COURSE: Spreadsheet Modelling & Analytics

G11, Group 8

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1 Company Background

U MAY Delight is a bakery shop located at Eunos Crescent Blk 6. Started up in October 2018, it is a small bakery shop that is operated by only 1 shop owner and 2 part-time employees. Positioned in the center of the neighborhood, they also offer a variety of products ranging from pastries, birthday cakes to waffles. U MAY Delight's owner aims to be an efficient bakery seller in terms of inventory management and production with its large variety of fresh bakery products. After roughly 16 months of operation, U MAY Delight has identified a few issues regarding their inventory management, production, and thus affecting possible profitability.

2 Data Collection

2.1 Data Collected from Bakery

Initially, the staff of U May Delight were not very tech-savvy. They recorded their sales and production on paper and pen. With this, they created stacks of papers filled with their sales and production data then filed them by quarters.

After obtaining a year's worth of handwritten data from them, we transferred it over onto Microsoft Excel to better analyze the data (refer to *Figure 1*).

We also organized the data into a smaller table (refer to *Figure 2*), where we made columns of the relatively more important information, such as the type of pastries sold, daily production and prices of each pastry and each pastry's daily leftovers.

2.2 Utilization of Collected Data 1: Calculating Lost Revenue ($)

With the data keyed into Excel, we calculated the amount of lost revenue daily over the year and produced a graph below (refer to *Figure 3*). The formula we used to calculate the daily lost revenue is as follows:

Daily Lost Revenue = Daily leftover amount (per pastry) * respective price * [duration]

This makes the issue of the inconsistent leftovers a major one as lost revenue could range from 15% to 25% (refer to *Figure 4*), which accounts for a large part of the revenue gone due to not being able to sell them off, hence a huge wastage in both resources and revenue which could have been earned. Ultimately, additional operational cost is incurred to U MAY Delight due to the leftover issue.

2.3 Utilization of Collected 2: Calculating Rate of Sale (%)

Additionally, we calculated the Rate of Sale daily (refer to Figure 5), which demonstrates the daily demand as the amount sold is equivalent to the customer's demand for the product. This will be used to determine the daily demand for each type of pastries and thus their respective popularity in our spreadsheet model. The formula used to calculate each pastry's rate of sale is as follows:

Rate of Sale Daily (%) = % of (Number of Daily productions – leftovers)

3 Problems Identification

3.1 Main Problem – Inefficient Data Collection

During the data collection, we realized a huge issue. Since the data was recorded manually by pen and paper, leftover issues would be a tedious problem to solve without the assistance of an electronic inventory system. Thus, we decided to focus on shifting U MAY Delight's inventory management to our customized model before utilizing the data to resolve other problems stated by the bakery. With their current handwritten data, it is hard for them to analyze and decide their production quantity, understand their inconsistent leftovers and demand for each pastry. Thus, this inefficient data collection became the main obstacle for U May Delight to improve their services and profits.

This branches out into few more problem symptoms, such as having inconsistent leftovers every day and restricted them from further profits due to the inefficient use of data.

3.2 Problem Symptom I – Inconsistent Leftovers (Inventory Management)

As a relatively new bakery in the neighborhood, U MAY Delight has observed an inconsistent issue of having leftovers throughout its operations. Sometimes, there could be a huge number of leftovers or almost none despite the fact that they are baking the same amount of pastry every day. Due to the heavy 12 hours daily operation hours from 8.30am to 8.30pm, the shop owner was unable to set the optimal amount for each bread due to time constraints, lack of analytical knowledge and unable to utilize the data they had. Without being able to understand the leftovers and subsequently modify production, the staff could only continue with the same production and result in huge losses for the bakery in terms of revenue lost through leftovers.

This is imperative as up to 25% could have been lost due to these leftovers because they were unable to do anything to solve it. Hence, this implies that the issue of inconsistent leftovers is quite a worrying one as they aim to be a efficient and profiting company.

3.2 Problem Symptom II – Inefficient use of Data

Due to the pen and paper model used for the current inventory system, the shop is unable to keep track of how much money is lost due to leftovers and the daily demand of customers. This makes it difficult for the owner to determine which pastries are the ones causing more wastage and whether to increase or decrease production for that pastry. Furthermore, the more popular pastries could have been charged more if the staff knew which ones were selling better. Hence, pen and paper method of collecting data is not sustainable in the long run and should be converted to automation to be better utilized.

With the spreadsheet model, they can better utilize the data, be it creating graphs or understanding the respective popularity of the different pastries and then modifying their production accordingly to suit the customer's demand daily, calculated by the new model.

Thus, another problem symptom arising from inefficient data collection is the inefficient use of data, which can be solved by our spreadsheet model.

4 Objectives and Solution

4.1 Countering Inefficient Data Collection

Firstly, our team would be providing U May Delight with our own uniquely built spreadsheet database. Its features include having a user-friendly interface so that the non-tech-savvy staff can use it easily, expandable for future data input, and automatically solving basic sales calculations. The staff can then update it regularly, much easier compared to handwritten.

