1. Introduction:

The hospitality business is one of the most dynamic and quickly changing areas of the global economy in recent years. Hotel managers must have a comprehensive awareness of guest behavior, preferences, and trends to stay ahead of the competition and maximize business performance. Insights may be gained from the vast amounts of data created by hotels by management with the aid of data analysis and visualization tools like Tableau and Power BI, which can then be utilized to boost operational effectiveness, enhance customer satisfaction, and boost revenue (Saabith et al., 2022).

Professionals in the hospitality business may analyze data from many sources in real-time using Tableau's interactive dashboards and reports, which enables them to spot trends, unearth insights, and make data-driven decisions. By responding to two crucial questions, this assignment intends to assist hotel operations managers like Joel from Sky High Hotel in making educated decisions. Hotel management can successfully allocate resources, establish pricing plans, and offer individualized service to their visitors by answering these questions.

1.1. Dataset Description:

The Hotel Reservations Classification dataset is a collection of records for hotel reservations that include information on the guests and the specifics of their reservations. The dataset contains a single CSV file and covers reservations made from July 2017 to December 2018.

Total: 36275 rows and 19 columns.
Used for the report: 36275 rows and 12 columns.
Source: https://www.kaggle.com/datasets/ahsan81/hotel-reservations-classification-dataset

Name	Description	Domain	Field Size for display
no_of_adults	Number of adults	Integer [0-10]	1
no_of_children	Number of Children	Integer [0-10]	2
no_of_weekend_nights	The number of weekend nights (Saturday or Sunday) the guest booked.	Integer [0-20]	2
no_of_week_nights	Number of weeknights (Monday to Friday) the guest stayed or booked.	Integer [0-20]	2
type_of_meal_plan	Type of meal plan booked by the customer	Nominal	11
room_type_reserved	Type of room reserved by the customer.	Nominal	11
lead_time	Number of days between the date of booking and the arrival date	Integer	3
arrival_year	Year of arrival date	Integer	4
arrival_month	The month of arrival date	Integer	10
arrival_date	Date of the month	Integer	2
market_segment_type	Market segment designation	Nominal	13
no_of_special_requests	Total number of special requests made by the customer	Integer [0-5]	1

1.2. Persona and questions:

Persona: Hotel operating manager.

Name: Joel.

Description: Joel is a hotel operations manager at 'Sky High Hotel. He is in charge of managing the hotel's daily operations. His main duty is to make sure that everything at the hotel operates properly and that the guests have a good time. He wants answers to the below questions to get a better understanding of their customer's needs and preferences, and allocate resources accordingly. He wants to use this information to ensure that the hotel can allocate resources appropriately and provide excellent service to guests. Joel may make wise choices about pricing and marketing tactics by being aware of how tastes change depending on the season and the sort of consumer.

Goal: Joel wants to use the dataset to answer the following questions:

1. How do the length of the guest's stay, number of special requests raised, and number of guests who arrived, vary across each month of the year for different market segments?

2. Which room type is high/least preferred and which meal plan is popular by the guest on weekends and weekdays, and how does it vary by season and customer type?

1.3. Requirements:

The main requirements to answer question 1:
Requirement 1 (Q1-R1): To analyze how the length of stay varies across each market segment, we can use a Bubble chart in Tableau. For this, we need to create a calculated field named 'Length of stay' and add it to the size in the marks field. Then, to visualize the data for different market segments, we can add the 'market_segment_type' to colors in the marks field.

Requirement 2 (Q1-R2): For this, we need to create a donut chart for each guest type, with 'Guest type' along with zero on the x-axis. We can then add the sum of 'no_of_special_requests' to the angle and 'market_segment_type' to colors in the marks field.

Requirement 3 (Q1-R3): To visualize how the number of guests varies across different market segments, we can use a Treemap in Tableau. We need to add the sum of 'No of Guest' to the size in the marks field, and 'market_segment_type' to colors in the marks field. Both these fields can also be added to the Label to provide more information.

Requirement 4 (Q1-R4): The visualization should display the data for specific months in a year. The 'arrival_month' variable is added to the x-axis, and it is also used as a filter so that we can select a particular month to display the data in the above three charts.

