

## **Weight-based cost estimation using Excel: candy, yogurt and salad applications**

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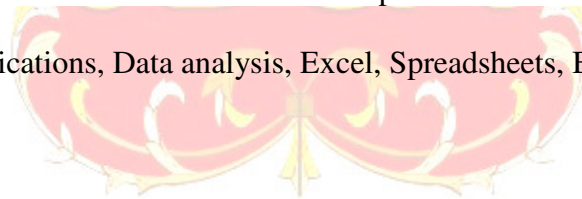
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### **ABSTRACT**

This paper presents three teaching cases involving weight-based product pricing problems. All three applications, a candy store, a frozen yogurt shop, and a salad bar, involve self-serve businesses in which customers make their own selections from a variety of products, each with different costs. The store charges by the pound or by the ounce, regardless of the contents of customers' orders, so the analysis involves Excel-based exercises to estimate typical costs per unit of weight using actual wholesaler costs and simulated samples of customer orders. The scenarios require students to utilize Excel to enter and organize data, to create simple formulas (addition, multiplication and division), and to use SUMPRODUCT to compute weighted averages, all while reinforcing absolute and relative cell referencing. The data sets for each problem and detailed instructions for students are provided.

Keywords: Business applications, Data analysis, Excel, Spreadsheets, Business Education, Cost Analysis



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## 1. INTRODUCTION

Microsoft Excel® has become a ubiquitous tool in the business world (Formby, Medlin & Ellington, 2017), used for organizing and manipulating data and creating graphs and pivot tables, among a host of other applications and uses. Therefore, Excel skills have become an important proficiency for 21<sup>st</sup> century employees, with a large percentage of “middle-skilled jobs” requiring at least basic if not advanced level knowledge (Formby et al., 2017; Geiger, 2015). In addition, in the era of “big data” positions requiring data analysis are ever more prevalent and Excel is still popular and useful to those employees (Dumbill, 2012). Spreadsheet skills are essential to success (Formby et al., 2017) especially for business students.

Freidman and Friedman (2016) argue that it is important for institutions to teach students skills that will allow them to succeed in the current economy. Institutions appear to agree, with several recent studies focusing on teaching Excel (Brooks & Taylor, 2016; Frownfelter-Lohrke, 2017; Willis, 2016; Zhang, 2014) and other computer tools (Khan, 2014; Roth & Butler, 2016)

As instructors of a freshman-level Business Information Tools course and sophomore level analytical courses in an AACSB accredited college of business, the authors prefer to teach Excel to undergraduate business majors using case studies and real-world applications that emphasize critical thinking and analytical skills. The authors believe the use of relatable problems with which students have first-hand experience benefits students and improves learning by holding student interest, making problems accessible and understandable, and encouraging students to apply common sense.

This paper presents three applications of a simple, recognizable business-costing problem to teach basic Excel skills, critical thinking and introductory business analyses. Each dataset is associated with a context familiar to beginning business students in their role as consumers. The contexts—a candy shop, a salad bar, and a frozen yogurt shop—do not rely on specialized understanding of applications from business, the physical or social sciences, technology, or education. Each dataset includes real price information and realistically simulated sales information. The motivation for the problem came from conversations with a former student whose family opened a frozen yogurt shop a block from campus; this shop is a frequent destination for local students and so it is instantly relatable.

While specific learning objectives include calculating weighted averages and percent markup utilizing Excel, perhaps more importantly, these three problems emphasize the use of Excel as an integral part of decision-making. The goal was to introduce just enough data to develop students’ problem-solving skills and alleviate their apprehension towards unstructured problems. The data have been intentionally arranged in a way that requires that students work with and convert different units of measurement. In this respect, these datasets differ from customary teaching datasets because a significant amount of thoughtful manipulation must be done before the analysis can occur. The student also needs to read the scenarios carefully to understand the nature of the decision and the best approach to the solution, providing more practice in critical and analytical thinking. The students will also put into practice the steps of workbook design, namely to determine the purpose, to identify inputs and outputs, and to organize and present data using labels and formatting.

The remainder of this article provides a description of the data, offers pedagogical uses and learning objectives, and presents the three case studies.

## 2. DESCRIPTION OF DATA

The yogurt dataset was the first to be created and stemmed from conversations with a former student who opened a frozen yogurt shop near campus. It presented an interesting business problem to consider how to establish a fixed per-ounce price for frozen yogurt orders, when customers added toppings—of varying cost and in varying quantities— of their choice to their dishes of yogurt. The cost data for yogurt, toppings, cones, bowls, and spoons are actual prices obtained from online suppliers representing real prices at the time of this writing. The quantity data, although simulated from a soft opening, represent realistic orders based on observation of customers. The candy store and salad bar problems were natural extensions of the yogurt problem and provide alternative scenarios when more than one application was needed for a larger class. Cost data for the candy and for the salad ingredients also reflect current actual prices from wholesalers.