4.2 Reduce/Eliminate Leftovers

To achieve this objective, our group will be looking at the demand for each pastry (calculated from each rate of sale) and the total amount of leftovers for each to determine their respective popularity according to the operation data provided by May Delight in their 16 months of operation. By using excel, we would be able to estimate the optimal amount of pastry for each category and determine how many pastries should be sold for each category to maximize the overall profit and minimize leftovers, by reducing or increasing production accordingly. Thus, the model would help them to reduce/eliminate leftovers.

4.3 Inefficient Use of Data

With our spreadsheet model, the staff can then make further analysis, such as learning of sales per month, which pastry could generate more revenue, etc. This model allows them to generate useful information about their operations and sales and predicting results too.

It can also monitor the demand effectively and give additional insights which can help optimize their daily productions and reduce their leftover rates significantly which would

ultimately improve net profits. Hence, the model helps the staff to better utilize the data they recorded instead of leaving it to idle.

4.4 Blackbox Diagram

With regards to the leftover issue that has been identified, we determined that the decisions the Bakery can control are the price of bread/pastry and the production units of each pastry. Through our analysis using excel, we hope to find the optimal production units of each pastry that the bakery should produce to effectively maximize revenues, minimize costs and to ultimately reduce leftovers (Performance Measures). Price of bread/pastry can be adjusted to determine the maximum price to be set with regards to the popularity of respective pastries and to boost production accordingly.

For U May Bakery, the parameters (uncontrollable) would be the fixed costs of pastries, operation hours and other revenue that it may make from the sale of other non-pastry items (Refer to ***Figure 7***). The consequence variables are the demand of the pastries which will evidently affect sales and profit as well as promotional demand which will determine the outcome of pastries being leftover.

5 User Functionalities

We want to enable U MAY Delight to input new data entries into an expandable model, as this would allow them to observe through the business with graphical visualization. With the model, it would also allow them to dynamically search for the pastry rankings between a range of dates, making short term demand observation possible.

6 Model Formulation

6.1 Leftover pastries

At each row in “Pastry Leftovers” sheet, the daily lost revenue sustained from leftover pastries would be calculated in both percentage and dollar. In addition, through the usage of Index and Match, a dynamic date field is created to allow staff to visualize the

lost revenue over a period of time, which allow them to have a better overview of the business in a short term.

With this data, the ranking of pastries can also be determined by calculating the rate of sale of each individual pastry. The formula is as follows:

1 - (total leftover of a product / total production)

This would indicate how fast each pastry is selling over a period to determine the most profitable and favorable pastries.

6.2 User-Friendly Interface for Model

We have designed the model to include tabs such as “Main Page”, “Inventory System”, “Pastry Leftover”, and “Operation Analysis”.

The “Inventory System” tab, will display pastry types, volumes of daily production, pastry price, potential revenue and the rate of sale percentages effortlessly to staff.

The “Pastry Leftover” tab will enable staff(s) at U MAY to clearly comprehend the daily leftover rates for the respective pastries and the daily lost in revenue due to the leftovers. This would allow them to plan effectively the pastry volumes to be produce the next morning to reduce the cost of leftovers. The calculation of daily revenue in (%) is computed by the dividing the lost revenue by the potential revenue of that day.

The “Operation Analysis” tab will direct the staff(s) to a page where they will be able to dynamically check the pastry ranking according to a date that they can set. Staff at U MAY will be able to see the top three ranking pastry (automated) for the day base on the data they have keyed in. Additionally, they can check previous rankings of pastry base on the date they have set and, in the event, if they were to set a date that does not exist (a future date) the model will prompt them to enter a correct date through data validation. The rank is set according to the rate of sale of individual pastries according to the date set and will display all 26 pastries in order of sales demand (popularity) so that the staff will be effectively able to monitor sales demand.

6.3 Model Results

The performance measures are the profit maximization by increasing revenue and decreasing cost (through loss reduction). With these results, the staff at the local bakery, U MAY Delight would be able to reduce costs by reducing the production of pastries that have a much slower rate of sales (demand for each pastry). By analyzing past sales, the model will show the average sale of each pastry product daily, giving U MAY Delight an additional insight through the utilization of their current data. It is then possible to determine optimal daily production and significantly reduce leftover rates.

7 Analysis and Limitations

7.1 Excel Framework Methodology

To facilitate the user's understanding, all documentation had been included in the excel model created. Remarks have been given to explain about the functions provided.

7.1.1 Inventory System

As U MAY Delight requires a user-friendly interface to keep track of their current inventory, we designed a table for them to input their current data. To minimize the repetition of data, the inventory system sheet is designed as a centralized table which would be referenced by other sheets (refer to *Figure 9*).

7.1.2 Pastry Leftovers

To keep track of the pastry leftovers, a sheet has been created for the bakery to key in daily leftovers (refer to *Figure 10*). To calculate the leftovers, all prices from the inventory system sheet is referenced (refer to *Figure 11*) and multiplied to the respective leftovers.

