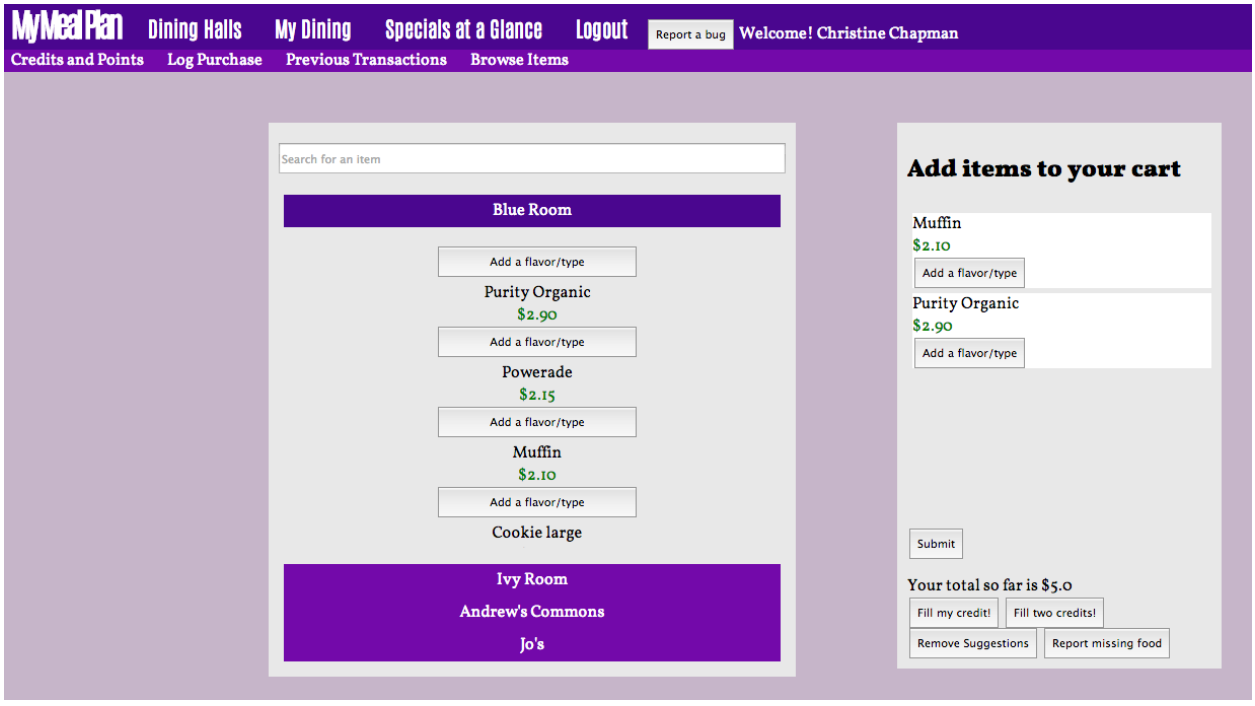
In order to fully fill a meal credit, we decided to approach it as a knapsack problem, where the items to fit in the knapsack are the different foods offered by the dining halls, and the values/costs are the prices of the foods in cents. This way, the knapsack problem attempts to maximize the price of the cart of food without going over the price of one meal credit. This is an Operations Research problem, specifically an integer programming problem, and thus to solve this problem, we implemented the solution to the problem using dynamic programming. Thus the Big O for this is O(F*C), where F is the number of foods in the database, and C is the amount of money available in the meal credit. This utility is already hooked up to the website, though there are a few security issues that we will have to fix. At first, we ran into an issue with the algorithm being entirely deterministic. Because of this, the algorithm would always suggest the same exact cart, because it would always decide ties the same way. To fix this, the algorithm now performs the Fisher-Yates shuffle on the input food list, permuting the input before running the dynamic programming. This is enough to ensure that most of the time the algorithm will produce different solutions each time the algorithm is called. In general, the backend for the mathematical algorithms that the site depends on is pretty much done, and the focus now is hooking them up to the website in a way that is secure.

Mobile:
The site works on Desktop and Mobile.

Screenshots:




MyMealPlan
Dining Halls
My Dining
Specials at a Glance
Logout
Report a bug
Welcome! Christine Chapman
Credits and Points
Log Purchase
Previous Transactions
Browse Items
BROWN
Overview
Print Overview
Account Name
Balance
Bear Bucks
$15.78
Flex Plus Points
$20.84
Meal Credits
48
PawPrints
$0.00
Club Plan
$0.00
Guest Meals
4
Flex Points - Additional
$0.00
Track your credit/points usage
Credits:
Points: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Credits and Points
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Previous Transactions
Browse Items
Search for an item
Blue Room
Add a flavor/type
Purity Organic
$2.90
Add a flavor/type
Powerade
$2.15
Add a flavor/type
Muffin
$2.10
Add a flavor/type
Cookie large
Ivy Room
Andrew's Commons
Jo's
Add items to your cart
Muffin
$2.10
Add a flavor/type
Purity Organic
$2.90
Add a flavor/type
Submit
Your total so far is $5.0
Fill my credit!
Fill two credits!
Remove Suggestions
Report missing food

MyMealPlan Dining Halls My Dining Specials at a Glance Logout Report a bug Welcome! Christine Chapman

Credits and Points Log Purchase Previous Transactions Browse Items

Search

1. Soda- small
   $1.30
2. Soda- medium
   $1.50
3. Soda- large
   $1.85
4. Coffee - medium
   $1.75
5. Simply OJ
   $2.90

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The Ratty

Spinach Fettucine Alfredo Salad Bar: Traditional Salad Bar

The VDub (Dinner)

Baked Chicken

The Ivy Room (Lunch)

Sweet & Sour Pork, Feta & Tomato Quiche

Jo's

Quesadillas, Crepes

Andrews Commons

Vietnamese Pho with Beef, Chicken or Tofu & Veggies Spicy Thai Pho with Beef, Chicken or Tofu & Veggies

Surprise Me!