

IT Service Desk – Understanding Factors That Hamper Process Efficiency and Customer Satisfaction

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1. Executive Summary:

The UM IT service desk is the centralized hub for 42 departments that deal with solving software and hardware issues that arise in all the University of Miami. Students and faculty are open to using the services and have many ways of reaching out and filling a case as well as they will receive confirmation at both the start and completion of their case.

The IT desk currently sends out a survey to $\frac{1}{3}$ of the customers who opened cases. These surveys consist of questions to gauge if the customer was satisfied or unsatisfied with the way their case was handled. The current satisfaction percentage is around 90-95%, leaving a small portion unsatisfied. The objective of this project is to use our acquired industrial engineering knowledge in order to present a reasoning for why unsatisfied customers aren't pleased with the service. We were tasked with providing deliverables for this project which include but are not limited to complete statistical analysis of the data given to us, new KPIs, and future recommendations for how to improve service.

Through multiple meetings with a member of the IT desk, we were given roughly 9000 data entries dating back to December of 2019. Due to Covid-19 we were not allowed to gather this data ourselves but also the data we needed would go back years and we wouldn't have been able to get it ourselves. The data was in excel and very unorganized because for every case number, there were 5 entries for every single category on the survey. What makes this difficult is that all the data was entered in one column and sorting through different categories would result in 5 replications of data. This was especially troublesome when looking at the duration a case was open, who opened it, or the date it was opened. Once we had all the data acquired, we had to clean and rearrange the data. We started cleaning our data by deleting data that would not be part of our analysis. "Taken by", "Closed by", "Closed notes" and "Description" were all columns that had no impact on our analysis. The other part of cleaning our data was the process of eliminating lines of data that were missing data in various cells. Once the data was cleaned of useless and empty values, we needed to rearrange the data because we wanted all the incident numbers to be represented by only 1 row. The goal was to take the values for each survey category and give them their own column. In order to rearrange the data from excel we had to use the code python and the software R. It involved using simple lines of code but after implementation, we were left with a new excel sheet that was easier to navigate.

The first steps of data analysis after rearranging and cleaning our data was a Tableau analysis to identify how often negative ratings are occurring in different priorities, departments, categories, subcategories and contact types. Using Tableau gave us early insight into areas of concern that had disproportionate negative responses. Once we looked into the Tableau analysis we started to focus on specific categories using various softwares such as R, Spss, Minitab, and Excel. The bulk of our analysis was done using logistic binary regression. In order to run a logistic binary regression to see the impact of various categories on the satisfaction of a customer related to various topics, we needed to turn our data into binary data. This means we separated our data into two categories, one being satisfied and the other was unsatisfied. If a survey score of 1 or 2 was given, that qualified as unsatisfied and was given a new value of 0. If the survey response was a 4 or 5, it would be satisfied and get a designated 1 as its value. All 3 values were removed from analysis. In Spss we ran the logistic binary regression using a dependent variable as the overall service experience, while the independent variables were the other four categories of timeliness, technical skill/knowledge, courtesy and professionalism and quality of service. The next

part of the binary regression was to see how various variables such as priority, department, etc would impact each survey category. Unfortunately we weren't able to use Spss because of the volume of data and analysis being done. To counteract that issue, we transitioned over to R. In R we had a few lines of code that were able to run the regression model for all the categories at once.

The results from the analysis were eye opening for making future recommendations. According to tableau approximately 95.5% of the data represents ratings that are 4 and 5 meaning only a very small proportion weren't satisfied with their overall service Experience. We were also able to see that a large majority of cases were in need of help with software, Accounts and Security, customer service and support, and network and voice. We also were given insight that a higher priority rating (more time taken to complete the case) resulted in more unsatisfied survey responses for both timeliness and overall service ratings. By using the logistical binary regression in Spss we are able to see that Timeliness, Technical skill and Quality of Service are the significant categories when it comes to impacting the overall service experience. The knowledge category had a much larger significance rating and therefore has little to no impact on the overall rating. Interestingly enough, Spss gives an exp(B) value that allows us to see the probability that when one survey category goes up by a rating, the overall experience will go up as well. The category with the largest impact was quality of service. The logistic binary regression model done is R to show correlations between all various categories and every survey question was more involved. From that analysis we are able to see that for the timeliness question, it was impacted significantly by the business duration(time to complete the case). This was expected. We also saw that the "Network and Voice" category is significant in impacting timeliness satisfaction rate for customers. This means that timeliness ratings are worse for those types of cases and thus should be a focus moving forward. For the knowledge survey question, Network and voice cases were also the most significant in causing a bad rating. Another factor that was found significant was that people opening the case via phone call would be less satisfied at the end. This may be due to the worker not asking enough questions or the person opening the case has a hard time fully explaining their issue. The quality of service question responses had the same statistical significant categories of knowledge and that is most likely because the two questions seem to be very similar in nature. Therefore, maybe only one of those two is necessary to keep on the survey. For courtesy and professionalism we saw no significant variables which makes sense because it has no impact on overall satisfaction. Also through box Minitab and Excel we were able to utilize boxplots and formulas in order to find the average time a case is open for a satisfied customer and an unsatisfied customer. We split them into priority ratings and evaluated them separately. Based on the data we got, some priorities were taking too long to complete the case and in other instances, they were getting done ahead of schedule. This allowed us to reevaluate the current target times that the IT desk sets for themselves. Priority 1 is unchanged due to lack of data, priority 2 goes from 4 hours to 5 hours. Priority 3 changes from 24 hours to 15 hours, and priority 4 changes from 72 hours to 35 hours.

A key component to our completion is coming up with more data driven analysis that the IT desk can do in the future to further improve their services. Because of our limited data and time, we are not able to discover and solve every issue but we can insist that they try in the future. One approach the IT desk can take in the future is evaluating comments left by survey takers and see if there is statistical correlation between similar comments or key words. Like previously mentioned, they should also look into the specific questions being asked on their survey. Some may be redundant or have no significance and can be removed. Our last recommendation at the moment would be to keep recording data for the next few years including the main employee who worked on the case. This added data will allow for better analysis of what we've already done, but also you would be able to see if any workers are struggling or prevailing in a certain case type.

2. Introduction:

This project focused on analyzing survey data from December 2019 to March 2021 that was provided to us by the UM IT service desk. The project sponsor initially wanted us to look at and analyze areas of concentration for dissatisfied customers and identify specific departments and correlation that could have existed between these variables and dissatisfied customers. The UM IT service desk is the main department at the University of Miami that handles complaints and issues in regards to software or hardware for technological devices for general students as well as faculty. The UM IT service desk is the central hub for all the different problems that are inputted. Once the issue is inserted, the issue is manually assigned to one of 42 Assignment groups (Groups made according to different departments/categories of issues) depending on the type of task. Once , the issue is solved, the type of input of ticket (Phone, Email, Online), the business duration (Time for the case to be solved), the category and subcategory of issue, ticket priority and general comments are recorded.

For this project, we specifically looked at this specific data provided to us by the UM IT service desk. This data was obtained by the IT service desk by sending out survey requests to 33% of the individuals that inputted a problem and had their ticket closed. These surveys have five categories; Timeliness, Courtesy and Professionalism, Quality of Service, Technical Skill/Knowledge and Overall Service Experience and these are asked to be evaluated on a 1-5 ordinal rating with 1 being least satisfied and 5 being very satisfied. Apart from that, the survey provided asks for overall comments and feedback from customers.

After looking at the initial goals of the project sponsor, we looked at the data sheet and were able to observe that most ratings for users tended to be satisfied. A very small percentage of cases were users being dissatisfied with the service. Also, our data was relatively small sized, as the project sponsor did not have data prior to December 2019. According to these factors and keeping in mind the goals of the client we decided that we would understand the distribution of the survey category ratings based on different combinations of the input variables and understanding the main drivers/areas in the department that lead to a low rating and caused these individuals to be dissatisfied with their experience at the IT service desk. The first part of this analysis was performed in Tableau, an interactive statistical visual analysis tool, was used in categorizing as well as visually representing the overall trends of data based on different variables of assignment group, category, priority, business duration etc. This gave us a qualitative analysis regarding the combination of factors that most impacted customer satisfaction.

The next part of the analysis was performing logistic binary regression using R, in order to understand the statistical significance as well as the degree of effect that each survey category of Timeliness, Technical Skill/ Knowledge, Courtesy and Professionalism and Quality of Service affect the overall Service Rating. This helped us understand the factors of service that are most important to the customers. Following this, each survey category apart from the overall service experience was analyzed in R, a statistical programming language to see which of the input variables statistically affect the other four survey categories the most.. By combining these two analyses done in R, we were able to get a clear picture of exactly the areas and types of inputs that lead to customers being satisfied or dissatisfied.

Both parts of this analysis gave us a clear idea as to the main areas where negative ratings are concentrated as well as the statistical significance of each factor in deciding overall satisfaction of the customer who performs the survey.

Our final deliverables for the project include:

1. A complete report that explains the introduction, process flow, data cleaning, Tableau and R steps with analysis included.
2. A final presentation that summarizes the procedure and the results obtained from the analysis.
3. A tableau interactive dashboard that allows the IT service desk to interactively be able to see the results based on different factors of input type, priority, category etc. and see patterns of performance based on these individual factors.
4. Logistic binary regression reports as well as corresponding analysis that interprets the results of the regression and provides statistical knowledge on factors affecting satisfaction.
5. A new KPI, that has changed response times based on current performance for each priority.
6. Current recommendations based on analysis conducted, as well as future recommendations that will help the IT service desk understand new areas of analysis and other factors that could be helpful in increasing the satisfaction rate.

3. Current Process and State:

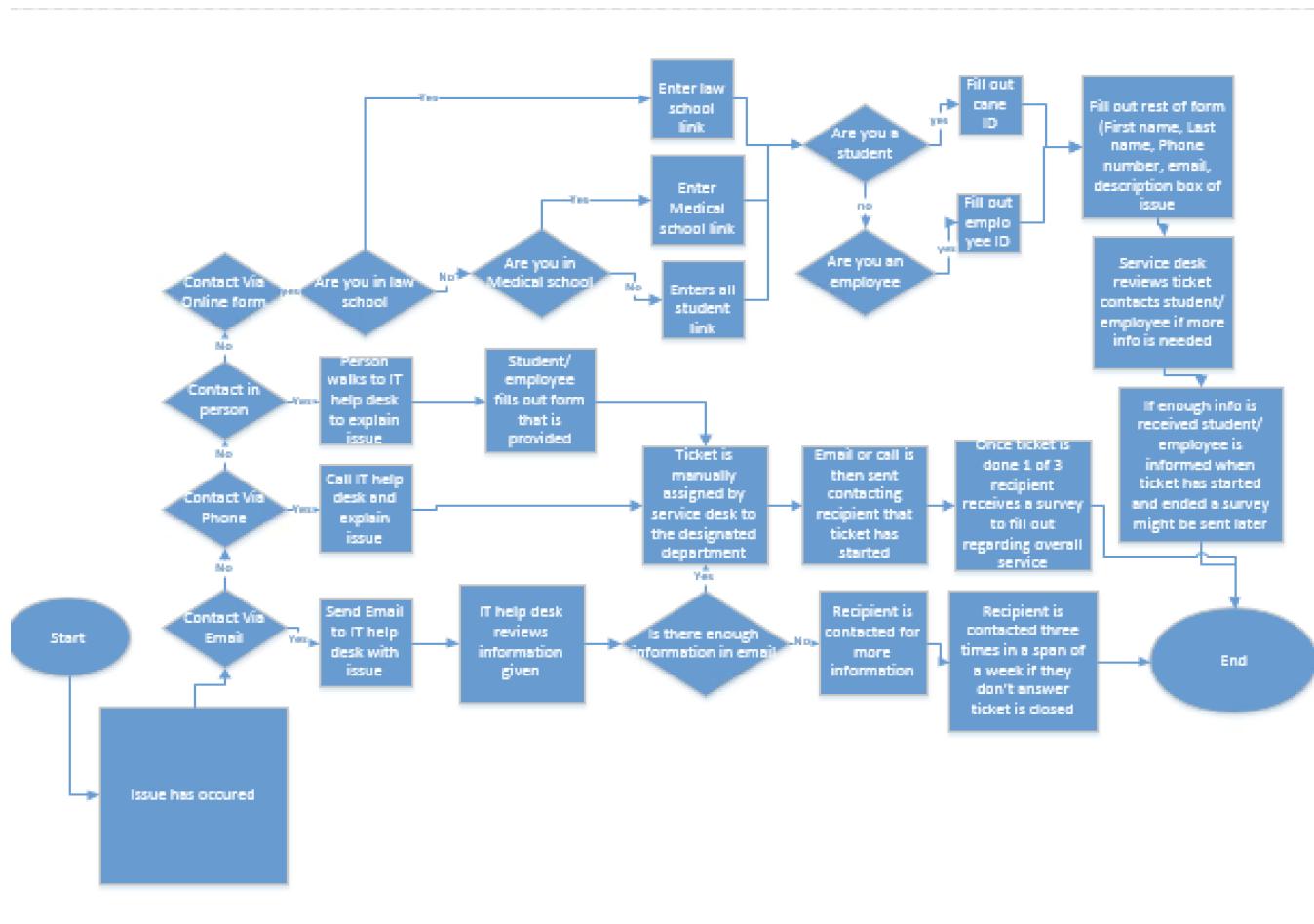


Figure 1: Visio Flowchart to show the process of how users input an issue to the IT service desk