The six datasets associated with this article include cost data (candycost, saladcost, and yogurtcost) and quantity data (candydata, saladdata, and yogurtdata) for each of the three scenarios. Each of the problems presents six components that are possible in a customer order. For example, an order at the yogurt shop may include the yogurt, up to four different kinds of toppings, and the option for including a waffle cone.

The cost data provides the price information for the store's inventory purchases. For each component (such as salad greens, yogurt, containers, spoons, etc.) the bulk cost is shown in dollars for so many units (pounds, ounces, pieces, etc.) The "saladcost" and "yogurtcost" files have an additional column that shows the bulk weight of inventory not purchased by weight (e.g. waffle cones, containers and breadsticks are sold in quantities of 216, 1000, and 180 at a time). This information is necessary to compute the cost, as eventual pricing in each shop will be done by how much weight these units add to a customer's order.

The quantity datasets each contain an index value labeled "Observation" for the 25 customer purchases in the dataset. Each observation has values for six variables providing the amount of each of six components making up that person's order.

If time permits and data gathering is important to the course learning objectives, instructors might want to have students research the current cost of ingredients or observe customer order patterns at a similar retailer instead of using the data provided. In that case, providing a list of components and empty table of the required prices and weights may be sufficient to provide students the guidance necessary to complete the assignment, and the questions used in the case should still be appropriate.

## 3. PEDAGOGICAL USES & LEARNING OBJECTIVES

In this section, three similar exercises are presented in order of complexity. The three scenarios can be used as projects or as instructor led exercises in introductory Excel courses. The learning objectives for both business/analytical thinking and Excel are the same for all three exercises.

Business/Analytical Learning Objectives: (critical thinking)

- Determine variable(s) of interest and identify and organize relevant information for a problem with multiple components
- Compute costs per unit and weight per unit from bulk costs and bulk weights

- Recognize and calculate fixed costs and variable costs
- Compute weighted averages and interpret in the context of a real-world problem
- Compute percent markup
- Apply results of analysis to make business decisions

Excel learning objectives:

- Recognize real-world business applications of Excel
- Identify inputs and outputs
- Organize and present data in Excel (create an input area, titles, spacing, spelling)
- Understand the use of 0/1 to represent Yes/No in calculations
- Use appropriate cell references in Excel (relative, absolute, and mixed)
- Apply basic formulas in Excel (add, multiply, divide, average, etc.)
- Use SUMPRODUCT function to compute weighted averages
- Alternative/advanced applications: use IF statements and/or Tables in Excel

### 3.1 SweetTooth Candies Pricing Problem

This exercise involves a self-serve candy store. It is the least complex of the three scenarios presented. The assignment for students is shown in its entirety in Appendix A.

The scenario facing the decision-maker is described first: the store serves a large variety of candies, including chocolates, hard candies, jelly beans and gummies. Customers can mix a variety of candies in a single self-filled bag. At the checkout, the clerk weighs the bag and charges the customer, by the pound, regardless of the contents of the bag. The owner, Rashed, needs to decide how much to charge for each pound of product, however, determining this answer is not so easy because the candies have different costs. The preliminary questions asked of students include:

- 1) Explain why Rashed cannot just average the costs of the different types of candies in order to determine his average cost per pound.
- 2) If two bags filled by customers both weighed 1 pound exactly, would they both have the same cost to Rashed? Why or why not? Explain.

This is a very basic but necessary first step. While many students will recognize intuitively that these statements are true, there may be some benefit from having to articulate the necessity of the entire analysis.

Next, the students are provided with a table that shows several different kinds of candies and the cost per unit purchased as well as bulk costs for plastic bags to hold the candy and twist ties to secure the bags. (See Table 1: “candycost” dataset in Appendix B.) The remainder of the assignment is as follows:

The output of this project will be a professional looking report and an Excel spreadsheet. Remember to follow workbook design techniques, including formatted values and column labels to organize and present the data.

- 3) Refer to the “candycost” dataset that shows all of the cost and weight data. Calculate how much each of the items costs per pound. Present results in new column labeled “Cost Per Pound.”
- 4) Determine how much each plastic bag and twist tie cost Rashed. While he will assume the weight of the bag and tie are negligible, Rashed wants their purchase cost factored into the cost of each order. Do these calculations in Excel, labeled as “Cost Per Unit”,

The “candydata” dataset (see Table 2 in Appendix B) includes a sample of 25 typical orders containing how much of each type of candy is included in the bag. Students are directed to perform these calculations:

- 5) The sample data for the 25 observations are shown in the dataset “candydata.” For each of these observations, determine the total weight of the observation. Do these calculations in Excel in a column labeled “Total Weight”.
- 6) Also in Excel, calculate the total cost of each of the 25 sample orders. Remember to add in the cost of the plastic bag and twist tie in addition to the cost of the candies. Do these calculations in Excel in a column labeled “Total Cost”. Hint: Use SUMPRODUCT.

