How much Ice do You need?

Midterm Presentation

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Content

Sponsor: McDonald's Corporation

- McDonald's Corporation is the world's largest chain of hamburger fastfood restaurants, serving around 68 million customers daily in 119 countries.
- Mcdonald's primarily sells hamburgers, cheeseburgers, chicken, French fries, breakfast items, soft drinks, milkshakes and desserts.
- In response to healthier consumer taste, the company has expanded its menu to include salads, wraps, smoothies and fruits.
- Soda drinks is a significant portion of McDonald's business, since it is often offered as a beverage along with the extra-value meals.

Problem Statement

- Selling soft drinks is a complement to any meal that a customer purchases at McDonald's. However, the server is not accustomed to putting much thought in measuring the amount of ice put in the cup.
- This often results in a overly diluted, or overly cold drink for the customer. This is likely to lower overall customer satisfaction, since a drink is a significant complement to a meal. Thus, customers are likely to appreciate if the right amount of ice was added for optimal satisfaction.
- To further define this problem, the exogenous variables are the proportion of ice to put in a drink. The endogenous variable would be the resulting temperature and concentration of the drink, as we are assuming that a customer's satisfaction is affected only by the temperature and concentration of the drink.

Deliverables

1. From Team to Sponsor
   - A table of optimal ice proportions/ratios for each different type of soda (namely Coca Cola, Sprite, Fanta Orange, Diet Coke),
   - Matlab code with complete set of documentations that resulting temperature and dilution based on specific heat capacities and ice proportions,
   - Numerical experiment results reporting success rate of different ice proportions,
   - Technical report and presentations summarizing the work.
2. From Sponsor to Team
   - Sufficient supply of the 4 different sodas we are concentrating on,
   - Computing resources,
   - Timely responses to inquiries.

Timeline

- Work Statement due date, Sep 28, 2012,
- Midterm Presentation due date, Oct 17, 2012,
- Progress Report due date, Oct 26, 2012,
- Final Presentation due date, Nov 6, 2012,
- Final Report due date, Nov 30, 2012.

Most of the experiments and coding will be done from mid-October to mid-November.

Approach Assumptions

- Consumer's taste depends entirely on the dilution and temperature factors.
- Dilution and temperature of drink come hand-in-hand and rely entirely on the ice proportion.
- Sample group accurately represents the population's preferred combinations of temperature and dilution.
- Customer only consumes the drink after all the ice has melted.

Approach 1: Experimental

- Experimenting with different types of soda - namely McDonald's Coca Cola, Sprite, Fanta Orange, and Diet Coke.
- Using different proportions of ice, we will then find the resulting temperature of the drink, as well as calculate the resulting dilution of the drink.

Approach 1: Experimental

- By experiment, we will test out which combination of temperature and dilution will yield the highest satisfaction from the test subjects.
- We will provide 4 different cups of the same soda (different ice proportions) for the test subject to drink and they will indicate their preference. This will be repeated for 3 more days for the other 3 drinks.
- This will be a blind test and the subject will not know what ice proportions the cups A, B, C, D have.

Ice Proportion	A	B	C	D
Coca Cola				
Sprite				
Fanta Orange				
Diet Coke				

Table: Sample form each test subject will need to fill out

Approach 2: Physics-based

- Utilizing the specific heat capacities of soda and ice (already found as specific values), we can calculate the different temperatures and dilution that the resulting drink will be.
- Using data from the first approach, we can see how the theoretical combinations of dilution and temperatures compare with the ones in practice.
- This will be used mainly as a support tool since it's just mathematical calculation.

Possible Results/Analysis

1. Experimental approach
   - Experiment results will show which combination of temperature and dilution is the most popular.
   - The physics-based approach will be able to tell us the expected temperature and dilution of any proportion of ice that we use.
2. Physics-based approach
   - This approach will yield more theoretical results since it has the implicit assumption of no outside environmental interference (eg. heat loss).
   - Heat capacities of sodas and ice might be different in different climates. Thus, it is difficult to say how conclusive these calculations can be.

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   - Numerical experiment results reporting success rate of different ice ratios/proportions,
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2. From Sponsor to Team
   - Sufficient supply of the 4 different sodas we are concentrating on,
   - Computing resources,
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Advantages

- Utilizing the specific heat capacities of soda and ice (already found as specific values), we can calculate the different combinations of temperatures and dilution of the drink.
- By surveying our sample group (which should be a accurate presentation of the population), we can determine which is the most popular combination of temperature and dilution. From there, we can figure out the optimal combination of ice proportion as well.
- We are able to use physics calculations to compare the accuracy of the experiments.

Disadvantages

- Assumption that all customers have the same taste regarding temperature and dilution is probably false, yet we only offer one optimal ice proportion for each drink.
- Desired temperature of drink may also depend on location of branch and climate.
- Physics-based calculation might not be as accurate since it assumes that there is no inteference with the environment, which is not true in reality.
- It is more likely that a customer starts sipping the drink once he/she gets it, rather than waiting for the ice to completely melt.

Further Recommendations

- Perform experiments on different days with different climates.
- Split sample group based on gender and age.
- Perform experiments such that test subject starts drinking once he receives it.