The process of how cases get submitted is represented in the Visio Flowchart above. People will typically reach out to the service desk for software issues but they will also process many hardware issues. In order for a case to be submitted, the party in need of help will address the IT desk in one of four ways. As seen in the flowchart, a case can be submitted through email, phone call, in person, or an online form that follows a slightly more lengthy process. In the case that the case is first processed through email, the IT desk will review the information provided to them. They make sure that the information needed to move forward is presented to them and if it is, they manually assign the case to the relevant department. The person working at the IT desk who opens and assigns the case is typically not the same person who closes the case at the end due to working hour randomness. There are forty two different specialized departments that a case can be assigned to (these departments and their case volume are shown in a chart below). If the information provided is not adequate then they will reach out to the party that submitted the case, up to three times, and if they get no response the case will be closed. For a phone call or an in person visit, the IT desk goes through the same process of gathering the required information and then manually assigning the case to the department that can help. The IT desk will also use a matrix they have designed to give each case a priority rating. This priority rating will be from one to four with estimated completion times set at thirty minutes, four hours, twenty four hours, and seventy two hours respectively. The way the IT desk comes up with these priority ratings is a combination of urgency and impact. Urgency is the effect that the problem is having on the person/group who filed the report. If the work was completely halted or damage was done to hardware then that would be an urgency of one. Typically more cases receive an urgency of three which is that “Work slowed or halted, but reasonable alternative(s) exist”. The urgency will be then crossed over with the “impact” that the problem is having. This impact rating is much more objective because it just represents the amount of people dealing with the issue. For instance, if it is a big conference and the projector doesn't work, that would have over one hundred people being impacted and therefore the impact rating is a 1 (highest). If there were only less than ten people, that is a level three impact. Once Impact and urgency are used to get the priority rating as shown in the chart below, a duration goal is assigned to the case. Like mentioned previously the respective time goals for ratings one to four are four hours, twenty four hours, and seventy two hours respectively. Once the case is assigned to the desired department, the person who filed the case will receive a confirmation email that they will begin working on fixing the issue. Once the problem is fixed, one out of three people will receive a survey to fill out. These surveys have five categories; Timeliness, Courtesy and Professionalism, Quality of Service, Technical Skill/Knowledge and Overall Service Experience and these are asked to be evaluated on a one to five rating with one being least satisfied and five being very satisfied. Aside from the first three options, people can file a case using an online form. The form will ask the user what school they are in (law, medical, undergrad/grad) and if they are a student or a faculty member. Depending on what they identify as, they will be asked to supply their ID. Once they fill out the form, the IT desk will manually look through the information and follow the same procedure as was followed for the other methods. The survey is the last element of the process and the information gathered is then used for statistical analysis and future improvement.

4. Data Processing and Cleaning

4.1. Initial Data Cleaning performed in Excel

Due to the current COVID - 19 Pandemic situation, we were not permitted to collect data ourselves. The data sheets were provided to us by our client that indicated survey responses of cases from December 2019 to March 2021. The data had initially approximately 8300 rows of data with 13 columns of data. There were multiple steps taken to find and analyze faults in the data and to clean.

The first steps involved in Data cleaning and sorting was to delete unnecessary data that would not be part of our analysis. These columns of data were “Taken by”, “Closed by”, “Closed notes” and “Description.” “ Taken by” was the name of the person who took the survey, which was irrelevant. “Closed by” refers to the employee who closed the ticket. However, this did not always represent the employee who actually worked on the issue and hence analyzing this data would provide us with incorrect conclusions. “Closed notes” and “Description” are both columns in the data that do not represent categorical information and analyzing text from each of these cases manually would not be feasible.

The next step was to find and eliminate blank fields or fields of data that had values that were not part of the same category. (Data Input errors). This was performed by using the filter function in excel where this function was applied to each column of our data. Once the filter was applied, excel automatically categorized the data and recognized the blanks. There were only 2 blank spaces identified in all of the columns of our data and the data rows were eliminated. In the filter function for the closed dates , we also realized that there were three cases that were completed in 2013 and should not have been part of the data set that was data from December 2019 to March 2021. After consulting with our client, we were advised to delete these data points. Once this was completed, we had finished our data cleaning process in Excel.

4.2 Data Collection, Sorting and Transposing.

In the current data file that was given to us by our client, there were some issues that the way the data was organized would pose to our analysis. For example, for each Task ID, the data given was separated by each row based on each of the five survey categories. This meant for each survey case that was given by the participant, there were five rows of data to represent. Therefore in order to make this easier to read and understand, we needed to transpose the data in a way that would provide us with all of our information for one case in one row of excel.

In order to perform this transposition we required the use of python and R. Task IDs were separated based on the variables of “Business Duration”, “Category”, “Subcategory”, “Priority”, “Assignment Group” and “Contact type.”. To transpose this data we simply required to eliminate the duplicates as the data for these variables would be the same for all five rows of the same case ID. Therefore this was done quite easily in python. This was the following code that helped us eliminate the duplicates from these variables: `“dfID = dfID.drop_duplicates(['Task']) dfID.reset_index(inplace=True,drop=True) dfID.to_excel('FinalTransposedData.xlsx')”`

ask	Question	Value	Assignment group	Closed date	Business duration	Contact type	Priority	Category	Subcategory
NC20190301690	Timeliness	5.00	Network Engineering - Gables & RSMAS	12-12-2019 12:00:38 PM	9825	Internal	3 - Moderate	Network & Voice	DNS
NC20190301690	Courtesy and Professionalism	5.00	Network Engineering - Gables & RSMAS	12-12-2019 12:00:38 PM	9825	Internal	3 - Moderate	Network & Voice	DNS
NC20190301690	Quality of Service	5.00	Network Engineering - Gables & RSMAS	12-12-2019 12:00:38 PM	9825	Internal	3 - Moderate	Network & Voice	DNS
NC20190301690	Overall Service Experience	5.00	Network Engineering - Gables & RSMAS	12-12-2019 12:00:38 PM	9825	Internal	3 - Moderate	Network & Voice	DNS
NC20190301690	Technical Skill/Knowledge	5.00	Network Engineering - Gables & RSMAS	12-12-2019 12:00:38 PM	9825	Internal	3 - Moderate	Network & Voice	DNS
NC20190302243	Quality of Service	5.00	Service Desk - UMIT	12-12-2019 12:00:38 PM	42	Phone	3 - Moderate	Software	Troubleshoot/Support
NC20190302243	Timeliness	5.00	Service Desk - UMIT	12-12-2019 12:00:38 PM	42	Phone	3 - Moderate	Software	Troubleshoot/Support
NC20190302243	Courtesy and Professionalism	5.00	Service Desk - UMIT	12-12-2019 12:00:38 PM	42	Phone	3 - Moderate	Software	Troubleshoot/Support
NC20190302243	Overall Service Experience	5.00	Service Desk - UMIT	12-12-2019 12:00:38 PM	42	Phone	3 - Moderate	Software	Troubleshoot/Support
NC20190302243	Technical Skill/Knowledge	5.00	Service Desk - UMIT	12-12-2019 12:00:38 PM	42	Phone	3 - Moderate	Software	Troubleshoot/Support
NC20190302243	Quality of Service	5.00	Service Desk - UMIT	12-12-2019 12:00:38 PM	42	Phone	3 - Moderate	Software	Troubleshoot/Support
NC20190300703	Overall Service Experience	5.00	Desktop Support - Gables	12-12-2019 02:00:14 PM	39165	Email	2 - High	Software	Troubleshoot/Support
NC20190300703	Courtesy and Professionalism	5.00	Desktop Support - Gables	12-12-2019 02:00:14 PM	39165	Phone	2 - High	Software	Troubleshoot/Support
NC20190300703	Quality of Service	5.00	Desktop Support - Gables	12-12-2019 02:00:14 PM	39165	Phone	2 - High	Software	Troubleshoot/Support
NC20190300703	Technical Skill/Knowledge	5.00	Desktop Support - Gables	12-12-2019 02:00:14 PM	39165	Phone	2 - High	Software	Troubleshoot/Support
NC20190300703	Timeliness	5.00	Desktop Support - Gables	12-12-2019 02:00:14 PM	39165	Phone	2 - High	Software	Troubleshoot/Support
NC20190300703	Courtesy and Professionalism	5.00	Desktop Support - Gables	12-12-2019 02:00:14 PM	39165	Phone	2 - High	Software	Troubleshoot/Support
NC20190300703	Overall Service Experience	5.00	Desktop Support - Gables	12-12-2019 02:00:14 PM	39165	Phone	2 - High	Software	Troubleshoot/Support
NC20190302032	Technical Skill/Knowledge	5.00	Telecom Support - Gables Operations	12-12-2019 03:00:26 PM	13105	Email	3 - Moderate	Network & Voice	Troubleshoot/Support
NC20190302032	Overall Service Experience	5.00	Telecom Support - Gables Operations	12-12-2019 03:00:26 PM	13105	Email	3 - Moderate	Network & Voice	Troubleshoot/Support
NC20190302032	Timeliness	5.00	Telecom Support - Gables Operations	12-12-2019 03:00:26 PM	13105	Email	3 - Moderate	Network & Voice	Troubleshoot/Support
NC20190302032	Courtesy and Professionalism	5.00	Telecom Support - Gables Operations	12-12-2019 03:00:26 PM	13105	Email	3 - Moderate	Network & Voice	Troubleshoot/Support
NC20190302032	Quality of Service	5.00	Telecom Support - Gables Operations	12-12-2019 03:00:26 PM	13105	Email	3 - Moderate	Network & Voice	Troubleshoot/Support
NC20190302032	Technical Skill/Knowledge	5.00	Telecom Support - Gables Operations	12-12-2019 03:00:26 PM	13105	Email	3 - Moderate	Network & Voice	Troubleshoot/Support
NC20190302746	Timeliness	5.00	Student Support - Help Desk	12-12-2019 04:00:17 PM	157	Walk-in	3 - Moderate	Software	Troubleshoot/Support
NC20190302746	Courtesy and Professionalism	5.00	Student Support - Help Desk	12-12-2019 04:00:17 PM	157	Walk-in	3 - Moderate	Software	Troubleshoot/Support
NC20190302746	Quality of Service	5.00	Student Support - Help Desk	12-12-2019 04:00:17 PM	157	Walk-in	3 - Moderate	Software	Troubleshoot/Support
NC20190302746	Overall Service Experience	5.00	Student Support - Help Desk	12-12-2019 04:00:17 PM	157	Walk-in	3 - Moderate	Software	Troubleshoot/Support

Figure 2: Data with duplicates

+ Code + Text							
[]	dfID = dfID.drop_duplicates(['Task'])	dfID.reset_index(inplace=True, drop=True)	dfID.to_excel('FinalTransposedData.xlsx')				
[]	dfID						
Task	Assignment group	Business duration	Contact type	Priority	Category	Subcategory	
0 INC20190301690	Network Engineering - Gables & RSMAS	9825	Internal	3 - Moderate	Network & Voice	DNS	
1 INC20190302243	Service Desk - UMIT	42	Phone	3 - Moderate	Software	Troubleshoot/Support	
2 INC20190300703	Desktop Support - Gables	39165	Phone	2 - High	Software	Troubleshoot/Support	
3 INC20190302032	Telecom Support - Gables Operations	13105	Email	3 - Moderate	Network & Voice	Troubleshoot/Support	
4 INC20190302746	Student Support - Help Desk	157	Walk-in	3 - Moderate	Software	Troubleshoot/Support	
...
1738 INC20210033227	Service Desk - UMIT	900	Phone	3 - Moderate	Customer Service & Support	Troubleshoot/Support	
1739 INC20210030816	UMIT Security Operations	40046	Email	3 - Moderate	Accounts & Security	Phishing	
1740 INC20210033821	Learning Platforms Team	621	Phone	3 - Moderate	Training	General Training	
1741 INC20210031966	Student Support - Help Desk	31838	Walk-in	3 - Moderate	Software	Installation	
1742 INC20200370127	Student Support - Help Desk	1501188	Walk-in	3 - Moderate	Hardware	Warranty	

Figure 3: Data without duplicates

Task	Question	Value
INC20190301690	Timeliness	5.00
INC20190301690	Courtesy and Professionalism	5.00
INC20190301690	Quality of Service	5.00
INC20190301690	Overall Service Experience	5.00
INC20190301690	Technical Skill/Knowledge	5.00
INC20190302243	Quality of Service	5.00
INC20190302243	Timeliness	5.00
INC20190302243	Courtesy and Professionalism	5.00
INC20190302243	Technical Skill/Knowledge	5.00
INC20190302243	Overall Service Experience	5.00
INC20190300703	Timeliness	5.00
INC20190300703	Courtesy and Professionalism	5.00
INC20190300703	Quality of Service	5.00
INC20190300703	Technical Skill/Knowledge	5.00
INC20190300703	Overall Service Experience	5.00
INC20190302032	Technical Skill/Knowledge	5.00
INC20190302032	Overall Service Experience	5.00
INC20190302032	Timeliness	5.00
INC20190302032	Quality of Service	5.00
INC20190302032	Courtesy and Professionalism	5.00
INC20190302746	Timeliness	5.00
INC20190302746	Technical Skill/Knowledge	5.00
INC20190302746	Quality of Service	5.00
INC20190302746	Courtesy and Professionalism	5.00
INC20190302746	Overall Service Experience	5.00
INC20190299256	Overall Service Experience	5.00
INC20190299256	Technical Skill/Knowledge	5.00
INC20190299256	Timeliness	5.00
INC20190299256	Quality of Service	5.00
INC20190299256	Courtesy and Professionalism	5.00
INC20190301848	Quality of Service	5.00
INC20190301848	Courtesy and Professionalism	5.00
INC20190301848	Overall Service Experience	5.00
INC20190301848	Timeliness	5.00
INC20190301848	Technical Skill/Knowledge	5.00
INC20190302646	Technical Skill/Knowledge	5.00