Requirement 5 (Q1-R5): We need to create a text table that shows the sum of 'No of Guests', the sum of 'no_of_special_requests', and the average 'length of stay' across all market segments. This table can be filtered by 'arrival_month' to show data for specific months.

The main requirements for answering question 2:
Requirement 1 (Q2-R1): A Butterfly chart is used to visualize the popularity of each room type, with the sum of 'room_type_reserved' on the y-axis. The chart is further split by the sum of 'no_of_weekend_nights', 'zero line', and 'no_of_week_nights' on the x-axis. The bars for each room type are further colored by the sum of the 'no_of_weekend_nights' and 'no_of_week_nights' fields. A filter could be used to select different 'seasons, and 'Guest types'.

Requirement 2 (Q2-R2): A scatter plot is used to visualize the popularity of meal plans over the week. To pick different 'seasons' and 'Guest types' a filter could be utilized. The x-axis shows the sum of 'no_of_weekend_nights' and the y-axis shows the sum of 'no_of_week_nights '. The type of meal is further differentiated by the colors.

2. Design:

Table 1, Difference between Prototype and Tableau Implementation.

Prototype	Tableau Implementation	Explanation
For Q1-R2: To find the total number of special requests for different market segment pie chart is used	A Donut chart is used to find the count in here.	The implementation switched from a pie chart to a donut chart, which allows for easier comparison of the segments' sizes.
For Q1: The months are given as a dropdown filter.	A customized line chart is used in tableau implementation	A customized chart provides a more dynamic and interactive representation of the data.
For Q2-R1: To visualize the least and most preferred room side by sidebar chart is used.	A butterfly chart is used here.	The implementation switched from a bar chart to a butterfly chart, which provides a more effective comparison of the least and most preferred room types by placing them next to each other.
For Q1-R5: This table is not included in the prototype.	A Table is included in the implementation. Which will give the detail about a number of guests who arrived, number of special requests raised, and average length of stay.	With this innovation, users now have quick and simple access to crucial metrics about the hotel's operations, which could be useful for management choices. Additionally, it enables a more thorough and precise analysis of visitor behavior, such as seeing patterns in stay duration or the frequency of specific requests.

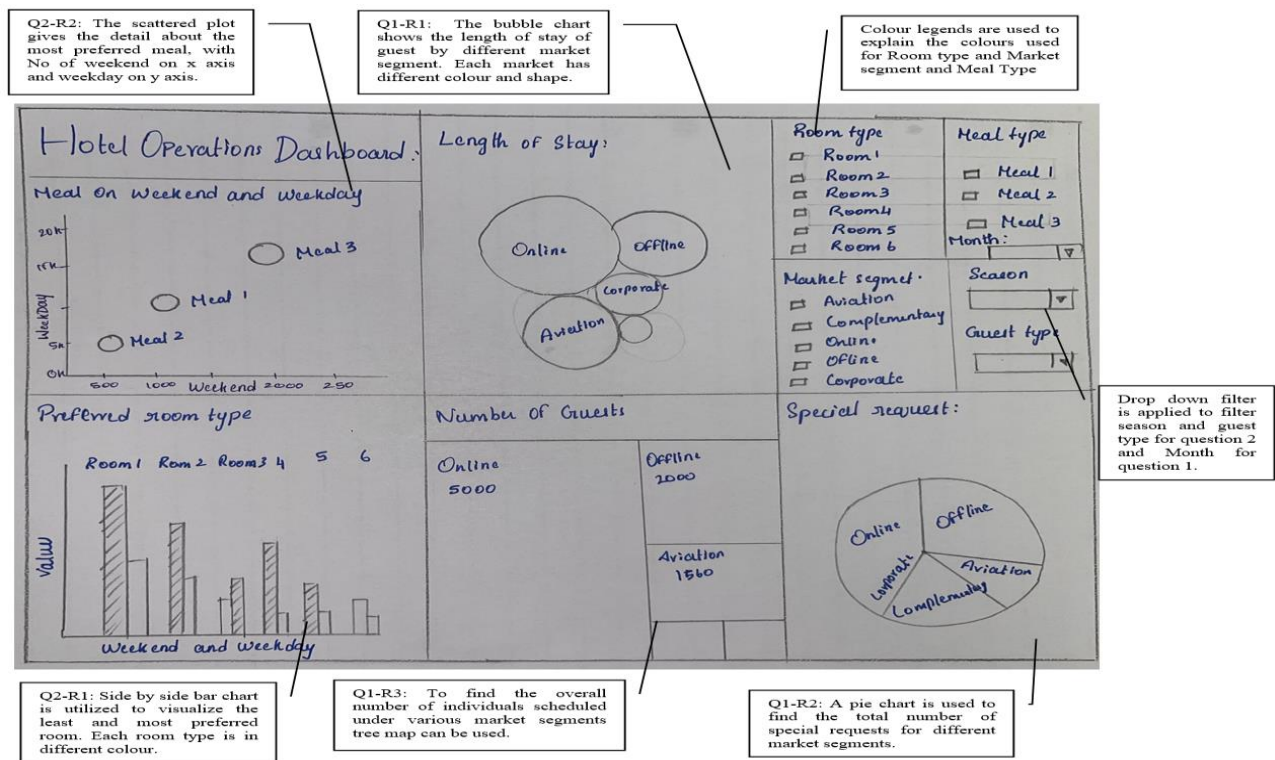The below figure is the original prototype design (Paper Landscape) with annotation.