Business majors may benefit from reviewing these basic arithmetic calculations while reinforcing Excel skills related to formulas. It may be necessary to remind students that while the weight of the plastic bag and tie are negligible; their fixed costs must be included in the cost of an order.

After the preliminary calculations are done and students are left with a column of sample weights and a column of associated sample costs, students are prompted to think analytically in order to address their overarching question. Students are asked to do the following cost analysis:

- 7) Use the “Total Weight” column and the “Total Cost” column to calculate the average cost per unit of weight for this sample. Hint: First, create a column that calculates the cost per pound for each customer order.
- 8) Interpret the results in terms of what Rashed should be told. What should he consider as an average cost per pound of the bag and its ingredients, based on the sample data?

It is important to point out that during class testing, some students used the average of all of the cost observations and the average of all of the weight observations and then took a ratio to arrive at a figure for average cost per weight. Since this is not technically correct (though its value is close to the actual value), instructions were added to question 7 to give the hint to create a cost per ounce for each observation.

Lastly, once the students have estimated an average cost per pound based on sample data, they will use this information to inform decision-making.

- 9) Should Rashed charge customers his average cost per pound? Why not?
- 10) Do some informal, online research for bulk candy stores of this type (e.g. Sweet Factor, Fuzziwig’s, etc.) and report what similar franchises charge per pound.
- 11) Compare Rashed’s cost per pound to what is charged per pound at similar candy shops. Assuming Rashed charged a similar price, what would his percent markup be? Do these

calculations in Excel. If unsure of how to compute percent markup, use any resources available to verify how this calculation should be done.

12) Discuss the markup. Include several considerations or reasons that Rashed might want to charge prices similar to these competitors, even given his cost per pound.

It is worthwhile to note that question 9 was not initially included in the assignment, but was added after experiences showed that some beginning students did not automatically understand that costs and prices should not be the same.

When calculations are completed, Rashed's average price per pound is found to be \$4.30 per pound.<sup>1</sup> The prices for competitors tended to vary widely but most students quoted between \$6.99 and \$9.99 per pound. In these cases, the percent markup can be calculated as being between 62% and 132%. Unfortunately, experience with this assignment revealed that many beginning business majors may not correctly understand or be able to compute the percent markup. Thus, a statement was added to the end of question 11 reminding students that it is acceptable to refer to outside resources if they are unsure of how to calculate percent markup. For the business concepts in question 12, student answers should identify concepts such as overhead, profitability, and awareness of competitors' prices.

### 3.2 YOLO FroYo Pricing Problem

The second pricing problem is a frozen yogurt shop, similar to Menchie's or Orange Leaf. In this application, the decision-maker, Maria, runs a self-serve frozen yogurt business. This shop, YOLO FroYo, serves a variety of frozen yogurt flavors. Customers fill a bowl with any flavors of yogurt and add toppings that include candies, nuts, and sauces. They can also add a waffle cone. They weigh their bowl and are charged by the ounce. A similar decision-making scenario is presented: Maria needs to decide how much to charge for each ounce of product. While she knows frozen yogurt costs her about \$0.15 per ounce to make, the dozens of toppings all have different costs.

The complete assignment for students is shown in Appendix C. Like Rashed, Maria has gathered data about how much of each type of topping a sample of 25 customers has chosen. The cost data are given in the "yogurtcost" dataset and appears in Table 3 in Appendix D. The customer data are in the "yogurtdata" dataset, shown as Table 4 in Appendix D. The cost and sample data are very similar to the previously described candy data, except that in this case, Maria will charge by the ounce instead of by the pound. The questions for this case are adjusted from the candy problem previously discussed, so the general questions and discussion will not be repeated here for this problem. However, because this application has some added complexity not found in the candy store problem, the focus will be on how it differs from the first application. The main differences are:

- Topping costs must be converted to per ounce from per pound figures
- Sauce costs must be converted to ounces from pounds

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<sup>1</sup> Teaching notes available by emailing authors

- Customers may include a waffle cone, which is a binary variable included in the sample data. It should be assumed that if a waffle cone is selected, it should be weighed with the rest of the customer order.
- The bowls used to hold the yogurt are non-trivial in weight and, obviously, the calculations will differ depending on if it is weighed with the rest of the customer order. The original intention was that bowls should be weighed, but it was observed that some students assumed that it should not be weighed, because, based on personal experience, they knew that some scales are “zeroed” out to negate the weight of the container. Therefore, the student instructions shown in Appendix C were amended to clearly indicate that the bowl should be weighed.

While most U.S. students should not have trouble converting costs per pound to costs per ounce, international students not familiar with Standard units of weight may require additional prompting to use additional resources to help them understand the conversion.