Figure 4: Pre-transposed data

Task	Courtesy and Professionalism	Overall Service Experience	Quality of Service	Technical Skill/Knowledge	Timeliness
INC0106905	4	4	4	4	4
INC20180165421	4	4	4	4	4
INC20190003272	5	5	5	5	5
INC20190009528	5	5	5	5	5
INC20190022816	5	5	5	5	5
INC20190259525	5	5	5	5	5
INC20190288147	5	5	5	5	5
INC20190294191	5	5	5	5	5
INC20190297286	5	5	5	5	5
INC20190298756	5	5	5	5	5
INC20190299086	5	5	5	5	5
INC20190299256	5	5	5	5	5
INC20190300703	5	5	5	5	5
INC20190301017	5	5	5	5	5
INC20190301459	3	2	2	3	2
INC20190301690	5	5	5	5	5
INC20190301848	5	5	5	5	5
INC20190301884	5	5	5	5	5
INC20190302032	5	5	5	5	5
INC20190302243	5	5	5	5	5
INC20190302646	5	5	5	5	5
INC20190302746	5	5	5	5	5
INC20190303456	5	5	5	5	5
INC20190303595	5	5	5	5	5
INC20190303784	4	4	4	4	2
INC20190304370	5	5	5	5	5
INC20190304389	5	5	5	5	5
INC20190304501	5	4	5	4	5
INC20190304728	5	5	5	5	5
INC20190304827	5	5	5	5	5
INC20190304860	5	5	5	5	5
INC20190305054	5	5	5	5	5
INC20190305143	4	4	4	4	5
INC20190305184	5	5	5	5	5
INC20190305246	5	5	5	5	5
INC20190305259	5	4	4	5	4
INC20190305603	2	2 NA		4	3
INC20190306055	5	5	5	5	5
INC20190306322	5	5	5	5	5
INC20190306406	5	5	5	5	5

Figure 5: Post-transposed data

The next step was to transpose our survey category ratings to different columns according to the category itself so that each survey question can be represented in a separate column and hence all the survey categories would be represented in the same row with the same Task ID. This transposition was conducted in R. In order to successfully transpose this data in the way that we wished to, we needed a function called “spread”. Therefore, we needed to install a package called “tidy”. Once the package was installed using the code “`install.packages("tidy")`”, we ran the spread function according to the column names we had and this was able to transpose the “question” (survey category) of the data. The figures below represent this transposition.

5. Data Analysis

5.1. Tableau Analysis:

Tableau analysis was conducted in order to clearly recognize and identify how negative ratings are being distributed according to the different priorities, assignment groups, categories, subcategories and contact types. This helped us look at trends in negative ratings for specific variables.

These are the following tables that we thought were especially important in understanding the trends of negative ratings in the IT service desk itself. The section is followed by our main inferences and summaries from the trends of data observed that gives us a fairly accurate idea about the main concentrations of negative ratings. Below are the tableau analysis that included percentages as well as a visual representation of each data.

Figure 6 and Figure 7: Overall Service Experience ratio of rating for all Cases

OverallServiceExperience For Cases	
Overall Service Experience	
1	1.67%
2	0.98%
3	1.73%
4	7.76%
5	87.87%

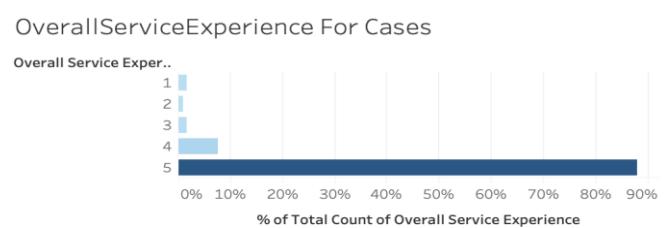


Figure 8 and Figure 9: Amount of cases in each survey category.

Count of cases in each category

Category	Count
Accounts & Security	447
Clinical Software	11
Customer Service & Suppo..	349
Hardware	115
Hosting	35
Investigation	1
Network & Voice	214
Software	542
Training	18
Web	7

Count of cases in each category

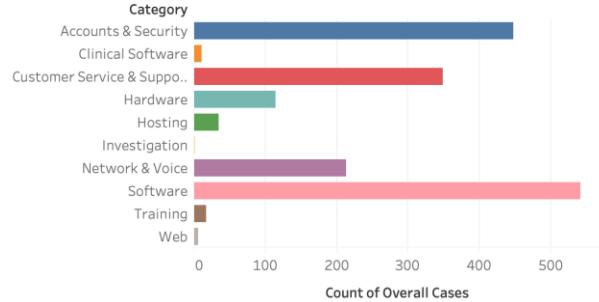
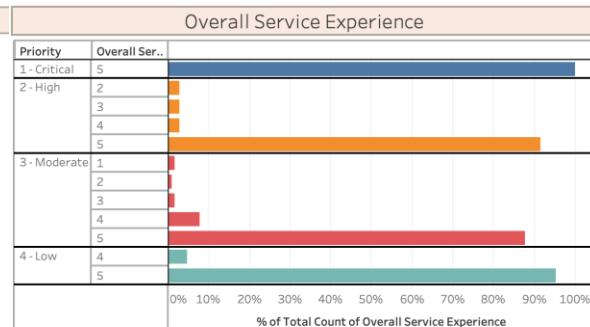
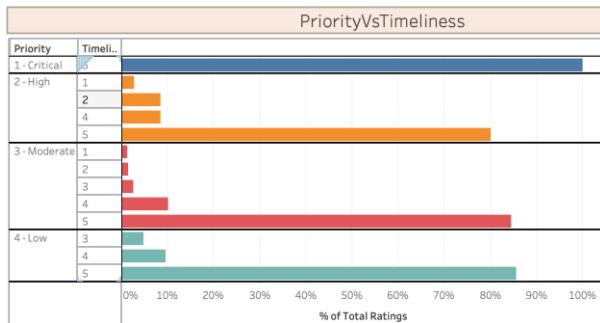


Figure 10 and Figure 11: Overall Service Experience and Timeliness according to ratings and priority



PriorityVsTimeliness

Priority	Timeliness	
1 - Critical	5	100.00%
2 - High	1	2.86%
	2	8.57%
	4	8.57%
	5	80.00%
3 - Moderate	1	1.31%
	2	1.43%
	3	2.50%
	4	10.23%
	5	84.54%
4 - Low	3	4.76%
	4	9.52%
	5	85.71%

Overall Service Experience

Priority	Overall Ser..	
1 - Critical	5	100.00%
2 - High	2	2.86%
	3	2.86%
	4	2.86%
	5	91.43%
3 - Moderate	1	1.72%
	2	0.95%
	3	1.72%
	4	7.91%
	5	87.69%
4 - Low	4	4.76%
	5	95.24%

Figure 12 and Figure 13: Overall Service Experience based on category

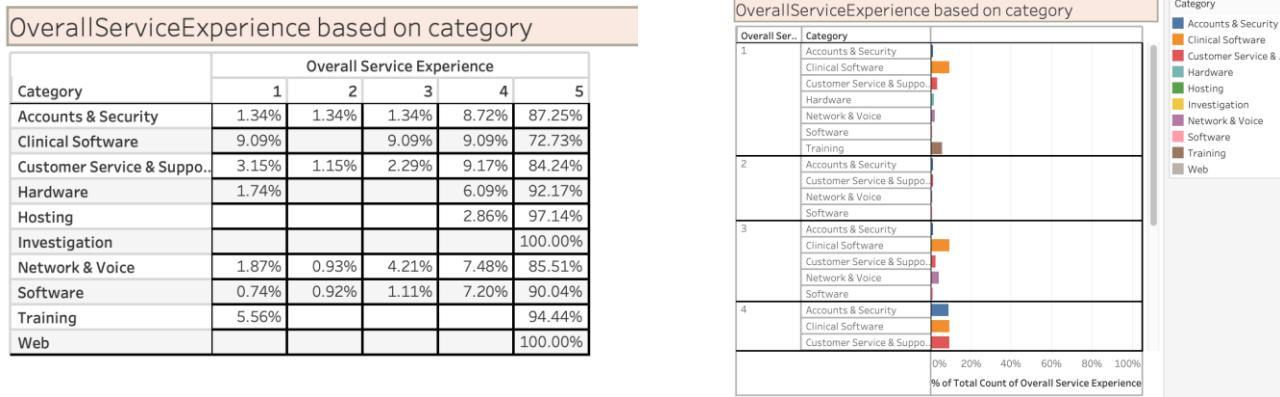


Figure 14 and Figure 15: Amount of rating based on assignment group

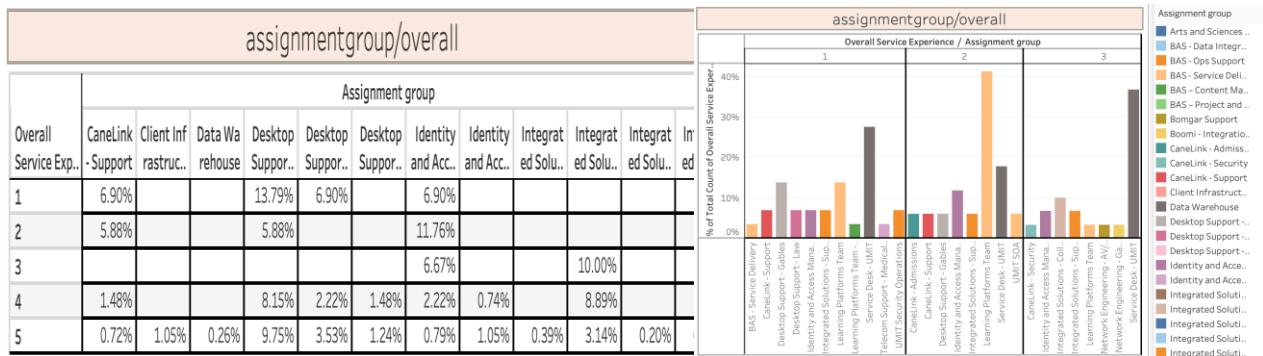


Tableau Qualitative Analysis

Based on the above initially analyzed data there are some conclusions regarding the data that can be drawn.

- Based on figure 1 and figure 2 out of all of the data approximately 95.5% of the data represents ratings that are 4 and 5. Meaning that only 4.5 % of the users who gave the survey were dissatisfied with the overall service Experience.
- Now based on figure 3 and figure 4, we can see that a high majority of cases come from software, Accounts and Security, customer service and support, and network and voice
- After that we conducted analysis on each category to see where the highest percentage of dissatisfied customers were. Based on figure 7 and figure 8, we can see that the most dissatisfied rating comes from clinical software with a 9 % dissatisfaction rating, which also has the lowest majority of cases. After that would come customer service and report with a 4.3 %, network and voice with 2.8%, and hardware with 1.74%.

- In both trends (overall service rating vs priority) and (timeliness vs priority) shown in figure 5-6 we saw that higher priority ratings have a higher percentage of lower customer review ratings. This made us think that both timeliness and overall service experience could be dependent on priority. For that reason we decided to analyze each variable isolated in the data sheet and see its effect on each of the four survey categories of Timeliness, Technical Skill/Knowledge, Quality of Service and Courtesy and Professionalism.
- For Assignment groups (employee groups) we see that the highest percentages of dissatisfied reviews are obtained for the assignment groups of UMIT Security operations, Learning Platform –Tier 2, Canelink support and BAS service delivery suggesting some problems in these employment groups.

5.2 Performing logistic binary regression

After understanding the main concentration of negative ratings, qualitative analysis gave us an idea regarding the main areas that need to be looked at in order to solve the negative ratings. The next part of our analysis involves understanding the factors that are most important to customers for being satisfied overall with the service experience they receive at the IT Service Desk. In order to understand this logistic binary regression is used.

Currently each of the five survey categories of timeliness, technical skill/knowledge, courtesy and professionalism, quality of service and overall service experience are rated on an ordinal scale from one to five. Therefore if a user is rating one of these categories as a 1 or a 2 it can be said that the user is dissatisfied with the experience for that particular category. If a 4 and 5 is received, then it can be said that the user was satisfied with the experience. Therefore, in order to understand how each of the four survey categories affect the overall service experience, the ratings for overall service experience needed to be converted to binary.