7.1.3 Operation Analysis

To allow the bakery to analyze sales in short term, dynamic date fields are provided for both the pastry ranking (refer to *Figure 12*) and lost revenue (refer to *Figure 3*) analysis. Data validation was used to allow the user to select the dates written in Pastry Leftovers sheet, whereas the index and match function (refer to *Figure 13*) was used with Name Manager to create a range of data, enabling the filtering function as seen in the model.

7.1.4 Limitations

Current model is unable to accommodate requests such as increasing types of pastries. However, it is not a problem for the bakery due to their current manpower, as the bakery is planning to cut down on the number of products. Additionally, since the inventory page's product pricing is linked to the prices entered in the inventory system sheet, any change of pricing requires the user to use a new excel template in order for the prices to be reflected accurately. However, this would not be a big problem since U MAY Delight

has no intention to change the pricing of pastry anytime soon, and they had not made any changes since the start of their operation.

7.1.5 Assumptions

We are assuming that the rate of sale and the leftover rate is when the prices are during the normal operational season of the bakery, without promotional discounts or seasonal product offerings.

8 Conclusion

8.1 Managerial Implications

U May Delights must start to implement the model in the production and marketing department to analyze the rate of sales (demand) for the respective pastries and price them effectively to generate optimum profits. The production department can analyze in the future the optimal amount. Continuous observation of the most favorable products that are ranked by the model developed and leftover monitoring can enable U MAY to effectively operate sustainably as a newly established bakery at Eunos by reducing / increasing the production of respective pastry according to popularity and even truncate product offerings that are under performing profit wise. Left over reduction will subsequently directly aid in reducing losses and in turn improve their net profits.

8.2 Lessons Learnt

In this project, we have learnt about the pragmatism and the palpable problems in business that excel can help solve or elevate. The model we developed will effectually show the demand for the respective pastries and the potential revenue loss from the leftovers, however, excel does not suggest other trends in the business that cannot be reflected by sales figure or leftover volumes such as the new and upcoming flavors or new pastry types that could bring in more revenues. Additionally, we have learnt that having much data does not help a business unless it is analyzed thoughtfully with a goal (s) in mind that could directly or indirectly maximize profit for a business in the long run.

9 Appendix

U MAY Delight: Pastry Inventory List				
Product No.	Type	Pastry Name	Daily Production	Pastry Price
1	Packet	Black Bean	8	$3.20
2	Packet	Kaya	6	$3.00
3	Packet	Coconut	6	$3.00
4	Packet	Cranberry Cheese	4	$3.50
5	Packet	Cheese Bread	4	$2.80
6	Packet	Sugar Roll	6	$3.20
7	Packet	Butter Sugar	4	$2.80
8	Packet	Raisin	4	$2.80
9	Packet	Chicken Floss Cheese	4	$3.50
10	Packet	Garlic Bread	4	$3.50
11	Bun	BBQ Chicken	6	$1.30
12	Bun	Tuna Fish	6	$1.30
13	Bun	Sardine	6	$1.30
14	Bun	Nyonya Chicken	4	$1.30
15	Bun	Japanese Red Bean	4	$1.30
16	Bun	Coffee	4	$1.30
17	Bun	Sausage Bun	4	$1.40
18	Bun	Otah	4	$1.40
19	Bun	Ham & Cheese	4	$1.40
20	Bun	Butter Sugar	4	$1.40
21	Bun	Yam Bun	4	$1.40
22	Puff	Chicken Curry Puff	8	$1.50
23	Puff	Tuna Puff	6	$1.50
24	Puff	Chicken Puff	6	$1.50
25	Puff	Custard Puff	12	$2.80
26	Puff	Durian Puff	5	$3.50

Figure 1: Handwritten Data Converted into Excel – Inventory List

Product No.	Type	Pastry Name	Pastry Price	Daily Production	Potential Revenue
1	Packet	Black Bean	$3.20	8	$25.60
2	Packet	Kaya	$3.00	6	$18.00
3	Packet	Coconut	$3.00	6	$18.00
4	Packet	Cranberry Cheese	$3.50	4	$14.00
5	Packet	Cheese Bread	$2.80	4	$11.20
6	Packet	Sugar Roll	$3.20	6	$19.20
7	Packet	Butter Sugar	$2.80	4	$11.20
8	Packet	Raisin	$2.80	4	$11.20
9	Packet	Chicken Floss Cheese	$3.50	4	$14.00
10	Packet	Garlic Bread	$3.50	4	$14.00
11	Bun	BBQ Chicken	$1.30	6	$7.80
12	Bun	Tuna Fish	$1.30	6	$7.80
13	Bun	Sardine	$1.30	6	$7.80
14	Bun	Nyonya Chicken	$1.30	4	$5.20
15	Bun	Japanese Red Bean	$1.30	4	$5.20
16	Bun	Coffee	$1.30	4	$5.20
17	Bun	Sausage Bun	$1.40	4	$5.60
18	Bun	Otah	$1.40	4	$5.60
19	Bun	Ham & Cheese	$1.40	4	$5.60
20	Bun	Butter Sugar	$1.40	4	$5.60
21	Bun	Yam Bun	$1.40	4	$5.60
22	Puff	Chicken Curry Puff	$1.50	8	$12.00
23	Puff	Tuna Puff	$1.50	6	$9.00
24	Puff	Chicken Puff	$1.50	6	$9.00
25	Puff	Custard Puff	$2.80	12	$33.60
26	Puff	Durian Puff	$3.50	5	$17.50
			Total:	137	$304.50