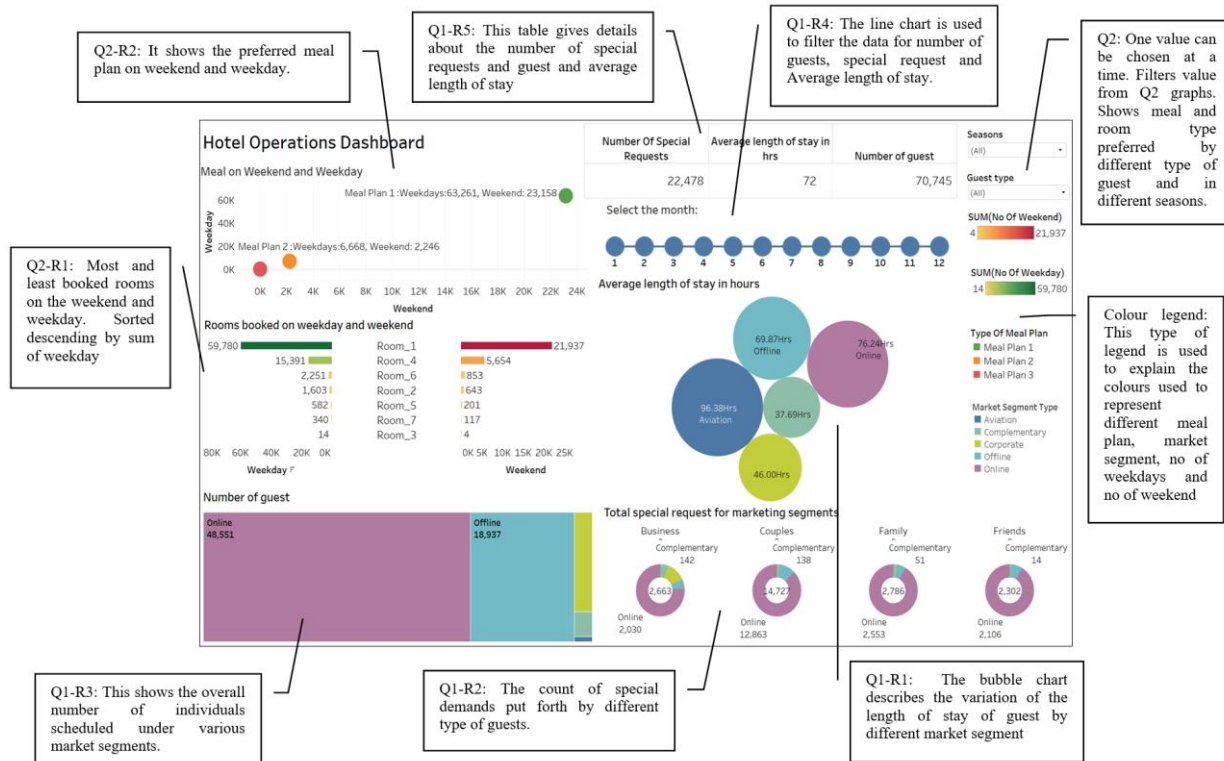**Figure 1, Original prototype design (Paper Landscape)**

Figure 2, Tableau Implementation Dashboard.