1 - 2 (Converted to 0)

4 - 5 (Converted to 1)

3 (Rows with this rating data were deleted)

Once the new data sheet was obtained, data was imported into R, where All of the 4 and 5 ratings were converted into 1 and all of the 1 and 2 ratings were converted to 0. Data was then exported with the new binary ratings. The next step was performing the logistic regression itself. Due to the small number of input variables, we decided to conduct this analysis in SPSS, where from the analysis tab, under regression, logistic binary regression was chosen. The dependent variable was the overall service experience, while the independent variables were the other four categories of timeliness, technical skill/knowledge, courtesy and professionalism and quality of service. This is how the report looks like in SPSS.

Variables in the Equation						
	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Timeliness	1.565	.542	8.332	1	.004
	Technical Skill/Knowledge	1.737	.726	5.722	1	.017
	Quality of Service	2.658	.660	16.201	1	<.001
	Courtesy and Professionalism	-.665	.743	.800	1	.371
	Constant	-15.532	3.599	18.629	1	<.001

a. Variable(s) entered on step 1: Timeliness, Technical Skill/Knowledge, Quality of Service, Courtesy and Professionalism.

Figure 16: Results of the ssps regression for overall service experience.

From this report there are multiple inferences that can be made. First we will look at the significance level

1. Timeliness, Technical skill and Quality of Service show significance levels of 0.004, 0.017 and 0.001. In statistical terms, these values of significance are extremely low which shows that these factors are statistically significant enough to affect the overall service experience for a user.
2. Courtesy and Professionalism with a significance level of 0.371 is much higher than the typical 0.05 significance level at which these values were tested for. This shows us that the rating of the courtesy and professionalism is not statistically significant in impacting the overall service experience for a user.
3. The next aspect of this is looking at the extent to which each of these survey categories affect the overall service experience. For this, out of all the columns of data, we will only be looking at the EXP (B) values. The other data in our columns is irrelevant to the subject of the analysis as this output is not relevant to our conclusions. We see a column for each data that represents the exp (B) value. This value represents the exponent of the variable B. This represents the odds of increase in a user being satisfied with an increment of 1 in the ordinal rating scale. Therefore, for every 1 increase in the rating of quality of service there is 14.26 odds increase that the user will be satisfied.

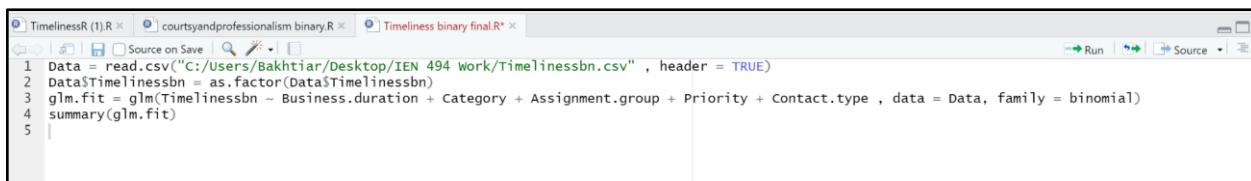
Based on these statistical information received, we see that Quality of Service is most important to the customers, followed by Technical Skill/knowledge, Timeliness and then Courtesy and Professionalism according to the exp(B) values of 14.26, 5,679 and 4.784 respectively. This analysis gives us an idea that users value Quality of Service, Technical Skill/Knowledge, Timeliness from most to least and courtesy and professionalism of the person is not valuable enough to affect the satisfaction or dissatisfaction of a user.

5.3 Performing Logistic Binary Regression to understand the factors that affected each survey category except overall service experience:

In order to perform Logistic Binary Regression to understand how our independent variables of “Contact Type”, “Category”, “Priority” and “Business Duration” and “Assignment Group” affect the satisfaction of a customer for the survey categories of “Timeliness”, “Courtesy and Professionalism”, “Technical Skill/Knowledge” and “Quality of Service”, we needed to use R in order to perform the logistic binary regression and obtain valid results. While trying this model in SPSS, we found that the data that we were receiving had an error associated with it and the results we were obtaining seemed incorrect and infeasible. Upon questioning and understanding we found that the amount of variables in our input were way too high for SPSS to run the model correctly. There were 42 Assignment groups, 5 contact types, 9 categories, 4 priority categories and a significant amount of values for business duration because these values are numerical and usually vary for every case.

We then decided to run the model in R, as we felt it would have a better chance of handling the amount of variables in our data set. In order to run this model in R, the first steps were eliminating 3 star ratings from each survey category, as a 3 represents neutral (Customer is neither satisfied/satisfied). Therefore, we separated each survey category into a different file with all the independent variables. Then, by using the filter function in Excel, we separated all the rows of data with 3* ratings and eliminated them as they would cause skewness in our analysis. Following this, we needed to again assign a binary value to all timeliness ratings. Therefore, 4 and 5 ratings would be deemed as 1 (satisfied) and 1 and 2 ratings would be deemed as 0 (dissatisfied). This was done for all four survey categories that would be part of the analysis.

Once the 3* ratings were eliminated and values were assigned to their respective binary variable, it was time to perform the logistic regression in R. Therefore, all the excel files were first converted to a CSV file (Comma Separated File). Then the data was imported in R. The binomial function was used in order to perform logistic regression in R. The picture below represents the code that was needed to perform the regression analysis for the Timeliness survey category. Other code for other survey categories, as well as all the answer reports are included in Appendix at the back of the report.

A screenshot of the RStudio interface. The top menu bar shows tabs for 'TimelinessR (1).R', 'courtesyandprofessionalism binary.R', and 'Timeliness binary final.R'. Below the menu is a toolbar with icons for file operations like Open, Save, and Run. The main workspace contains five lines of R code:

```
1 Data = read.csv("C:/Users/Bakhtiar/Desktop/IEN 494 Work/Timelinessbn.csv", header = TRUE)
2 Data$Timelinessbn = as.factor(Data$Timelinessbn)
3 glm.fit = glm(Timelinessbn ~ Business.duration + Category + Assignment.group + Priority + Contact.type, data = Data, family = binomial)
4 summary(glm.fit)
5
```

Figure 17: Running the code in R studio to run logistic regression.

The next part of this analysis includes our findings and the interpretation of these results.

A comment on the validity of the results

The data provided to us had two aspects to it

1. The data was extremely skewed towards high ratings in comparison to the low ratings.
(Approximately 95% of our data involved satisfied customers.)

2. We simply do not have data points for every single category, assignment group, priority and contact type. We also do not see any significant balance in the amount of data in any of the individual variables of our data.

These two aspects of this data causes an error in computing these individual variables while performing logistic regression due to the skewness and lack of balance in the data. This is the reason why our results for this section of the analysis might not be 100% reliable.

Timeliness

For this Running logistic regression model we were trying to understand which of the factors of Business duration, Category, Assignment Group, Priority and Contact type is most significant in impacting the timeliness rating.

1. We observed a significance level in business duration. This significance value is 0.0297 which suggests that business duration impacts a customers rating towards timeliness, which makes intuitive sense. However, the factor at which business duration affects the timeliness rating cannot be inferred from the data because of the numerical state of the values of the business duration. Therefore, in order to analyze this completely, we will be creating boxplots. This is covered in section 2.5.
2. The next level of significance we see is observed in the category of the issue “Network and Voice” The significance level of this is 0.00572 suggesting that issues of the type “Network and Voice” is significant in impacting timeliness satisfaction rate for customers. This states that there are timeliness issues with completing the Network and Voice type of issue. Therefore, IT service department needs to focus on improving the speed of Network and Voice Issues.
3. Apart from that, we see no assignment group, no specific priority, no contact type significantly affecting the timeliness rating. This suggests that the IT service desk is performing really well with their Timeliness rating.

Technical Skill/Knowledge

For this Running logistic regression model to understand which of the factors of Business duration, Category, Assignment Group, Priority and Contact type is most significant in impacting the Technical Skill/Knowledge rating for customers.

1. Our first level of significance in our data point is observed for the same category of issue as the one for Timeliness. Network and Voice has a significance level of 0.0155. This again suggests to us that there is some issue with the technical skill behind handling the issues of category Network and Voice. This makes sense, when we look at timeliness, because a lack of technical skill or knowledge can lead to longer durations for solving this type of issue. This shows that Network and Voice issues need to be analyzed and solved with more knowledge regarding these types of issues.
2. The next level of significance observed in the data was the Contact type of Phone. We received a significance value of 0.05214 suggesting that when customers input their issue via phone, there was a statistical impact that the customer can be dissatisfied. This suggests to us, that when an issue is contacted via phone, the exact issue can be harder to explain via phone and hence technical skill/knowledge would be affected because the exact issue would not be clear. We would suggest that submitting an issue via phone should be eliminated due to the lack of specific nature of explanation.

3. Apart from these two significance ratings, the technical skill/knowledge is not statistically impacted by any of our other variables, suggesting that the IT service desk has proper technical skill/knowledge for these variables and suggests that IT service desk is performing really well based on their technical skill and knowledge.

Quality of Service

For this Running logistic regression model to understand which of the factors of Business duration, Category, Assignment Group, Priority and Contact type is most significant in impacting the Technical Skill/Knowledge rating for customers.

1. The first level of significance was observed for the category “Network and Voice” with a significance level of 0.00301. This is a repeating pattern so far, and clearly shows that the lack of timeliness and technical skill/knowledge is overall affecting the quality of service of a customer in Network and Voice. This category of issues definitely needs to be looked at.
2. The second level of significance was also observed for the contact type of phone. We received a significance value of 0.0523 suggesting that when an issue is submitted via phone, there is statistical significance that this affects the satisfaction of the customer for the quality of the service. This can be connected to technical skill because this same issue was also present with technical skill suggesting that technical skill also affects the overall quality of service that a customer receives.
3. These were the only issues present, as like the Technical Skill/Knowledge case. This suggests that IT Service Desk is able to, for the most part, successfully excel at the quality of service that they provide.

Courtesy and Professionalism

We ran this logistic regression model to understand which of the factors of Business duration, Category, Assignment Group, Priority and Contact type is most significant in impacting the Courtesy and Professionalism rating for customers.

1. There was no significance level observed for any of the independent variables when affecting Courtesy and Professionalism.
2. This however, makes sense, because courtesy and professionalism is usually a given minimum considering current service standards. This means that they are performing well with their courtesy and professionalism.
3. The lowest significance observed is for Contact type-Internal which is 0.152. However, this is still not significant enough.

5.4 Minitab and Excel Analysis to estimate and provide a new KPI

1. We ran a boxplot for each priority to see what the ideal time taken by the IT desk to complete a case would be if they want a satisfied customer.

2. In order to do this we used our binary data to identify satisfied customers as a 1, and unsatisfied customers as a 0.
3. If a box plot was not sufficient due to too much data and outliers, we would use excel to find the Interquartile range and then eliminate any outlier that falls beyond 3 times that range.
4. For priority 1 there has only been one case over the last 3 years and the given data suggests it was solved in no time, so we aren't able to do analysis on it.
5. For priority 3 there was too much data with such a large spread that minitab wasn't able to give an accurate boxplot. In order to combat this, we made an excel formula to find the average time for a satisfied vs unsatisfied customer when a priority of 3 was used (the formula was if the customer was satisfied and the priority was 3, add the time it took to complete the case. If the customer was unsatisfied, put a blank space). After this we found the median of the category and split the data into two quartiles. We took the median of both and found the difference. Any values outside that value time 3 would be eliminated. Then we averaged all the valid numbers
6. These numbers allow up to give future recommendations for restructuring the target time values for each priority.

URGENCY	
1-CRITICAL	Work halted on core system, or materially damaged overall
2-HIGH	Work halted, no reasonable alternative exists
3-MEDIUM (STANDARD)	Work slowed or halted, but reasonable alternative(s) exist
4-LOW	Work unaffected, but near-term change is desired

IMPACT	
1-CRITICAL	>=100 persons affected
2-HIGH	< 100 persons
3-MEDIUM	< 10 persons
4-LOW	1 person

PRIORITY	IMPACT			
	(1) CRITICAL	(2) HIGH	(3) MEDIUM	(4) LOW
URGENCY	(1) CRITICAL	P1	P1	P2
	(2) HIGH	P1	P2	P3
	(3) MEDIUM/STANDARD	P2	P2	P3
	(4) LOW	P3	P3	P4

SLA	RESPONSE		COMPLETION	
	PRIORITY 1	PRIORITY 2	PRIORITY 3	PRIORITY 4
	< 30 minute response	< 42 hour completion		
	< 4 hours response	< 72 hour completion		
	< 24 hour response	< 10 day completion		
	< 96 hour response	< 30 day completion		

Figure 18: This chart is the representation of how the priority of a case is assigned and the corresponding time associated.

The following charts are boxplots for the timeliness and overall satisfaction ratings compared to how long satisfied cases were open vs unsatisfied. They are split into priority ratings. For Priority 3, the boxplots had a tremendous amount of outliers. We eliminated those outliers in excel and we've attached pictures of our formulas for all priority 3 analysis.