Figure 2: A more organized data table

Lost Revenue ($)

Start Date:	12-Jan-20

End Date:	26-Feb-20

Remarks

This section allows you to dynamically **check your lost revenue ($) according to date set above.**

Data validation has been applied to ensure that date is within range from "Pastry Leftovers" page.

Figure 3: Lost Revenue ($)

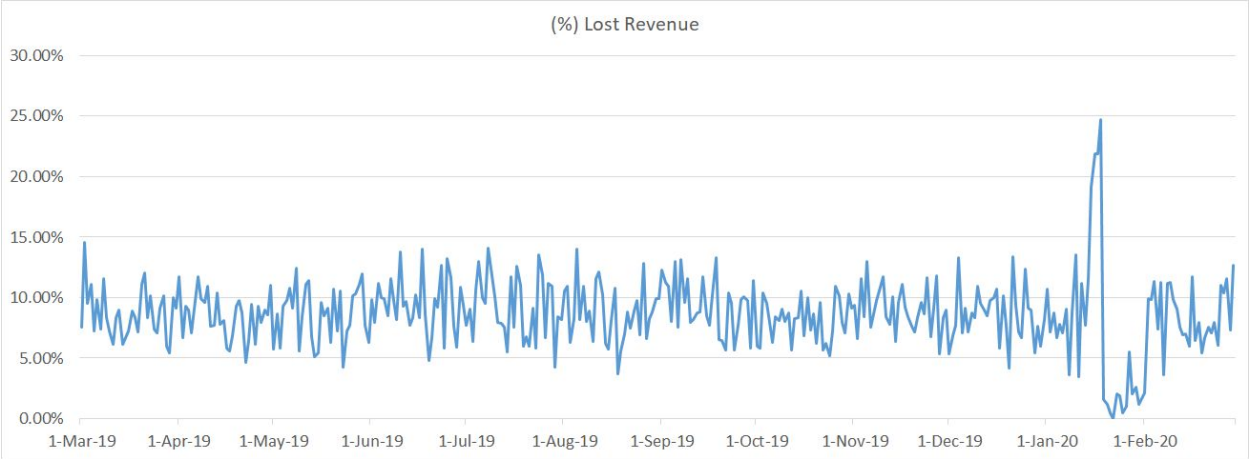


Figure 4: Lost Revenue (%)

Figure 5: Daily Rate of Sale (%)