The calculation for sauces has an added layer of conversion. A dollar amount is paid for a 6.5 gallon container that weighs 64.2 pounds. Thus, to convert to a cost per ounce, students must realize that the \$65 should be divided by  $64.2 * 16 = 1027.2$  ounces. Calculating costs per unit for waffle cones, bowls and spoons is a straightforward division problem; however, finding the per-unit weight for the waffle cones and containers again requires a conversion from pounds to ounces. Specifically, the weight in pounds should be multiplied by 16 ounces before dividing by the number of units. Results show that each waffle cone weighs about 1.07 ounces, while each container weighs about 0.7 ounces. When calculating weights, a hint was provided in the student instructions to encourage them to use the 0/1 variable for waffle cone as a multiplier for the waffle cone weight. Costs are easily calculated using the SUMPRODUCT function in Excel and then adding in fixed costs of the bowl and spoon.

Analysis of the customer orders show that Maria’s average price per ounce is \$0.18. The same concluding questions regarding competition and percent markup are also asked for this yogurt data. The prices students quoted for competitors tended to vary between about \$0.30 to \$0.55 per ounce. In these cases, the percent markup can be calculated as between 62% to 198%.

### 3.3 Healthy Options Salad Bar Pricing Problem

The third exercise involves a self-serve salad bar, similar to The Salad Station and those found within many grocery stores. Customers are able to build their own salads from a wide variety of organic greens and toppings. Patrons will pick up a salad bowl/container, fill it with their choice of ingredients, and add whole grain breadsticks if they choose. They weigh their bowl (including breadsticks) and are charged by the pound. Aaron, the food service manager, needs to decide how much to charge for each pound of product. While he knows mixed organic greens cost about \$0.30 per ounce, the dozens of toppings all have different costs.

The complete assignment for students is shown in Appendix E. Because several of the vegetable toppings have similar costs and weights, he has grouped them together into type 1 toppings (the lighter, such as sliced mushrooms and radishes) and type 2 (the heavier, such as tomatoes and chickpeas). The “costdata” dataset is displayed in Table 5 in Appendix F. Like the decision makers in the other problems, Aaron has gathered data about exactly how much of each type of topping a sample of 25 customers has chosen, and the resulting “saladdata” are shown in Table 6 in Appendix F.

The cost and sample data are very similar to the previously described candy and yogurt data, and the questions are mirrored for this application. Again, since the questions and helpful hints are similar, the focus will be on the differences between this problem and the previous two. The main differences are:

- Similar to the yogurt problem, salad greens cost must be converted to per pound from the per ounce figure;
- Customers may include one or more breadsticks with their order, so this is a discrete quantitative variable, rather than the binary for the waffle cone in the yogurt problem. It should be assumed that the breadsticks are weighed with the rest of the customer order.
- The containers used to hold the salad are non-trivial in weight, and similar to the yogurt problem, the weight was intended to be added to the order. Again, since some students might know from personal experience that the some scales are adjusted to subtract the weight of the container, the instructions in Appendix E are explicit about including the container’s weight in the calculations.
- Students may also be aware that some self-serve salad bars do not weigh dressing but allow customers to fill a separate container that is not weighed. For simplicity again, instructions were written to specify that dressing should be weighed.

Calculations for pounds per unit and cost per unit for breadsticks, containers and forks should be straightforward. Results show that each breadstick weighs about 0.094 pounds and costs \$0.26. Again, instructions provide a hint to use the number of breadsticks to multiply by the weight. Costs are, again, easily obtained with SUMPRODUCT function and the addition of fixed costs of the container and fork.

Analysis of the customer orders revealed Aaron’s average price per pound to be \$4.39. The same concluding questions regarding competition and percent markup are also asked for this salad data. The prices for competitors tended to vary between about \$6.50 to \$8.99 per pound. In these cases, the percent markup can be calculated as between 48% to 105%.



#### 4. CONCLUSION

This paper presented three scenarios of weight-based cost analysis in situations that are familiar to students whose only business experience may be as customers. The three business applications of cost estimation are ideal for introductory Excel courses to apply learned business concepts and Excel functionality. Each problem requires students to recognize realistic applications of spreadsheets, to use Excel to manipulate data and perform pricing calculations, and to utilize the results to inform decision-making in a business setting. The scenarios can be used in different learning spaces, both in the classroom and online. Although the assignments have been tested with beginning college students, the applications are also appropriate for younger students who are learning Excel. Scenarios can be assigned to individuals or groups as in-class or take home exercises or projects. Because the data are realistic and motivated by real-world business concerns, the students may relate more to a project if they are familiar with these types of businesses.



## APPENDIX A: INSTRUCTIONS FOR STUDENTS: SWEETTOOTH CANDIES PRICING PROBLEM

### INTRODUCTION

Rashed just bought a self-serve candy business. This shop, SweetTooth Candies, serves a large variety of candies, including chocolates, hard candies, jelly beans and gummies. The customer fills an empty bag with their choice of candies and then it is weighed at the checkout. All candies are sold for the same price per pound to customers.