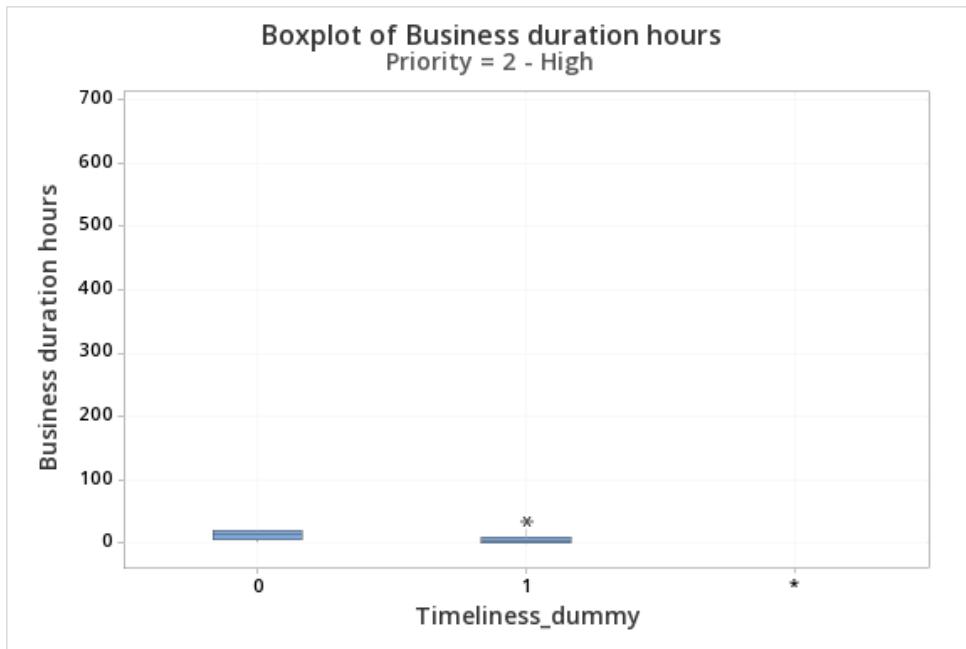


Figure 19: Priority 2 Timeliness boxplot

Priority 2 - Timeliness

For all the following priorities and the respective categories (timeliness or overall satisfaction) there is the current average time taken, the benchmark currently set to get a case done, and the average times for satisfied and unsatisfied cases.

Priority 2 current average time : 8.81 hours

Priority 2 current benchmark: 4.0 hours

Priority 2 timeliness satisfied : 4.98 hours

Priority 2 timeliness unsatisfied : 16 hours

For these priority 2 times related to the timeliness survey question, we can see that the current average is taking longer than the benchmark we have set. In order to get a satisfied customer we will need the case to be finished in about 5 hours. This means we would suggest changing the benchmark to 5 instead of 4. It allows more time and since the average is at 8 currently, it is less of a barrier to cut 3 hours off of the completion time compared to trying to cut the current time in half.

NEW SUGGESTED TARGET TIME: 5.0 Hours

Priority 3 - Timeliness

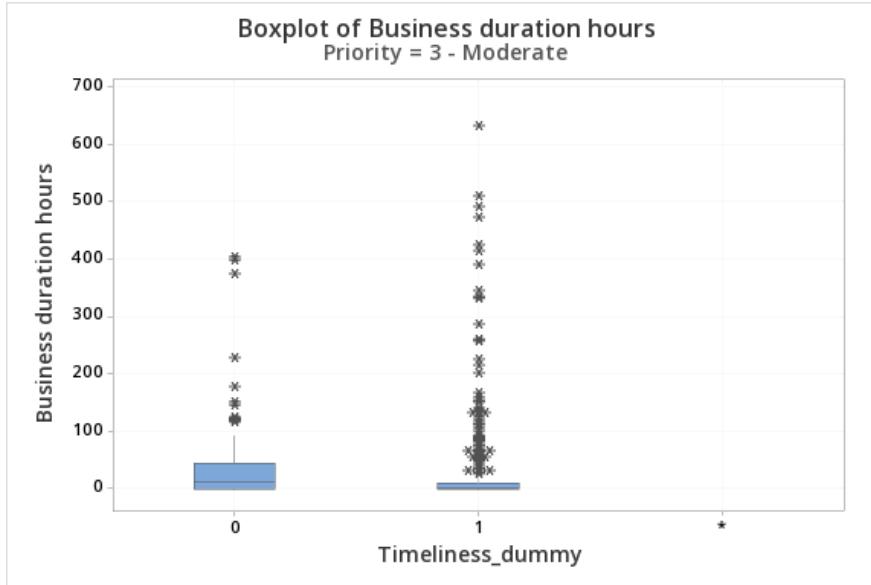


Figure 20: Priority 3 Timeliness faulty boxplot

Time-	=MEDIAN(Q10:Q90)
	=MEDIAN(Q10:Q49)
	=MEDIAN(Q51:Q90)
=Q6-Q5	=3*Q7
=3*Q7	=AVERAGE(Q10:Q84)
=AVERAGE(Q10:Q84)	=IF(AND(J10=0,E10="3 - Moderate"),C10,"")
=IF(AND(J10=0,E10="3 - Moderate"),C10,"")	=IF(AND(J11=0,E11="3 - Moderate"),C11,"")
=IF(AND(J11=0,E11="3 - Moderate"),C11,"")	=IF(AND(J12=0,E12="3 - Moderate"),C12,"")
=IF(AND(J12=0,E12="3 - Moderate"),C12,"")	=IF(AND(J13=0,E13="3 - Moderate"),C13,"")
=IF(AND(J13=0,E13="3 - Moderate"),C13,"")	=IF(AND(J14=0,E14="3 - Moderate"),C14,"")
=IF(AND(J14=0,E14="3 - Moderate"),C14,"")	=IF(AND(J15=0,E15="3 - Moderate"),C15,"")
=IF(AND(J15=0,E15="3 - Moderate"),C15,"")	=IF(AND(J16=0,E16="3 - Moderate"),C16,"")
=IF(AND(J16=0,E16="3 - Moderate"),C16,"")	=IF(AND(J17=0,E17="3 - Moderate"),C17,"")
=IF(AND(J17=0,E17="3 - Moderate"),C17,"")	=IF(AND(J18=0,E18="3 - Moderate"),C18,"")
=IF(AND(J18=0,E18="3 - Moderate"),C18,"")	=IF(AND(J19=0,E19="3 - Moderate"),C19,"")
=IF(AND(J19=0,E19="3 - Moderate"),C19,"")	=IF(AND(J20=0,E20="3 - Moderate"),C20,"")
=IF(AND(J20=0,E20="3 - Moderate"),C20,"")	=IF(AND(J21=0,E21="3 - Moderate"),C21,"")
=IF(AND(J21=0,E21="3 - Moderate"),C21,"")	=IF(AND(J22=0,E22="3 - Moderate"),C22,"")
=IF(AND(J22=0,E22="3 - Moderate"),C22,"")	=IF(AND(J23=0,E23="3 - Moderate"),C23,"")
=IF(AND(J23=0,E23="3 - Moderate"),C23,"")	=IF(AND(J24=0,E24="3 - Moderate"),C24,"")
=IF(AND(J24=0,E24="3 - Moderate"),C24,"")	=IF(AND(J25=0,E25="3 - Moderate"),C25,"")
=IF(AND(J25=0,E25="3 - Moderate"),C25,"")	=IF(AND(J26=0,E26="3 - Moderate"),C26,"")
=IF(AND(J26=0,E26="3 - Moderate"),C26,"")	=IF(AND(J27=0,E27="3 - Moderate"),C27,"")
=IF(AND(J27=0,E27="3 - Moderate"),C27,"")	=IF(AND(J28=0,E28="3 - Moderate"),C28,"")
=IF(AND(J28=0,E28="3 - Moderate"),C28,"")	=IF(AND(J29=0,E29="3 - Moderate"),C29,"")
=IF(AND(J29=0,E29="3 - Moderate"),C29,"")	=IF(AND(J30=0,E30="3 - Moderate"),C30,"")

Figure 21: Priority 3 Timeliness Fixed Excel Formulas

Priority 3 current average time : 16.48 hours

Priority 3 current benchmark: 24.0 hours

Priority 3 timeliness satisfied (EXCEL) : 6.1 hours

Priority 3 timeliness unsatisfied (EXCEL) : 28.5 hours

For the current priority 3 rating when related to timeliness, the average time taken is below the benchmark of 24 hours. The average time taken to receive a satisfied rating from the customer, the average was about

6.1 hours after eliminating outliers. Given that the current process is taking on average 16.5 hours, if we want more satisfied customers we must cut the time down to around 6.

NEW SUGGESTED TARGET TIME: 6 Hours

Priority 4 - Timeliness

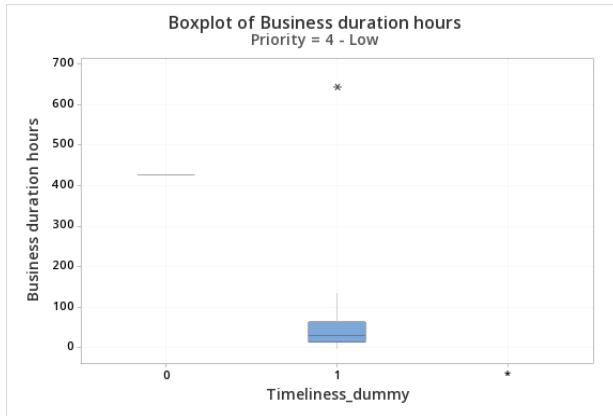


Figure 22: Priority 4 Timeliness boxplot

Priority 4 current average time : 86.54 hours

Priority 4 current benchmark: 72.0 hours

Priority 4 timeliness satisfied : 31.47 hours

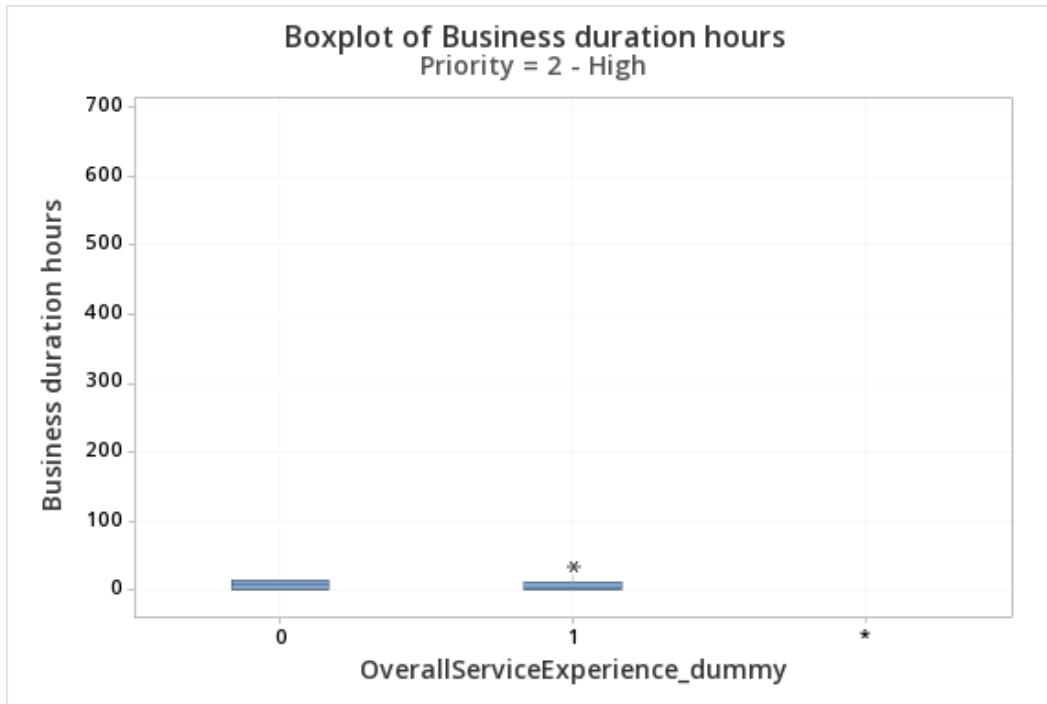
Priority 4 timeliness unsatisfied : 427.38 hours (only 1 data point)

For the current priority 4 rating when related to timeliness, the average time taken is above the benchmark of 72 hours. However this is due to such a large outlier of 430 hours. That was the only unsatisfied customer, and since the data was limited we see that all the other cases were satisfied and held an average of about 32 hours. Therefore we can see that 72 hours is much larger than what is actually needed and the target value should be closer to the average after removing the one outlier.

NEW SUGGESTED TARGET TIME: 35.0 Hours

Priority 2 - Overall

Figure 23: Priority 2 Overall boxplot



Priority 2 current average time : 8.81 hours

Priority 2 current benchmark: 4.0 hours

Priority 2 overall satisfied : 5.04 hours

Priority 2 overall unsatisfied : 10.14 hours

For these priority 2 times related to the overall service survey question, we can see that the current average is taking longer than the benchmark we have set. In order to get a satisfied customer we will need the case to be finished in about 5 hours. This means we would suggest changing the benchmark to 5 instead of 4. It allows more time and since the average is at 8 currently, it is less of a barrier to cut 3 hours off of the completion time compared to trying to cut the current time in half.