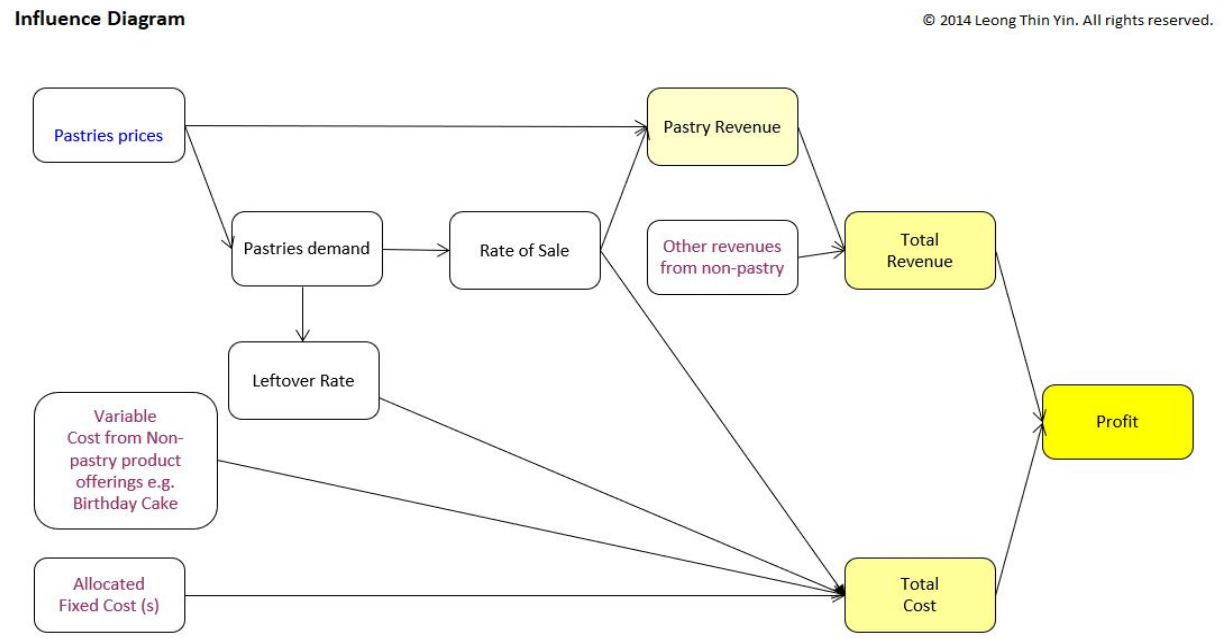


Figure 6: Influence Diagram

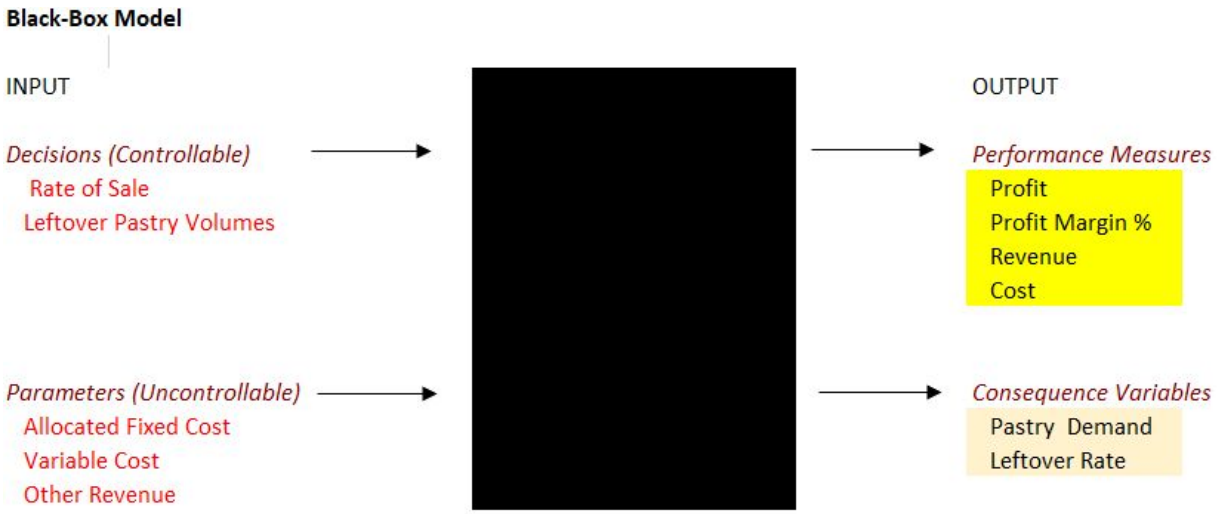
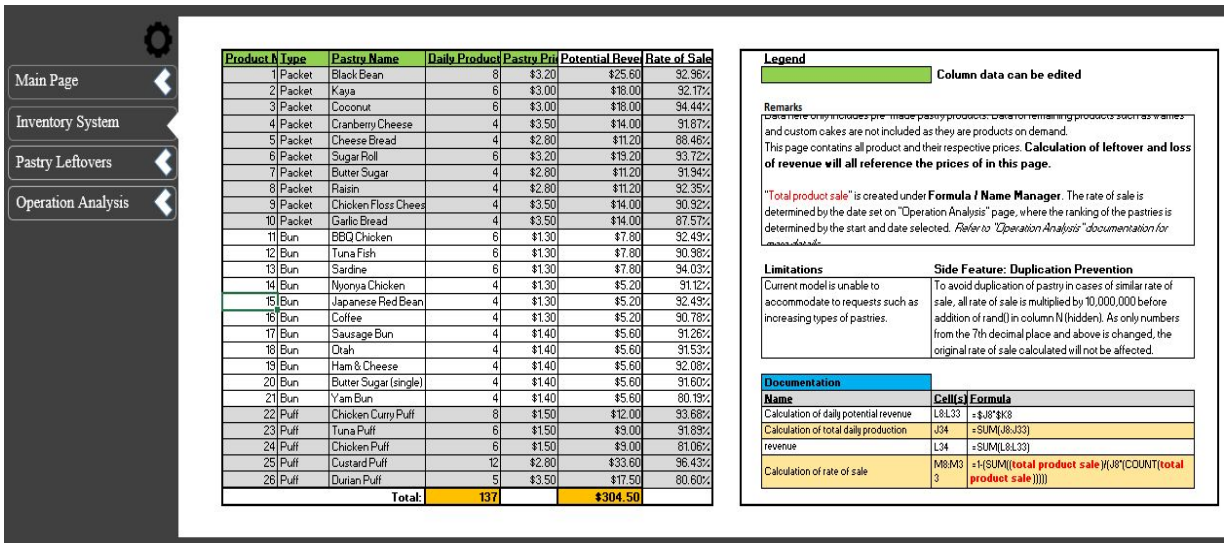