Rashed needs to decide how much to charge for each pound of product. However, he has discovered that determining this answer is not so easy because many of the candies have different costs. Based on his initial orders and invoices, Rashed has gathered data on the costs and weights of the products he stocks. Several of the candies have the same costs, so he has grouped them together into types. Refer to the “candycost” dataset for this information.

Next, Rashed knows that he cannot just take an average price of the candies. Instead, he invites 25 family and friends to the shop just prior to its opening and tells them to get themselves whatever they would like. The catch is that Rashed weighs each ingredient they put into their bag, so he knows exactly how much of each type of candy each person chooses. The details of these measurements are shown in the “candydata” dataset.

The output of this project will be a professional looking report and an Excel spreadsheet. Remember to follow workbook design techniques, including formatted values and column labels to organize and present the data.

### PROBLEMS & QUESTIONS

#### Preliminary questions

- 1) Explain why Rashed cannot just average the costs of the different types of candies in order to determine his average cost per pound.
- 2) If two bags filled by customers both weighed 1 pound exactly, would they both have the same cost to Rashed? Why or why not? Explain.

#### Initial Calculations

- 3) Refer to the “candycost” dataset that shows all of the cost and weight data. Calculate how much each of the items costs per pound. Present results in new column labeled “Cost Per Pound.”
- 4) Determine how much each plastic bag and twist tie cost Rashed. While he will assume the weight of the bag and tie are negligible, Rashed wants their purchase cost factored into the cost of each order. Do these calculations in Excel, labeled as “Cost Per Unit”,
- 5) The sample data for the 25 observations are shown in the dataset “candydata.” For each of these observations, determine the total weight of the observation. Do these calculations in Excel in a column labeled “Total Weight”.

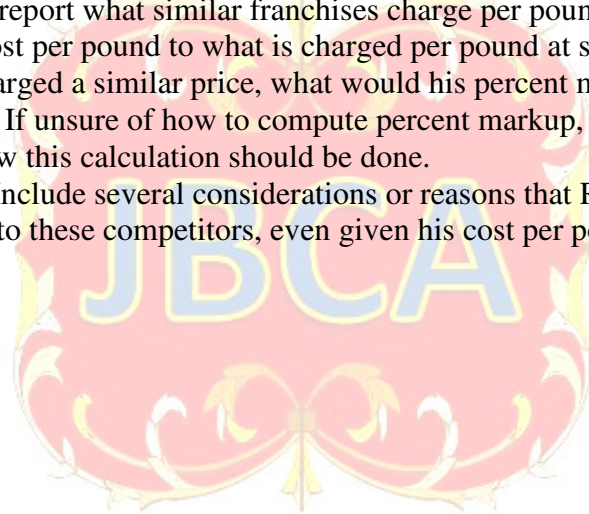
- 6) Also in Excel, calculate the total cost of each of the 25 sample orders. Remember to add in the cost of the plastic bag and twist tie in addition to the cost of the candies. Do these calculations in Excel in a column labeled “Total Cost”. Hint: Use SUMPRODUCT.

#### Cost Analysis

- 7) Use the “Total Weight” column and the “Total Cost” column to calculate the average cost per unit of weight for this sample. Hint: First create a column that calculates the cost per pound for each customer order.
- 8) Interpret the results in terms of what Rashed should be told. What should he consider as an average cost per pound of the bag and its ingredients, based on the sample data?

#### Conclusions & Recommendations

- 9) Should Rashed charge customers his average cost per pound? Why not?
- 10) Do some informal, online research for bulk candy stores of this type (e.g. Sweet Factor, Fuzziwig’s, etc.) and report what similar franchises charge per pound.
- 11) Compare Rashed’s cost per pound to what is charged per pound at similar candy shops. Assuming Rashed charged a similar price, what would his percent markup be? Do these calculations in Excel. If unsure of how to compute percent markup, use any resources available to verify how this calculation should be done.
- 12) Discuss the markup. Include several considerations or reasons that Rashed might want to charge prices similar to these competitors, even given his cost per pound.



**APPENDIX B: SWEETTOOTH CANDIES DATASETS**

Table 1: “candycost” dataset

Component	Bulk Cost
Chocolate covered nuts	\$12.96 / 2 U.S. pounds
Gourmet jelly beans	\$24.50 / 5 U.S. pounds
Gummy candies	\$13.50 / 5 U.S. pounds
Sour hard candies	\$16.50 / 5 U.S. pounds
Individually wrapped candies	\$14.99 / 5 U.S. pounds
M&Ms, Skittles, Reese’s pieces, etc.	\$156.50 / 25 U.S. pounds
Plastic bags to hold candy	\$35 / 1000 bags
Twist ties to secure bags closed	\$ 10 / 2000