NEW SUGGESTED TARGET TIME: 5.0 Hours

Priority 3 - Overall

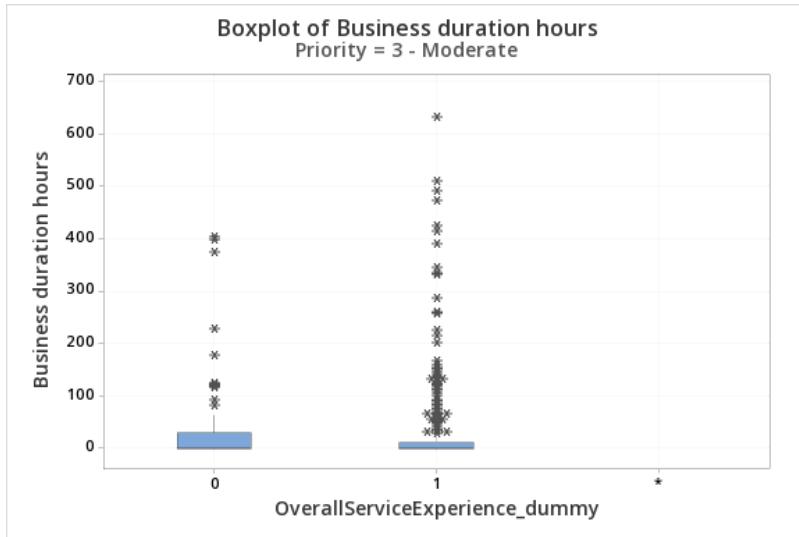


Figure 24: Priority 3 Overall faulty boxplot

S	T
=MEDIAN(T147:T1611)	=IF(AND(H138=1,E138="3 - Moderate"),C
=MEDIAN(T147:T878)	=IF(AND(H139=1,E139="3 - Moderate"),C
=MEDIAN(T880:T1611)	=IF(AND(H140=1,E140="3 - Moderate"),C
=S141-S140	=IF(AND(H141=1,E141="3 - Moderate"),C
=3*S142	=IF(AND(H142=1,E142="3 - Moderate"),C
=AVERAGE(T147:T1472)	=IF(AND(H143=1,E143="3 - Moderate"),C
	=IF(AND(H144=1,E144="3 - Moderate"),C
	=IF(AND(H145=1,E145="3 - Moderate"),C
	=IF(AND(H146=1,E146="3 - Moderate"),C
	=IF(AND(H147=1,E147="3 - Moderate"),C
	=IF(AND(H148=1,E148="3 - Moderate"),C
	=IF(AND(H149=1,E149="3 - Moderate"),C
	=IF(AND(H150=1,E150="3 - Moderate"),C

Figure 25. Priority 3 Overall Fixed Excel Formulas

Priority 3 current average time : 16.48 hours

Priority 3 current benchmark: 24.0 hours

Priority 3 overall satisfied (EXCEL) : 6.61 hours

Priority 3 overall unsatisfied (EXCEL) : 28.5 hours

For the current priority 3 rating when related to overall service, the average time taken is below the benchmark of 24 hours. The average time taken to receive a satisfied rating from the customer was about 6.61 hours after the elimination of outliers. Given that the current process is taking on average 16.5 hours, the new benchmark would have to be lower and closer to 6.

NEW SUGGESTED TARGET TIME: 6.0 Hours

Priority 4 - Overall

Priority 4 current average time : 86.54 hours

Priority 4 current benchmark: 72.0 hours

Priority 4 overall satisfied : 32.5 hours after removing outliers

Priority 4 overall unsatisfied : (There has never been 1)

For the current priority 4 rating when related to overall service, the average time taken is above the benchmark of 72 hours. There has never been an unsatisfied customer in our data, and since the data was limited we see that all the cases were satisfied and held an average of about 32 hours apart from outliers. Therefore we can see that 72 hours is much larger than what is actually needed and the target value should be closer to the average.

NEW SUGGESTED TARGET TIME: 35.0 Hours

Final Results

Given the solutions from our analysis in regards to average time to receive a satisfied rating (while eliminating outliers), these are our final benchmark goals for every priority.

Table 2. Original vs New Suggested Priority Time KPI

Priority	Original	New
1	30 min	30 min
2	4 Hr	5 Hr
3	24 Hr	6 Hr
4	72 Hr	35 Hr

6. Possible Solutions and Improvement recommendations.

1. We suspect that the way priority is currently assigned is flawed. There is such a disproportionate number of cases that were assigned a priority of 3 and there was too large of a spread in the data. The fact that some priority 3 cases took seconds and others took hundreds of hours is an indication that some of those belonged in other priorities. Also, higher priority 2 cases were typically more dissatisfied with their service. We feel that the problem most likely lies in the impact category. As a typical case would impact less than 10 people, the number of people seems to carry too much weight. We also believe that when people receive their confirmation email for their case, they should be made aware of the priority that was set to it and how long they should expect to wait. If they feel their case deserves a more substantial priority, they should be able to communicate that.
2. Because the category of issues that relates to “Customer Service and Support” has comparatively higher dissatisfied customers, we suggest that training focus over the next few months is geared towards learning how to solve those cases in an effective and timely manner. We can infer from the analysis that the specialists who handle those cases are less effective than others, therefore give special attention to that category.
3. Our analysis showed that Quality of Service is most important to customer satisfaction/dissatisfaction, followed by Technical skill/knowledge and Timeliness. Courtesy and Professionalism is not significant in determining satisfaction. This is most likely because people expect there to be professionalism, and anything less will receive a negative rating but anything more won’t resonate with the person. We suggest removing that question from the survey as it holds no significance statistically and holistically for many people.
4. The contact type of phone is statistically significant in impacting quality of service and technical skill/knowledge suggesting issues in the comprehension and question asking of the service desk employees while on the phone. According to the psychology of sales and human interaction people favor expressing their opinions and interacting with human tonality more than generic email. Email takes longer and more energy to communicate and receive an adequate response. A phone call is much easier to have a back-and-forth conversation where you can quickly correct any misunderstanding. In order to combat the current issue, we advise that the IT desk trains the employees on appreciating questions to ask and having monthly conversational practice. Also, the IT desk should advise anyone who emails a case to them that they should call into the desk to explain more in depth.
5. We advise that the IT service desk uses and updates our tableau dashboard monthly. Our dashboard differs from the current powerbi dashboard by showing the percentages of every possible category compared to relatable categories (each survey questions rating percentage vs the other questions, the percentage of a category of case issue vs the other categories, etc.).
6. We recommend that the IT service desk conduct logistic regression to understand if factors of customer satisfaction have changed on a quarterly basis, This will help keep them track of whether or not they are completing their improvement objectives or if their performance is getting worse.
7. For categories that have only had one or two cases in the past two years, they should be merged into other categories as they are currently too vague. A category like “investigation” has no specific purpose and could easily have fallen into a different category.

8. Network and Voice Category of issues is significant in affecting timeliness, quality of service and technical skill/knowledge satisfaction. Therefore, we advise the service desk to take on monthly training in this category. Going through old cases and practicing how you would fix them is most likely the best way to improve employees' skills on these problems.
9. Specific to the current process, we advise having in the future an additional category of data be taken for every case. Currently there is only data for who opened the case and who closed the case. It is important for future learning to see what specific employee worked on the case.
10. Because there are so few cases submitted through voicemail, we advise that the service desk eliminate the category of voicemail. Instead we suggest that they should include any voicemail data into the phone category.
11. We believe that quality of service is an odd survey category to be kept distinct from the others. This is because quality of service logically is a cumulative result of technical skill/knowledge, timeliness and courtesy and professionalism and quality of service is very similar to overall service experience category, so we would recommend eliminating this category.

7. Proposed Future State and Recommendations.

1. After providing the logistic binary regression as well as the tableau dashboard, we were able to successfully offer insight regarding the main concentrations of the dissatisfied customers. We were also able to understand the current areas that have the most significance when impacting one of the four survey categories and this helped us identify sections of the IT service desk that had a significant impact on affecting these ratings.
2. The next step of the project for the IT Service Desk is to identify and analyze the general comments as well as user comments for a particular case. A machine learning algorithm can be used to identify specific keywords in these comments that would help to more clearly identify the type of issues that customers face individually and see if there is a connection within the different variables based on these comments.
3. Other steps that can be taken by the IT service desk would be to check and see the correlation between the different survey categories to see if there are one or more categories that are redundant/similar in description. This will provide the opportunity to eliminate similar survey questions in place of actual factors that impact customers. This can be achieved by conducting a random sample survey to see if users feel that two or more survey categories are answering the same question. In our observations, we felt that quality of service is actually based on the rating of the technical skill/knowledge, courtesy and professionalism and timeliness together. i.e. quality of service seems to provide a similar rating to overall service experience. By replacing these with more relevant survey categories, more specific data regarding their services can be obtained.
4. Another step would be to check each individual employee performance in the different assignment groups. This can be done by correlating the ratings from different survey categories to the person who solved the case. However, the person who closes the case, sometimes does not end up solving the issue. Therefore, we feel the IT service desk needs to have one more column of data that clearly shows the employee that worked on the project rather than who opened/closed it.

5. Due to the limited availability of data from the client from December 2019 to March 2021, we would recommend that data is consistently collected for all years that the IT service desk is in function. This will help the iT service Desk also analyze trends related to the time of the year, to see if there are specific times that the department receives more dissatisfied customers for certain categories.

8. References:

<https://stackoverflow.com/questions/27983389/converting-factor-levels-to-column-names>

<https://www.youtube.com/watch?v=DiflCZDncOE&t=110s>

<https://blog.rstudio.com/2014/07/22/introducing-tidyr/>

9. Appendix:

- **Data Collection Sheet**

A	B	C	D	E	F	G	H	I	J	K	L
Task	Assignment group	Business duration	Contact type	Priority	Category	Subcategory	Courtesy and Professionalism	Overall Service Experience	Quality of Service	Technical Skill/Knowledge	Timeliness
INC0106905	Identity and Access Management - Support	260 Internal	3 - Moderate Accounts & Account Management	4	4	4	4	4	4	4	4
INC20180165421	Network Engineering - Medical & NOTA	4169 Email	3 - Moderate Network & Network Connectivity	4	4	4	4	4	4	4	4
INC20190003272	Arts and Sciences - Desktop Support	400 Phone	3 - Moderate Web New Site	5	5	5	5	5	5	5	5
INC20190009528	Arts and Sciences - Desktop Support	219 Phone	3 - Moderate Software Browser	5	5	5	5	5	5	5	5
INC20190022816	Arts and Sciences - Desktop Support	491 Phone	3 - Moderate Hardware Desktop	5	5	5	5	5	5	5	5
INC20190259525	Integrated Solutions - Support	238890 Email	3 - Moderate Software Email	5	5	5	5	5	5	5	5
INC20190288147	Desktop Support - Gables	1042080 Self-service	3 - Moderate Hardware Laptop	5	5	5	5	5	5	5	5
INC20190294191	Desktop Support - Gables	306000 Email	3 - Moderate Hardware Laptop	5	5	5	5	5	5	5	5
INC20190297286	Network Engineering - Gables & RSMAS	223723 Email	3 - Moderate Network & Troubleshoot/Support	5	5	5	5	5	5	5	5
INC20190298756	Integrated Solutions - Support	100660 Phone	3 - Moderate Customer Support/Troubleshoot/Support	5	5	5	5	5	5	5	5
INC20190299086	UService - Training & KB	255311 Email	3 - Moderate Software Development	5	5	5	5	5	5	5	5
INC20190299256	Learning Platforms Team	84993 Email	3 - Moderate Training General Training	5	5	5	5	5	5	5	5
INC20190300703	Desktop Support - Gables	39165 Phone	2 - High Software Troubleshoot/Support	5	5	5	5	5	5	5	5
INC20190301017	Desktop Support - Tier2 - Gables	62604 Email	3 - Moderate Software Troubleshoot/Support	5	5	5	5	5	5	5	5
INC20190301450	Service Desk - UMIT	61200 Phone	3 - Moderate Network & Wireless	3	2	2	2	3	2	3	2
INC20190301690	Network Engineering - Gables & RSMAS	9825 Internal	3 - Moderate Network & DNS	5	5	5	5	5	5	5	5
INC20190301849	CanLink - Admissions	46805 Self-service	3 - Moderate Accounts & Account Management	5	5	5	5	5	5	5	5
INC20190301884	Integrated Solutions - Collaboration Services	63808 Phone	3 - Moderate Software Configure	5	5	5	5	5	5	5	5
INC20190302032	Telecom Support - Gables Operations	13105 Email	3 - Moderate Network & Troubleshoot/Support	5	5	5	5	5	5	5	5
INC20190302243	Service Desk - UMIT	42 Phone	3 - Moderate Software Troubleshoot/Support	5	5	5	5	5	5	5	5
INC20190302646	Desktop Support - Gables	27269 Phone	3 - Moderate Hardware Desktop	5	5	5	5	5	5	5	5
INC20190302746	Student Support - Help Desk	157 Walk-in	3 - Moderate Software Troubleshoot/Support	5	5	5	5	5	5	5	5
INC20190303456	Learning Platforms Team	29387 Email	3 - Moderate Accounts & Account Management	5	5	5	5	5	5	5	5
INC20190303595	Service Desk - UMIT	377 Phone	3 - Moderate Software Troubleshoot/Support	5	5	5	5	5	5	5	5
INC20190303784	Desktop Support - Gables	554728 Phone	3 - Moderate Software Installation	4	4	4	4	4	4	4	2
INC20190304370	Service Desk - UMIT	80 Phone	3 - Moderate Network & Conferencing Services	5	5	5	5	5	5	5	5
INC20190304389	Service Desk - UMIT	496 Phone	3 - Moderate Software Email	5	5	5	5	5	5	5	5

```

1 Datacourtsy = read.csv("C:/Users/Bakhtiar/Desktop/IEN 494 work/courtesyandprof.csv", header = TRUE)
2 Datacourtsy$Courtesyandprofessional$mbn = as.factor(Datacourtsy$Courtesyandprofessional$mbn)
3 Datacourtsy$Courtesyandprofessional$mbn2 <- ifelse(Datacourtsy$Courtesyandprofessional$mbn>=4, "satisfactory", "unsatisfactory")
4 Datacourtsy$Courtesyandprofessional$mbn2 = as.factor(Datacourtsy$Courtesyandprofessional$mbn2)
5 attach(Datacourtsy)
6 glm.fitcourtsy = glm(CourtesyandProfessional$mbn2 ~ Business.duration + Contact.type + Priority + Assignment.group, data = Datacourtsy, family = binomial)
7 summary(glm.fitcourtsy)
8

1 Datatech = read.csv("C:/Users/Bakhtiar/Desktop/IEN 494 Work/technicalskillbn.csv",header = TRUE)
2 Datatech$TechnicalsSkill$Knowledgebn = as.factor(Datatech$TechnicalsSkill$Knowledgebn)
3 attach(Datatech)
4 glm.fittech = glm(TechnicalSkill$Knowledgebn ~ Business.duration + Priority + Category + Assignment.group + Contact.type , data = Datatech, family = binomial)
5 summary(glm.fittech)
6

1 DataQ = read.csv("C:/Users/Bakhtiar/Desktop/IEN 494 Work/qualityofservicebn.csv", header = TRUE)
2 DataQ$QualityofServicebn = as.factor(DataQ$QualityofServicebn)
3 DataQ$QualityofServicebn2 <- ifelse(DataQ$QualityofServicebn>=4, "Satisfactory", "Unsatisfactory")
4 glm.fitq = glm(QualityofServicebn ~ Business.duration + Category + Assignment.group + Priority + Contact.type , data = DataQ, family = binomial)
5 summary(glm.fitq)
6

1 Data = read.csv("C:/Users/Bakhtiar/Desktop/IEN 494 work/Timelinessbn.csv", header = TRUE)
2 Data$Timelinessbn = as.factor(Data$Timelinessbn)
3 glm.fit = glm(Timelinessbn ~ Business.duration + Category + Assignment.group + Priority + Contact.type , data = Data, family = binomial)
4
5