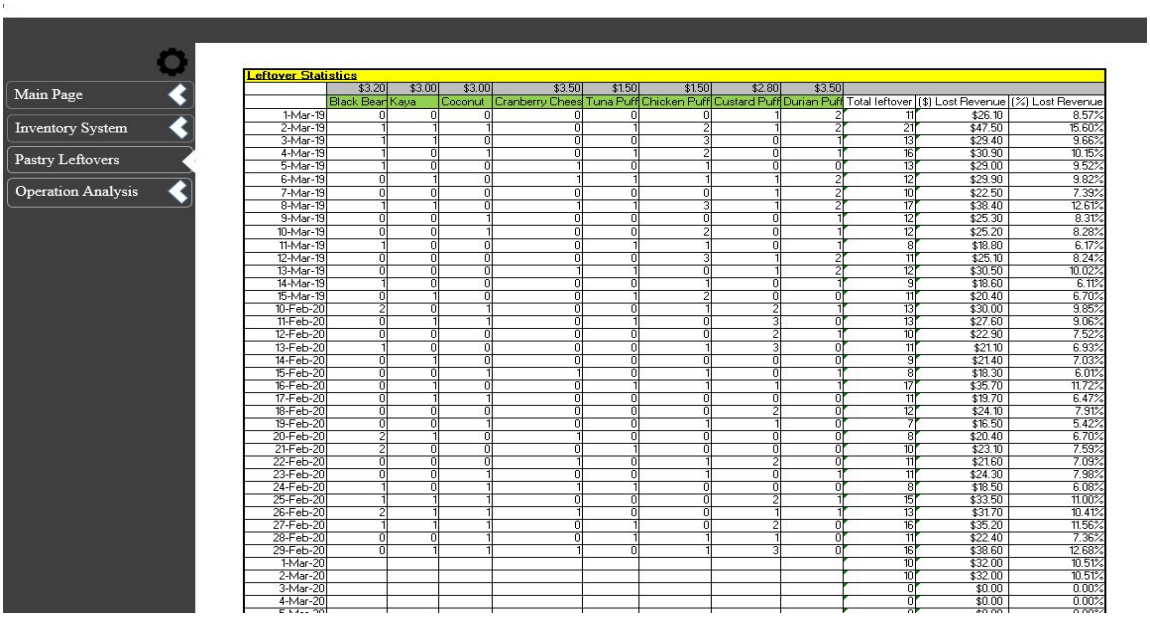
Figure 7: Blackbox Diagram

Figure 8: Main Page



Product N	Type	Pastry Name	Daily Product	Pastry Pri	Potential Reve	Rate of Sale
1	Packet	Black Bean	8	$3.20	$25.60	92.96%
2	Packet	Kaya	6	$3.00	$18.00	92.17%
3	Packet	Coconut	6	$3.00	$18.00	94.44%
4	Packet	Cranberry Cheese	4	$3.50	$14.00	91.87%
5	Packet	Cheese Bread	4	$2.80	$11.20	88.46%
6	Packet	Sugar Roll	6	$3.20	$19.20	93.72%
7	Packet	Butter Sugar	4	$2.80	$11.20	91.94%
8	Packet	Raisin	4	$2.80	$11.20	92.35%
9	Packet	Chicken Floss Chees	4	$3.50	$14.00	90.32%
10	Packet	Garlic Bread	4	$3.50	$14.00	87.57%
11	Bun	BBQ Chicken	6	$1.30	$7.80	92.49%
12	Bun	Tuna Fish	6	$1.30	$7.80	90.98%
13	Bun	Sardine	6	$1.30	$7.80	94.03%
14	Bun	Nyonya Chicken	4	$1.30	$5.20	91.12%
15	Bun	Japanese Red Bean	4	$1.30	$5.20	92.49%
16	Bun	Coffee	4	$1.30	$5.20	90.78%
17	Bun	Sausage Bun	4	$1.40	$5.60	91.26%
18	Bun	Otah	4	$1.40	$5.60	91.53%
19	Bun	Ham & Cheese	4	$1.40	$5.60	92.08%
20	Bun	Butter Sugar (single)	4	$1.40	$5.60	91.60%
21	Bun	Yam Bun	4	$1.40	$5.60	80.19%
22	Puff	Chicken Curry Puff	8	$1.50	$12.00	93.68%
23	Puff	Tuna Puff	6	$1.50	$9.00	91.89%
24	Puff	Chicken Puff	6	$1.50	$9.00	81.06%
25	Puff	Custard Puff	12	$2.80	$33.60	96.43%
26	Puff	Durian Puff	5	$3.50	$17.50	80.60%
		Total:	137		$304.50	