Table 2: “candydata” dataset

Observation	Number of pounds					
	Choc	JellyBean	Gummy	Sour	Wrapped	M&Ms
1	0.26	0	0.56	0.53	0.43	0
2	0.24	0.81	0	0	0	0.22
3	0.36	0	0.49	0.44	0	0.33
4	0	0.52	0.73	0.47	0.16	0.7
5	0.34	0.43	0	0.55	0	0
6	0.43	0.83	0.94	0.25	0.59	0
7	0.34	0	0.78	0.38	0.25	0.69
8	0.23	0.15	0.58	0	0.32	0.48
9	0.14	0.23	0.57	0	0.64	0.21
10	0.36	0.87	0.68	0.48	0.28	0.52
11	0.26	0.98	0.42	0.33	0	0
12	0	0.88	0.76	0.66	0.3	0.74
13	0.19	0.23	0.51	0.58	0.11	0.91
14	0.28	0.32	0	0.4	0.55	0.35
15	0.39	0.48	0	0.75	0.48	0
16	0.3	0.38	0.68	0	0.51	0.64
17	0.21	0	0.43	0.39	0.33	0.24
18	0.28	0.52	0.9	0.63	0.28	0.46
19	0	0.57	0	0.22	0.17	0.38
20	0.26	0.17	0.59	0.35	0.15	0.86
21	0.23	0.28	0.56	0.52	0.62	0
22	0.26	0.5	0.35	0.59	0.55	0.59
23	0	0.35	0.66	0.46	0	0.39
24	0.28	0.2	0.47	0.62	0.65	0.13
25	0.32	0.71	0	0.66	0.33	0

## APPENDIX C: INSTRUCTIONS FOR STUDENTS: YOLO FROYO PRICING PROBLEM

### INTRODUCTION

Maria just bought a self-serve frozen yogurt business. This shop, YOLO FroYo, serves a variety of frozen yogurt flavors (12 at a time on a rotating basis). In a cup that they fill, customers can choose any flavors of yogurt and toppings, including candies, nuts, and sauces. They can also choose to include a waffle cone in their bowl. They weigh their bowl and are charged by the ounce.

Maria needs to decide how much to charge for each ounce of product. However, she has discovered that determining this answer is not so easy. While she knows frozen yogurt costs her about \$0.15 per ounce to make, the dozens of toppings all have different costs. Based on her initial orders and invoices, Maria has gathered data on the costs and weights of the products she uses. Because several of the chopped candies have the same costs, she has grouped them together into type 1 toppings (the less expensive) and type 2 (more expensive). Refer to the “yogurtcost” dataset for this information.

Next, Maria knows that she cannot just take an average price of the toppings. Instead, she invites 25 family and friends to the shop just prior to her opening and tells them to get themselves whatever they would like. The catch is that Maria weighs each ingredient they put into their bowl, so she knows exactly how much yogurt and how much of each type of topping each person uses. The details of these measurements are shown in the “yogurtdata” dataset. Note that Waffle Cone = 1 means the person included a waffle cone in their order, 0 means they did not.

The output of this project will be a professional looking report and an Excel spreadsheet. Remember to follow workbook design techniques, including formatted values and column labels to organize and present the data.

### PROBLEMS & QUESTIONS

#### Preliminary questions

- 1) Explain why Maria cannot just average the costs of the yogurt and the different types of toppings to determine her average cost per ounce.
- 2) If two bowls filled by customers both weighed 10 ounces exactly, would they both have the same cost to Maria? Why or why not? Explain.

#### Initial Calculations

- 3) Refer to the “yogurtcost” dataset that shows all of the cost and weight data. Calculate how much each of the items costs per ounce. Present results in a new column labeled “Cost Per Ounce.” Note: if unsure of how many ounces are in a U.S. pound, look it up.
- 4) Determine how much each individual waffle cone would weigh and how much it would cost Maria, if a customer added it into their bowl. Next, determine the weight in ounces and cost of each individual bowl, which must be included for every customer. Lastly, while spoons

are not weighed, Maria wants them to be factored into the cost of each order, so calculate the cost of a single spoon as well. Do these calculations in columns labeled as “Ounces per Unit” and “Cost per Unit”.

- 5) The sample data for the 25 observations are in the “yogurtdata” dataset. For each of these 25 observations, determine the total weight of the order. Remember to add in the weight of a bowl for each order in addition to the weights of the yogurt and toppings. If a waffle cone is included in the order (Waffle Cone = 1), add that weight as well. Hint: multiply the value of 0 or 1 for that order by the weight for a cone. Do these calculations in Excel in a column labeled “Total Weight.”
- 6) Also in Excel, calculate the total cost of each of the 25 sample orders. Remember to add in the cost of the yogurt in the bowl, the cost of all toppings included in the bowl, the cost of a waffle cone if appropriate, and the cost of the bowl itself and one spoon. Do these calculations in Excel in a column labeled “Total Cost.” Hint: Use SUMPRODUCT.

### Cost Analysis

- 7) Use the “Total Weight” column and the “Total Cost” column to calculate the average cost per unit of weight for this sample. Hint: First create a column that calculates the cost per ounce for each customer order.
- 8) Interpret the results in terms of what Maria should be told. What should she consider as an average cost per ounce of the bowl and its ingredients, based on the sample data?