```

- **Charts and Graphs**

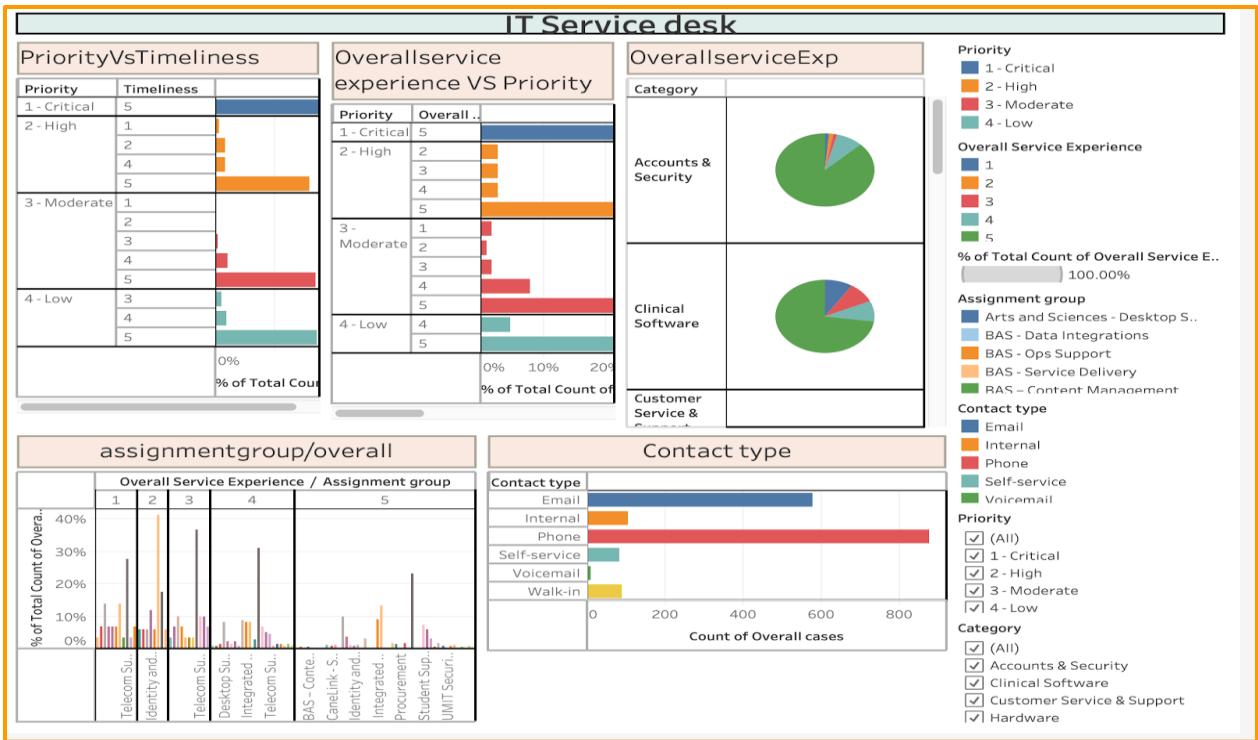


Figure 11. Interactive dashboard

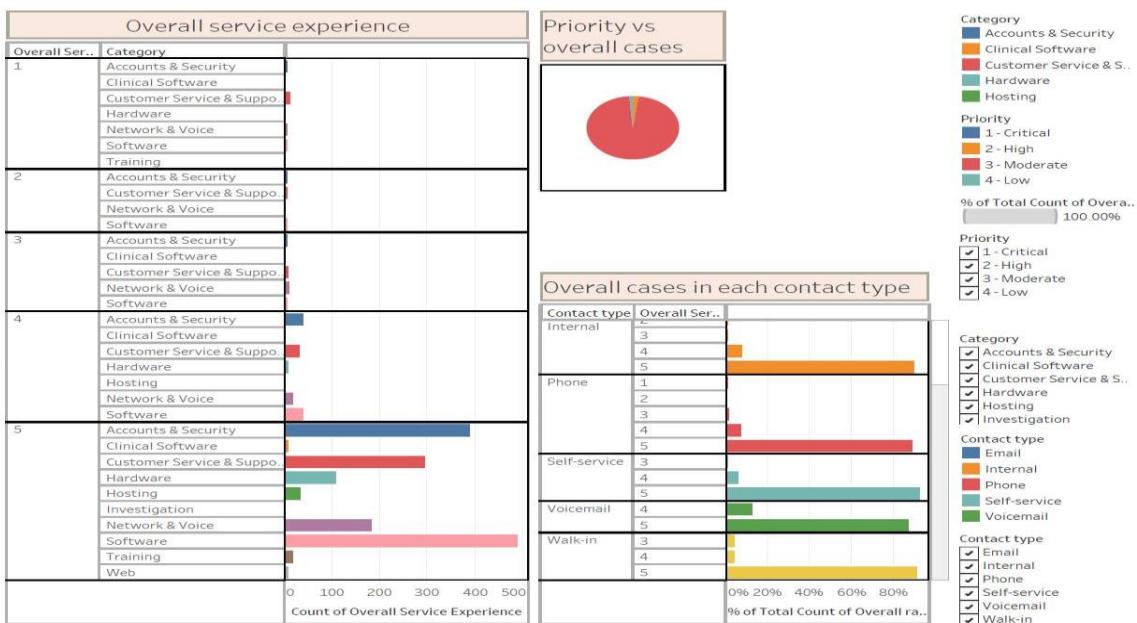


Figure 12. Interactive dashboard 2

- **List of Raw Data**

A	B	C	D	E	F	G	H
	Task	Taken By	Question	Val	Assignment group	Closed by	Closed date
95	01-09-2020 12:12:36 PM	INC20200001449	Helen Wohl	Technical Skill/Knowledge	2.00 Service Desk - UMIT	Hugo Escobar	01-09-2020 12:00:31 PM
96	01-09-2020 12:12:36 PM	INC20200001449	Helen Wohl	Quality of Service	2.00 Service Desk - UMIT	Hugo Escobar	01-09-2020 12:00:31 PM
97	01-09-2020 12:14:01 PM	INC20200002374	Griselda Mendoza	Overall Service Experience	5.00 BAS – Content Management	Maria Moneo	01-09-2020 12:00:11 PM
98	01-09-2020 12:14:01 PM	INC20200002374	Griselda Mendoza	Technical Skill/Knowledge	5.00 BAS – Content Management	Maria Moneo	01-09-2020 12:00:11 PM
99	01-09-2020 12:14:01 PM	INC20200002374	Griselda Mendoza	Timeliness	5.00 BAS – Content Management	Maria Moneo	01-09-2020 12:00:11 PM
00	01-09-2020 12:14:01 PM	INC20200002374	Griselda Mendoza	Quality of Service	5.00 BAS – Content Management	Maria Moneo	01-09-2020 12:00:11 PM
01	01-09-2020 12:14:01 PM	INC20200002374	Griselda Mendoza	Courtesy and Professionalism	5.00 BAS – Content Management	Maria Moneo	01-09-2020 12:00:11 PM
02	01-09-2020 08:30:41 PM	INC20200002592	Guiselle Guerrero	Technical Skill/Knowledge	5.00 Desktop Support - Gables	Juan Carlos Holguin	01-09-2020 07:00:03 PM
03	01-09-2020 08:30:41 PM	INC20200002592	Guiselle Guerrero	Courtesy and Professionalism	5.00 Desktop Support - Gables	Juan Carlos Holguin	01-09-2020 07:00:03 PM
04	01-09-2020 08:30:41 PM	INC20200002592	Guiselle Guerrero	Overall Service Experience	5.00 Desktop Support - Gables	Juan Carlos Holguin	01-09-2020 07:00:03 PM
05	01-09-2020 08:30:41 PM	INC20200002592	Guiselle Guerrero	Timeliness	4.00 Desktop Support - Gables	Juan Carlos Holguin	01-09-2020 07:00:03 PM
06	01-09-2020 08:30:41 PM	INC20200002592	Guiselle Guerrero	Quality of Service	5.00 Desktop Support - Gables	Juan Carlos Holguin	01-09-2020 07:00:03 PM
07	01-10-2020 09:08:40 AM	INC20200002354	Hanna Fife	Timeliness	5.00 Workday - Security	Jorge Fuste	01-10-2020 09:00:20 AM
08	01-10-2020 09:08:40 AM	INC20200002354	Hanna Fife	Courtesy and Professionalism	5.00 Workday - Security	Jorge Fuste	01-10-2020 09:00:20 AM
09	01-10-2020 09:08:40 AM	INC20200002354	Hanna Fife	Overall Service Experience	5.00 Workday - Security	Jorge Fuste	01-10-2020 09:00:20 AM
10	01-10-2020 09:08:40 AM	INC20200002354	Hanna Fife	Quality of Service	5.00 Workday - Security	Jorge Fuste	01-10-2020 09:00:20 AM
11	01-10-2020 09:08:40 AM	INC20200002354	Hanna Fife	Technical Skill/Knowledge	5.00 Workday - Security	Jorge Fuste	01-10-2020 09:00:20 AM
12	01-10-2020 10:43:53 AM	INC20200003588	Caroline Morin	Quality of Service	5.00 Service Desk - UMIT	Carlos Cameselle	01-10-2020 09:00:18 AM
13	01-10-2020 10:43:53 AM	INC20200003588	Caroline Morin	Overall Service Experience	5.00 Service Desk - UMIT	Carlos Cameselle	01-10-2020 09:00:18 AM
14	01-10-2020 10:43:53 AM	INC20200003588	Caroline Morin	Courtesy and Professionalism	5.00 Service Desk - UMIT	Carlos Cameselle	01-10-2020 09:00:18 AM
15	01-10-2020 10:43:53 AM	INC20200003588	Caroline Morin	Timeliness	4.00 Service Desk - UMIT	Carlos Cameselle	01-10-2020 09:00:18 AM
16	01-10-2020 10:43:53 AM	INC20200003588	Caroline Morin	Technical Skill/Knowledge	4.00 Service Desk - UMIT	Carlos Cameselle	01-10-2020 09:00:18 AM
17	01-10-2020 11:01:33 AM	INC20200003709	Natasha Crowther	Overall Service Experience	5.00 Identity and Access Management - Support	Andre Carty	01-10-2020 11:00:13 AM
18	01-10-2020 11:01:33 AM	INC20200003709	Natasha Crowther	Timeliness	5.00 Identity and Access Management - Support	Andre Carty	01-10-2020 11:00:13 AM
19	01-10-2020 11:01:33 AM	INC20200003709	Natasha Crowther	Courtesy and Professionalism	5.00 Identity and Access Management - Support	Andre Carty	01-10-2020 11:00:13 AM
20	01-10-2020 11:01:33 AM	INC20200003709	Natasha Crowther	Technical Skill/Knowledge	5.00 Identity and Access Management - Support	Andre Carty	01-10-2020 11:00:13 AM
21	01-10-2020 11:01:33 AM	INC20200003709	Natasha Crowther	Quality of Service	5.00 Identity and Access Management - Support	Andre Carty	01-10-2020 11:00:13 AM
22	01-10-2020 11:43:50 AM	INC20200003107	Jessica Klauer	Overall Service Experience	4.00 Telecom Support - Gables Operations	David Gil	01-10-2020 11:00:28 AM
23	01-10-2020 11:43:50 AM	INC20200003107	Jessica Klauer	Quality of Service	5.00 Telecom Support - Gables Operations	David Gil	01-10-2020 11:00:28 AM
24	01-10-2020 11:43:50 AM	INC20200003107	Jessica Klauer	Courtesy and Professionalism	4.00 Telecom Support - Gables Operations	David Gil	01-10-2020 11:00:28 AM
25	01-10-2020 11:43:50 AM	INC20200003107	Jessica Klauer	Timeliness	5.00 Telecom Support - Gables Operations	David Gil	01-10-2020 11:00:28 AM
26	01-10-2020 11:43:50 AM	INC20200003107	Jessica Klauer	Technical Skill/Knowledge	4.00 Telecom Support - Gables Operations	David Gil	01-10-2020 11:00:28 AM
27	01-10-2020 03:03:29 PM	INC20200004399	Dennis Hansell	Overall Service Experience	5.00 RSMAS Support	Darren ONeal	01-10-2020 03:00:17 PM
28	01-10-2020 03:03:29 PM	INC20200004399	Dennis Hansell	Courtesy and Professionalism	5.00 RSMAS Support	Darren ONeal	01-10-2020 03:00:17 PM
29	01-10-2020 03:03:29 PM	INC20200004399	Dennis Hansell	Quality of Service	5.00 RSMAS Support	Darren ONeal	01-10-2020 03:00:17 PM
30	01-10-2020 03:03:29 PM	INC20200004399	Dennis Hansell	Technical Skill/Knowledge	5.00 RSMAS Support	Darren ONeal	01-10-2020 03:00:17 PM
31	01-10-2020 03:03:29 PM	INC20200004399	Dennis Hansell	Timeliness	5.00 RSMAS Support	Darren ONeal	01-10-2020 03:00:17 PM
32	01-10-2020 03:14:47 PM	INC20200004213	Gina Maranto	Timeliness	5.00 Learnline Platforms Team	Corey Rilev	01-10-2020 02:00:09 PM