Figure 9: Inventory System



Leftover Statistics

	$3.20	$3.00	$3.00	$3.50	$1.50	$1.50	$2.80	$3.50			
	Black Bear	Kaya	Coconut	Cranberry Chees	Tuna Puff	Chicken Puff	Custard Puff	Durian Puff	Total leftover	($) Lost Revenue	(%) Lost Revenue
1-Mar-19	0	0	0	0	0	0	1	2	11	$26.10	8.57%
2-Mar-19	1	1	1	0	1	2	1	2	21	$47.50	15.60%
3-Mar-19	1	1	0	0	0	3	0	1	13	$29.40	9.66%
4-Mar-19	1	0	1	0	1	2	0	1	16	$30.90	10.15%
5-Mar-19	1	0	0	1	0	1	0	0	13	$29.00	9.52%
6-Mar-19	0	1	0	1	1	1	1	2	12	$29.90	9.82%
7-Mar-19	0	0	0	0	0	0	1	2	10	$22.50	7.39%
8-Mar-19	1	1	0	1	1	3	1	2	17	$38.40	12.61%
9-Mar-19	0	0	1	0	0	0	0	1	12	$25.30	8.31%
10-Mar-19	0	0	1	0	0	2	0	1	12	$25.20	8.28%
11-Mar-19	1	0	0	0	1	1	0	1	8	$18.80	6.17%
12-Mar-19	0	0	0	0	0	3	1	2	11	$25.10	8.24%
13-Mar-19	0	0	0	1	1	0	1	2	12	$30.50	10.02%
14-Mar-19	1	0	0	0	0	1	0	1	9	$18.60	6.11%
15-Mar-19	0	1	0	0	1	2	0	0	11	$20.40	6.70%
10-Feb-20	2	0	1	0	0	1	2	1	13	$30.00	9.85%
11-Feb-20	0	1	1	0	1	0	3	0	13	$27.60	9.06%
12-Feb-20	0	0	0	0	0	0	2	1	10	$22.90	7.52%
13-Feb-20	1	0	0	0	0	1	3	0	11	$21.10	6.93%
14-Feb-20	0	1	0	0	0	0	0	0	9	$21.40	7.03%
15-Feb-20	0	0	1	1	0	1	0	1	8	$18.30	6.01%
16-Feb-20	0	1	0	0	1	1	1	1	17	$35.70	11.72%
17-Feb-20	0	1	1	0	0	0	0	0	11	$19.70	6.47%
18-Feb-20	0	0	0	0	0	0	2	0	12	$24.10	7.91%
19-Feb-20	0	0	1	0	0	1	1	0	7	$16.50	5.42%
20-Feb-20	2	1	0	1	0	0	0	0	8	$20.40	6.70%
21-Feb-20	2	0	0	0	1	0	0	0	10	$23.10	7.59%
22-Feb-20	0	0	0	1	0	1	2	0	11	$21.60	7.09%
23-Feb-20	0	0	1	0	0	1	0	1	11	$24.30	7.98%
24-Feb-20	1	0	1	1	1	0	0	0	8	$18.50	6.08%
25-Feb-20	1	1	1	0	0	0	2	1	15	$33.50	11.00%
26-Feb-20	2	1	1	1	0	0	1	1	13	$31.70	10.41%
27-Feb-20	1	1	1	0	1	0	2	0	16	$35.20	11.56%
28-Feb-20	0	0	1	0	1	1	1	0	11	$22.40	7.36%
29-Feb-20	0	1	1	1	0	1	3	0	16	$38.60	12.68%
1-Mar-20									10	$32.00	10.51%
2-Mar-20									10	$32.00	10.51%
3-Mar-20									0	$0.00	0.00%
4-Mar-20									0	$0.00	0.00%

Figure 10: Pastry Leftovers

Legend

Column data can be edited

Documentation

Name	Cell(s)	Formula	Remarks
Calculation of daily leftover	AH10 and below	=SUM(H10:AG10)	
Calculation of daily lost revenue	AI and below	=SUM($H$8:$AG$8*H10:AG10)	Prices from cell C3 to AB3 is referenced to the sheet (Product Details). Each pastry product is multiplied by their respective price from cell C3 to AB3.
Calculation of daily lost revenue (%)	AJ and below	=$AI10/'Inventory System'!$L$34	Calculated by dividing lost revenue of the day / potential revenue of the day