### Conclusions & Recommendations

- 9) Should Maria charge customers her average cost per pound? Why not?
- 10) Do some informal, online research for yogurt shops of this type (e.g. Menchie’s) and report what similar franchises charge per ounce.
- 11) Compare Maria’s cost per ounce to what is charged per ounce at similar shops such as Menchie’s. Assuming Maria charged a similar price, what would her percent markup be? Do these calculations in Excel. If unsure of how to compute percent markup, use any resources available to verify how this calculation should be done.
- 12) Discuss the markup. Include several considerations or reasons that Maria might want to charge prices similar to her competitors, even given her cost per ounce.

**APPENDIX D: YOLO FROYO DATASETS**

Table 3: “yogurtcost” dataset

	Bulk Cost	Bulk Weight
Yogurt	\$0.15 / ounce	
Topping Type 1 - chopped candy	\$2 / U.S. pound	
Topping Type 2 - chopped candy	\$5 / U.S. pound	
Topping Type 3 - nuts	\$8 / U.S. pound	
Topping Type 4 - sauces	\$65 / 6.5 gallons	6.5 gallons = 64.2 U.S. pounds
Waffle Cones	\$49 / 216 cones	216 = 14.4 U.S. pounds
Paper Bowls	\$85 / 1000	1000 = 44 U.S. pounds
Eco-friendly spoons	\$37 / 1000	n/a

Table 4: “yogurtdata” dataset

Observation	Number of Ounces					(1=Yes, 0=No)
	Yogurt	Top1	Top2	Top3	Top4	Waffle Cone
1	6.4	0.4	1.1	1.4	2	0
2	4.7	1.2	0.7	0.8	0.8	0
3	7	0.2	0.1	0.9	2	1
4	5.5	0.3	0.8	0.5	1.1	0
5	6.3	0.5	0.8	0.8	0.6	1
6	5	0.9	0.2	1.1	0.2	0
7	6.2	1.4	0	0.5	0.2	0
8	3.3	0.4	0.7	0.6	1.6	0
9	4.3	0	0.2	1.3	0	0
10	4	0.9	1.1	1.2	1.5	0
11	3.5	1.4	1.3	0.4	0.5	0
12	3.1	1.2	0	0.3	0.9	0
13	5.2	0.9	0.6	1.4	0.3	0
14	7.1	1.1	1.5	0.8	0.6	1
15	5.5	0.8	0.3	1.4	1.3	1
16	5.8	1	0.4	1.1	0.3	1
17	6.8	1	0	0.1	0.7	1
18	8.2	0.6	0.5	0.8	0.3	0
19	7.5	1.1	0	0.5	0.4	1
20	6.3	1	0.2	0.6	0.5	0
21	6.2	0.1	0.7	1.1	0.5	1
22	5.5	1.2	1.4	1.1	0.5	1
23	6	0.9	0.3	0.9	1.6	0
24	4.8	1.2	1.1	1.1	1	0
25	8.8	0.2	0.9	0	0.7	1

## **APPENDIX E: INSTRUCTIONS FOR STUDENTS: HEALTHY OPTIONS SALAD BAR PRICING PROBLEM**

### **INTRODUCTION**

As part of its wellness initiative, Springville College is opening a new Healthy Options section of the campus dining center. In the salad section, customers will be able to choose to build their own salads from a wide variety of organic greens and toppings. Patrons will pick up a salad bowl/container, fill it with their choice of ingredients, and add one or more whole grain breadsticks if they choose. They weigh their bowl (including the breadstick/s and dressing) and are charged by the pound.

Aaron, the food service manager, needs to decide how much to charge for each pound of product. However, he has discovered that determining this answer is not so easy. While he knows mixed organic greens cost about \$0.30 per ounce, the dozens of toppings all have different costs.

Based on his initial orders and invoices, Aaron has gathered the following data on the costs and weights of the products for the salad bar. Because several of the toppings have similar costs and weights, he has grouped them together into type 1 toppings (the lighter, such as sliced mushrooms and radishes) and type 2 (the heavier, such as tomatoes and chickpeas). Refer to the “saladcost” dataset for this information.

Next, Aaron knows that he cannot just take an average price of the toppings. Instead, he invites 25 students to make a salad just prior to the opening and tells them to get themselves whatever they would like. The catch is that Aaron weighs each ingredient they put into their bowl, so he knows the exact weight of the salad greens and of each type of topping each person uses. The details of these measurements are shown in the “saladdata” dataset. Note that Breadstick variable shows the number of breadsticks the customer chose.

The output of this project will be a professional looking report and an Excel spreadsheet. Remember to follow workbook design techniques, including formatted values and column labels to organize and present the data.