M	N	O	P	Comments and Work notes	
1	Contact typ	Priority	Category	Subcategory	
395	Email	3 - Moderate	Software	Troubleshoot/Support	01-06-2020 11:49:15 AM - Helen Wohl (Additional comments)I'm surprised you say you have made numerous attempt
396	Email	3 - Moderate	Software	Troubleshoot/Support	01-06-2020 11:49:15 AM - Helen Wohl (Additional comments)I'm surprised you say you have made numerous attempt
397	Phone	3 - Moderate	Accounts & Security	Account Management	
398	Phone	3 - Moderate	Accounts & Security	Account Management	
399	Phone	3 - Moderate	Accounts & Security	Account Management	
400	Phone	3 - Moderate	Accounts & Security	Account Management	
401	Phone	3 - Moderate	Accounts & Security	Account Management	
402	Phone	3 - Moderate	Hardware	Desktop	01-06-2020 05:08:06 PM - Juan Carlos Holguin (Work notes)The unit has been having performance issues due update:
403	Phone	3 - Moderate	Hardware	Desktop	01-06-2020 05:08:06 PM - Juan Carlos Holguin (Work notes)The unit has been having performance issues due update:
404	Phone	3 - Moderate	Hardware	Desktop	01-06-2020 05:08:06 PM - Juan Carlos Holguin (Work notes)The unit has been having performance issues due update:
405	Phone	3 - Moderate	Hardware	Desktop	01-06-2020 05:08:06 PM - Juan Carlos Holguin (Work notes)The unit has been having performance issues due update:
406	Phone	3 - Moderate	Hardware	Desktop	01-06-2020 05:08:06 PM - Juan Carlos Holguin (Work notes)The unit has been having performance issues due update:
407	Phone	3 - Moderate	Accounts & Security	Access Control	01-07-2020 08:13:56 AM - Jorge Fuste (Work notes)Removed Expiration Date01-06-2020 09:48:04 AM - Oscar Guzman
408	Phone	3 - Moderate	Accounts & Security	Access Control	01-07-2020 08:13:56 AM - Jorge Fuste (Work notes)Removed Expiration Date01-06-2020 09:48:04 AM - Oscar Guzman
409	Phone	3 - Moderate	Accounts & Security	Access Control	01-07-2020 08:13:56 AM - Jorge Fuste (Work notes)Removed Expiration Date01-06-2020 09:48:04 AM - Oscar Guzman
410	Phone	3 - Moderate	Accounts & Security	Access Control	01-07-2020 08:13:56 AM - Jorge Fuste (Work notes)Removed Expiration Date01-06-2020 09:48:04 AM - Oscar Guzman
411	Phone	3 - Moderate	Accounts & Security	Access Control	01-07-2020 08:13:56 AM - Jorge Fuste (Work notes)Removed Expiration Date01-06-2020 09:48:04 AM - Oscar Guzman
412	Phone	3 - Moderate	Accounts & Security	Account Management	
413	Phone	3 - Moderate	Accounts & Security	Account Management	
414	Phone	3 - Moderate	Accounts & Security	Account Management	
415	Phone	3 - Moderate	Accounts & Security	Account Management	
416	Phone	3 - Moderate	Accounts & Security	Account Management	
417	Email	3 - Moderate	Accounts & Security	Account Management	01-07-2020 10:01:49 AM - Andre Carty (Work notes)Enabling account in reference to RITM20200000081Modified acc
418	Email	3 - Moderate	Accounts & Security	Account Management	01-07-2020 10:01:49 AM - Andre Carty (Work notes)Enabling account in reference to RITM20200000081Modified acc
419	Email	3 - Moderate	Accounts & Security	Account Management	01-07-2020 10:01:49 AM - Andre Carty (Work notes)Enabling account in reference to RITM20200000081Modified acc
420	Email	3 - Moderate	Accounts & Security	Account Management	01-07-2020 10:01:49 AM - Andre Carty (Work notes)Enabling account in reference to RITM20200000081Modified acc
421	Email	3 - Moderate	Accounts & Security	Account Management	01-07-2020 10:01:49 AM - Andre Carty (Work notes)Enabling account in reference to RITM20200000081Modified acc
422	Email	3 - Moderate	Network & Voice	Change Display Name	01-07-2020 10:52:52 AM - David Gil (Work notes)spoke to user, was able to setup voice mail in AVST01-07-2020 10:52
423	Email	3 - Moderate	Network & Voice	Change Display Name	01-07-2020 10:52:52 AM - David Gil (Work notes)spoke to user, was able to setup voice mail in AVST01-07-2020 10:52
424	Email	3 - Moderate	Network & Voice	Change Display Name	01-07-2020 10:52:52 AM - David Gil (Work notes)spoke to user, was able to setup voice mail in AVST01-07-2020 10:52
425	Email	3 - Moderate	Network & Voice	Change Display Name	01-07-2020 10:52:52 AM - David Gil (Work notes)spoke to user, was able to setup voice mail in AVST01-07-2020 10:52
426	Email	3 - Moderate	Network & Voice	Change Display Name	01-07-2020 10:52:52 AM - David Gil (Work notes)spoke to user, was able to setup voice mail in AVST01-07-2020 10:52
427	Phone	3 - Moderate	Software	Troubleshoot/Support	01-07-2020 02:39:37 PM - Darren ONeal (Work notes)Removed and re-added the laptop to the domain to remedy the
428	Phone	3 - Moderate	Software	Troubleshoot/Support	01-07-2020 02:39:37 PM - Darren ONeal (Work notes)Removed and re-added the laptop to the domain to remedy the
429	Phone	3 - Moderate	Software	Troubleshoot/Support	01-07-2020 02:39:37 PM - Darren ONeal (Work notes)Removed and re-added the laptop to the domain to remedy the
430	Phone	3 - Moderate	Software	Troubleshoot/Support	01-07-2020 02:39:37 PM - Darren ONeal (Work notes)Removed and re-added the laptop to the domain to remedy the
431	Phone	3 - Moderate	Software	Troubleshoot/Support	01-07-2020 02:39:37 PM - Darren ONeal (Work notes)Removed and re-added the laptop to the domain to remedy the
432	Email	3 - Moderate	Software	Confieure	01-07-2020 01:24:47 PM - Corey Rilev (Work notes)Hello Professor,Thank you for contacting us to merge the courses !



○ *Fullfillment of ABET Learning Outcomes*

- 1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

- ❖ We used numerous analytical techniques to solve the complex problem of unsatisfied customers from the UM IT service desk. We used logistic binary regression, tableau analysis, boxplots, and interquartile range outlier elimination. By doing all these techniques we were able to evaluate the information given to us and provide advice that was backed by statistics.

- 2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
 - ❖ During this project we used visio flowcharts to understand the current process of the UM IT service desk and then used statistical analysis to find a solution to poor service towards students and faculties technical issues. Throughout the whole project we took into consideration the mental wellbeing of anyone experiencing IT issues. For instance any student or faculty members having canelink issues, we want to make sure that we can provide them a sufficient service so they can continue their education/work in a timely manner.
- 3) An ability to communicate effectively with a range of audiences.
 - ❖ We will be presenting our outcome to our client, professors, the class, and anyone who will be interested in attending our project during the design expo ceremony
- 4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
 - ❖ We analyzed the harvard business course packs dealing with ethics and integrity in business
- 5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
 - ❖ This was done through having set weekly meetings, and constantly updating and communication in teams or in a group chat. We also constructed a timesheet in microsoft projects to keep track of future goals and tasks
- 6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
 - ❖ We used statistical analysis skills such as logistic binary regression and constructed tableau data to better analyze and interpret our data. We even did interquartile range outlier elimination to better analyze priority and timeliness.
- 7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- ❖ All the statistical analysis we ran was a new skill that we didn't know how to do before. We had taken statistics courses but never ran a logistic binary regression for a project. We also had to learn different softwares such as tableau, spss, and r-studio. To do this we spent hours watching videos and practicing how to use the softwares.

Images of tableau code

The image contains two side-by-side screenshots of the RStudio interface, each displaying an R script editor window.

Top Screenshot:

```

RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins Project: (None)
courtsandprofessionalism binary.R | Technicalskill binary analysis.R | Qualityofservice binary analysis.R | Timeliness binary final.R
1 DataQ = read.csv("C:/Users/Bakhtiar/Desktop/IEEN 494 work/Qualityofservicebn.csv", header = TRUE)
2 DataQ$Qualityofservicebn = as.factor(DataQ$Qualityofservicebn)
3 DataQ$Qualityofservicebn2 <- ifelse(DataQ$Qualityofservicebn<=4, "satisfactory", "unsatisfactory")
4 glm.fitq = glm(Qualityofservicebn ~ Business.duration + Category + Assignment.group + Priority + Contact.type , data = DataQ, family = binomial)
5 summary(glm.fitq)
6

```

Bottom Screenshot:

```

RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function Addins Project: (None)
courtsandprofessionalism binary.R | Technicalskill binary analysis.R | Qualityofservice binary analysis.R | Timeliness binary final.R
1 Datatech = read.csv("C:/Users/Bakhtiar/Desktop/IEEN 494 work/technicalskillbn.csv", header = TRUE)
2 Datatech$TechnicalSkillKnowledgebn = as.factor(Datatech$TechnicalSkillKnowledgebn)
3 attach(Datatech)
4 glm.fittech = glm(TechnicalSkillKnowledgebn ~ Business.duration + Priority + Category + Assignment.group + Contact.type , data = Datatech, family = binomial)
5 summary(glm.fittech)
6

```

RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

courtesyandprofessionalism binary.R | Technicalskill binary analysis.R* | Qualityofservice binary analysis.R* | Timeliness binary final.R*

```
1 Data = read.csv("C:/Users/Bakhtiar/Desktop/IEN 494 Work/Timelinessbn.csv", header = TRUE)
2 Data$Timelinessbn = as.factor(Data$Timelinessbn)
3 glm.fit = glm(Timelinessbn ~ Business.duration + Category + Assignment.group + Priority + Contact.type , data = Data, family = binomial)
4
5
```

RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

courtesyandprofessionalism binary.R* | Technicalskill binary analysis.R* | Qualityofservice binary analysis.R* | Timeliness binary final.R*

```
1 Datacourty = read.csv("C:/Users/Bakhtiar/Desktop/IEN 494 Work/courtesyandprof.csv", header = TRUE)
2 Datacourty$CourtesyandProfessionalismbn = as.factor(Datacourty$CourtesyandProfessionalismbn)
3 Datacourty$CourtesyandProfessionalismbn2 <- ifelse(Datacourty$CourtesyandProfessionalism>=4, "satisfactory", "unsatisfactory")
4 Datacourty$CourtesyandProfessionalismbn2 = as.factor(Datacourty$CourtesyandProfessionalismbn2)
5 attach(Datacourty)
6 glm.fitcourty = glm(CourtesyandProfessionalismbn2 ~ Business.duration + Contact.type + Priority + Assignment.group, data = Datacourty, family = binomial)
7 summary(glm.fitcourty)
8
```