Figure 11: Pastry Leftover Documentation

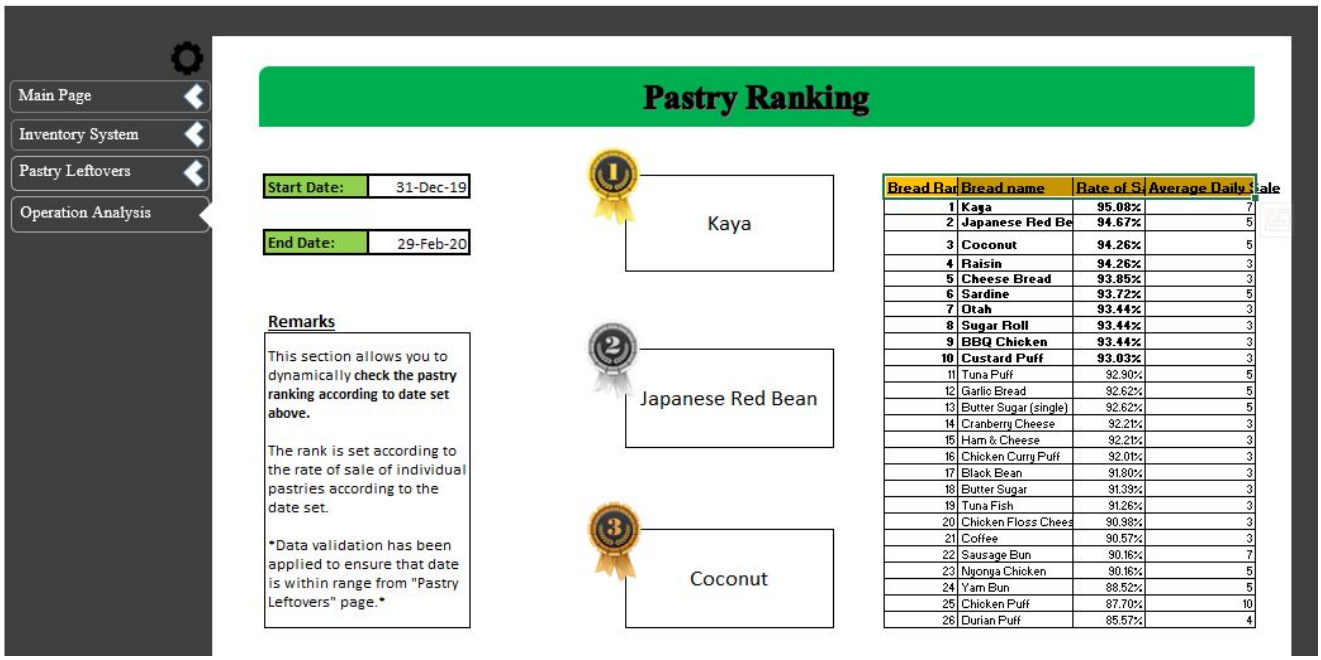


Figure 12: Operation Analysis

Documentation			
Name	**Cell(s)**	**Formula**	**Remarks**
Pastry Ranking Date Filtering (To, From)	I14, I17	=INDEX('Pastry Leftovers'!$H$10:$H$1411,MATCH('Operation Analysis'!$I$14,'Pastry Leftovers'!$G$10:$G$1411,0)):INDEX('Pastry Leftovers'!$H$10:$H$1411,MATCH('Operation Analysis'!$I$17,'Pastry Leftovers'!$G$10:$G$1411,0))	1) Date is set on "Start Date" and "End Date" row. 2) The date is used to with index & match function, matching against the dates present in "Pastry Leftovers" as seen in the formula beside (highlighted in red). 3) "Start Date" and "End Date" would each return a cell upon match (e.g. "Start Date" returns H20, "End Date" returns H23). As seen in the index function, it returns column H (blackbean) data in this example. The formula becomes the range for the set of data. 4) In Name Manager, the formula is repeated twice, separated by a colon ':', allowing us to find the range. (e.g. H20 : H23). **The data is then reflected in "Inventory System" under "Rate of Sale" for each pastry.**
Organising **Rate of sale**	V15:V40	=LARGE('Inventory System'!$M$8:$M$33,'Operation Analysis'!T15)	The rate of sale is organised using large function to determine which pastry sells the best. **However, these values are not used to find the pastries name due to possible duplication when using index / match function.**
Finding the corresponding pastry names	U15:U40 and W15:W40 (hidden)	Hidden Column Formula =LARGE('Inventory System'!$N$8:$N$33,'Operation Analysis'!T23) Main Formula =INDEX('Inventory System'!$I$8:$I$33,MATCH('Operation Analysis'!$W15,'Inventory System'!$N$8:$N$33,0),1)	First, this function refers to the hidden column under "Inventory System". **To ensure that there is no duplication, all pastries' unique rate of sale** (*Refer to "Inventory System" documentation: "Side Feature: Duplication Prevention" for more details*) **is being organised using the LARGE() function.** After which, the index and match function is being used to retrieve the corresponding pastry names from "Inventory System" sheet.

Figure 13: Dynamic Date Documentation

Week	
3	Source for companies/ business clients with a business problem with data available
4	Interview, and Collect Data from selected Company – U MAY Delights
5	Convert handwritten data into excel and understand scope of project
6	Problem Identification and possible solutions incubation
7	Develop Project Proposal and Influence Diagrams/ BlackBox
8	Submission of Project Proposal & Present Proposal
9	Creation Commencement
10	Refined Model Creation
11	Pivot Problems and Redefined Influence Diagrams & Model
12	Final presentation, Final Report and Model Refinement
13	Final Presentation & Final Report Submission

Figure 14: Project Timeline