### **PROBLEMS & QUESTIONS**

#### Preliminary questions

- 1) Explain why Aaron cannot just average all of the costs of all of the types of salad greens and toppings in order to determine the cost per pound.
- 2) If two containers filled by customers both weighed 1 pound exactly, would they both have the same cost to Aaron? Why or why not? Explain.

#### Initial Calculations

- 3) Refer to the “saladcost” dataset that shows all of the cost and weight data. Calculate how much each of the items costs per pound. Present results in a new column labeled “Cost Per Pound.” Note: if unsure of how many ounces are in a U.S. pound, look it up.
- 4) Determine how much each individual breadstick would weigh and how much it would cost Aaron, if a customer added it into their order. Next, determine the weight in pounds and cost



of each container, which must be included for every customer. Lastly, while forks are not weighed, Aaron also wants them to be factored into the cost of each order, so calculate the cost of a single fork as well. Do these calculations in columns labeled as “Pounds per Unit” and “Cost per Unit.”

- 5) The sample data for the 25 observations are in the “saladdata” dataset. For each of these 25 observations, determine the total weight of each order. Remember to add in the weight of a container for each order in addition to the weights of the greens, toppings and dressing. If any breadsticks are included in the order, add the weight of those as well. Hint: multiply the value for “Breadsticks” for that order by the weight for one breadstick. Do these calculations in Excel in a column labeled “Total Weight.”
- 6) Also in Excel, calculate the total cost of each of the 25 sample orders. Remember to add in the cost of the greens, the cost of all toppings included, the cost of any breadsticks included, and the cost of the container itself plus one fork. Do these calculations in Excel in a column labeled “Total Cost.” Hint: Use SUMPRODUCT.

### Cost Analysis

- 7) Use the “Total Weight” column and the “Total Cost” column to calculate the average cost per unit of weight for this sample. Hint: First, create a column that calculates the cost per pound for each customer order.
- 8) Interpret the results in terms of what Aaron should be told. What should he consider as an average cost per pound of the salad container and its ingredients, based on the sample data?

### Conclusions & Recommendations

- 9) Should Aaron charge customers his average cost per pound? Why not?
- 10) Do some informal, online research for salad bars and report what similar businesses charge per ounce. (*Note: if prices are in ounces, convert those prices to pounds.*)
- 11) Compare Aaron’s cost per pound to what is charged per pound at similar salad bars. Assuming Aaron charged a similar price, what would his percent markup be? Do these calculations in Excel. If unsure of how to compute percent markup, use any resources available to verify how this calculation should be done.
- 12) Discuss the markup. Include several considerations or reasons that Aaron might want to charge prices similar to her competitors, even given his cost per pound.

**APPENDIX F: HEALTHY OPTIONS SALAD BAR DATASETS**

Table 5: “saladcost” dataset

	Bulk Cost	Bulk Weight
Salad Greens	\$0.30 / ounce	
Topping Type 1 - veggies	\$4.00 / U.S. pound	
Topping Type 2 - veggies	\$2.50 / U.S. pound	
Topping Type 3 – meat and cheese	\$8 / U.S. pound	
Topping Type 4 - dressing	\$89.25 / 4 gallons	4 gallons = 32.4 pounds
Bread stick	\$47.35 / 180	180 = 16.875 pounds
Plastic Bowls	\$41.29 / 126	126 = 7.875 pounds
Forks	\$10.42 / 1000	n/a

Table 6: “saladdata” dataset

Observation	Number of Pounds					Number of Breadsticks
	Salad Greens	Top1	Top2	Top3	Top4	
1	0.24	0.05	0.24	0.20	0.09	1
2	0.24	0.11	0.24	0.21	0.11	1
3	0.26	0.16	0.31	0.32	0.12	0
4	0.23	0.13	0.44	0.08	0.07	1
5	0.25	0.13	0.18	0.19	0.08	2
6	0.41	0.14	0.40	0.09	0.06	1
7	0.34	0.12	0.14	0.10	0.10	0
8	0.44	0.12	0.24	0.24	0.06	0
9	0.33	0.16	0.32	0.14	0.12	1
10	0.33	0.18	0.41	0.21	0.11	0
11	0.40	0.14	0.29	0.06	0.09	2
12	0.31	0.13	0.15	0.16	0.08	0
13	0.31	0.23	0.14	0.14	0.12	0
14	0.36	0.11	0.35	0.18	0.10	1
15	0.20	0.12	0.33	0.28	0.12	1
16	0.34	0.23	0.28	0.16	0.09	1
17	0.34	0.13	0.31	0.09	0.08	1
18	0.32	0.09	0.08	0.16	0.12	1
19	0.25	0.18	0.22	0.24	0.10	1
20	0.25	0.23	0.27	0.18	0.09	0
21	0.29	0.18	0.19	0.33	0.11	0
22	0.39	0.12	0.22	0.19	0.13	1
23	0.32	0.19	0.38	0.12	0.09	2
24	0.29	0.09	0.29	0.27	0.09	1
25	0.31	0.14	0.34	0.10	0.08	1

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