**Business Understanding:**

CybertronPC is renowned as 15th largest system Builder in the USA. They provide highest quality for customized products and service. There customized products needs excellent customer service to make their existing and potential customers satisfied. The company has two call centers for IT support and PC support operates which 8am-8pm throughout the week. The company has long operating hours. Cybertron PC spends a significant amount of money as pay expense on their call center representatives to ensure that best customer service is provided. Cybertron PC can hugely benefit from optimized call representative schedule because it will increase their quality of customer service but it will reduce their cost. This report will improve the cost effectiveness of the company by optimizing the employee schedule.

**Data Understanding:**

The data collection was through three Excel sheets. One Excel sheet represent IT support data second Excel sheet represent PC support data. Third Excel sheet shows the current schedule of the call center that the employees follow and the ideal call center that employee desire. The PC support had total 8036 calls data and IT support had 1394 calls data for 3 months. Excel sheets has data of day and time. The day column represent the date at which a certain call is received. The time column has two attributes. First represent the start call time and the second represent the end call time. Most of the data was refined on Excel by applying the filter on the columns and use of pivot table. The date column was used to sub split into weekdays and months. The time column was split into three column as hours, call duration and am/pm.

There are a number of trends among the data. That are listed as follow:

* The call center had highest number of calls during 3pm-5pm from Monday to Friday. The percentage of calls from 3pm-5pm was 20% of the total calls in both PC and IT support.
* Most of the calls were generated from 8am-8pm, i.e. approximately 94% of the calls were coming during this time.
* There were 71% of the calls in PM.
* Around 60% of the calls are less than 2 min long and 76% of the calls were less than 6 min.
* Most of the calls were generated in month of January which is 34%, March was slightly less at 31%.
* Call per weekday shows that most of the calls were coming on Monday with 17% which is slightly higher than Tuesday, Wednesday, and Thursday and Friday that are 16%.

The data quality issue was that there were still incoming calls in the data set when the call center was closed. The incoming calls were also showing the call duration which was contradictory as there was no one in the call center to answer the calls. There was approximately 6% calls that were after the closing time and had call duration.

**Data Preparation:**

Data cleaning include the task of creating intervals of time as 8:00 am- 8:59 am to count the no. of calls received in an hour interval. Data transformation was also done by changing the 24 hour time to am pm format and analyze the count of calls. Data was also broken down into months and weekdays so an analysis can show the peak time when most of the calls are coming. Data was than combined together and an average of calls were calculated by dividing either by the no. of days in a month or no. of weekdays in four month. Call duration was calculated by subtracting end call time from start call time and intervals were created to count the calls. The data of PC support and IT support was combined and total no. of calls were generated for each variable. A percentage formula was implemented to understand the impact of each variable on company.

A granulated analyses of data was conducted through expanding am and pm of the every hour in a day. There was double digit calls from 11am -7pm every weekday except Sunday. This deeper analyses shows the clear trend of maximum no. of in a time interval which would help to optimize the employee schedule.

The schedule shows that the employees are willing to work overtime and seven of the eight employees are working overtime. The call center time is from 8am-8pm on Monday and Saturday, 8am-9pm on Tuesday, Wednesday, Thursday and Friday, 9am-8pm on Sunday. According to ideal schedule, employees are willing to from 8 am-9 pm from Monday to Friday and from 8am-5pm on weekends. Six of the employees are working 9 hours on 5 days, two of them work 11 hours on 4 days and one work 9 hours on 3 days and 7 hours on 1 day. The ideal schedule is different for one employee because he is assigned 7 hours than he ideally desired. This will help to give better insight about the employee motivation and company wage policy.

**Evaluation:**

We decide to implement linear programming optimization technique. Because it involves algorithm and is more likely to be human error free. Linear programming is also better suited because it helps the business to undertake the constraints that would be ignored under decision tree model. There are some assumption that were made to before implementing this model.

1. The employees are paid at an hourly basis instead of a salary.
2. There are no quality assurance forms that the call center representatives have to fill after they speak to the customer related to their query.
3. The call center representatives are highly trained and answer all the queries at hand.
4. There are no more than two calls that are simultaneously.
5. There is no break given during the shifts.
6. Employees would be more motivated if they are given their ideal time of shifts.
7. Employee always show on their shifts.
8. Company pays at a rate of 1.5 for overtime.
9. Maximum minute a call last is 10 min. 75% of the calls last less than 6 in the data provided.
10. No employee could be fired.

The four basic components of Linear Programing are:

1. Data: The data represent the call received by a call center for two major support service that they provide to their customer. The data has a strong link with the clear objective function and constraints as the call data shows different trends that the company could utilize to increase their customer service and reduce their cost.
2. Objective Function: The objective function is to minimize the total number of employees in a week. This will help company to effectively allocated their resources and optimize the results by being cost effective.
3. Decision Variables: Decision variable are number of employees per shift. This help the company to allocate the optimize number of employees that will result into optimize solution.
4. Constraints: There a number of constraints that are taken into account:
* Minimum number of employee per shift for Monday, Thursday and Friday for first shift is 3. This is calculated by aggregating the first shift average calls count and then dividing it with 6 hours which shows that there would 7.5 calls in an hour resulting need of 2 people as one person will respond to 6 calls in an hour with 10 min long. We decide to have a cushion of one person.
* Minimum number of employee per shift for Monday till Friday for second shift is 4.
* Minimum number of employee per shift for Saturday and Sunday for whole day is 1.
* Maximum number of employee per shift for Monday till Sunday for all shift is 7.
* Maximum number of shift per employee per week is 7. As one shift is 6 hours long so we do not want to pay extra for overtime.
* Maximum number of hour per shift is 40. As maximum number of employee per shift is 7 and a shift is 6 hour so we do not want to exceed 40 hours, we subtract 2 hours from it.
* Maximum number of hours per employee in a week is 40. We do not want to pay extra for overtime.
* Number of employee per shift is an integer number.

**Deployment:**

Cyberton PC has 8 people working on Wednesday whereas the data shows that the highest no. of calls received on a weekday is Monday and there are only 4 people working on Monday. It shows that customer might have to wait on call to connect to customer representative on Monday. Moreover, Cybertron PC have most calls in pm time and there are less customer representatives that are working at pm. This could be improved by implementing the new model. The hidden trends in the data will help the company to better understand the business environment and manage their resources effectively.

The linear programming model is the best solution because it will help the company to save 125 hours in a week and no overtime would be paid. Company could save around $2000 per week improving the service of customer service. The company can deploy this model on its own every month data to provide best quality at a least cost.