3. Implementation:

Using data visualization, the implementation of Tableau produced custom interactive reports that made it easier to see and comprehend the data (Batt **et al., 2020**). To answer the research questions few calculated fields are created. Such as,

1. 'Length of stay' is calculated by adding two variables 'No of Week Nights' and 'No of Weekend Nights'.
2. The 'No of Guest' is created by adding the variable 'No of Children' and 'No of adult'.
3. 'Arrival date' is computed by adding the 'Arrival Date', 'Arrival Month', and 'Arrival Year' fields and date parsing it.
4. 'Guest Type' by grouping the guest depending on the 'No of the child' and 'No of adult'.
5. 'Season' is created by grouping the arrival month into four different seasons.
6. 'Arrival date' is computed by adding the 'Arrival Date', 'Arrival Month', and 'Arrival Year' fields and date parsing it.

Tableau Implementation for research question 1:

- To implement Q1-R1: The length of the stay of the guest can be easily visualized through a bubble chart with the average 'Length of stay' added to the size and 'market segment type' to color in the marks field. A bubble chart primarily depicts and shows relationships between numeric variables.

- To implement Q1-R2: To visualize the number of special requests, which vary across each month of the year for different market segments, a Donut chart is used. The sum of 'No of special requests' is added to the angle so, the pie chart is divided according to the sum of special requests.

- To implement Q1-R3: A tree graph is utilized to find the number of arrived. The sum of 'No of people' is added in. These charts are typically used to represent accumulated totals over time and are the conventional way to display stacked lines.

- To implement Q1-R4: A text table is created to display the required values for the research question. 'Length of Stay', 'No of people', and 'No of special request' variables are added in the measure values to display it.

- To implement Q1-R5: A customized line chart is created using "arrival month" on the x-axis and min(0) on the y-axis. The action filter is applied in the dashboard, with 'month in a year' as the source and all the above four sheets as the target, so whenever the user touches one month in this sheet will filter values from the other charts and display data that only belong to the selected month.

Tableau Implementation for research question 2:

- To answer Q2-R1: We need to visualize the type of rooms booked on weekends and weekdays; this can be achieved by a butterfly chart. The butterfly chart allows for comparing two sets of data with the same parameters. The 'Room type reserved' is added in rows and the sum of 'No of the weekend night', zero line, and sum of 'No of weekday Night' is added in the column.

- To answer Q2-R2: The scatter plot is used to visualize the relationship between the two measures. The sum of 'No of the weekend night' is added to the x-axis and the sum of 'No of weekday night' is added to the y-axis. To identify the type of meal easily, the 'Type of meal plan' is set in the colors of the marks panel. In the above two graphs 'Guest type' and 'season' are added in the filter, so we can identify how the data is varying by season and guest type.

Power BI implementation for the research question:

More interactive visualization options are available with Power BI, including drill-down, drill-through, and the use of slicers to filter data. Furthermore, Power BI enables more adaptable data modeling, which makes it simpler to work with various data sources and the connections between them (Becker et al., 2019).

Instead of using the filter, I used a slicer in Power BI for variables like seasons, months, and Guest type. We can easily filter and explore data with the help of Power BI's powerful slicers, which eliminate the need for lengthy searches or coding. Additionally, they are interactive, which can considerably improve the user experience and make data analysis more understandable because the user can instantly see the results of their filter choices (Ali et al., 2016). While Tableau requires the use of a third-party tool or manual data refresh, Power BI offers the opportunity to schedule data refreshes automatically.
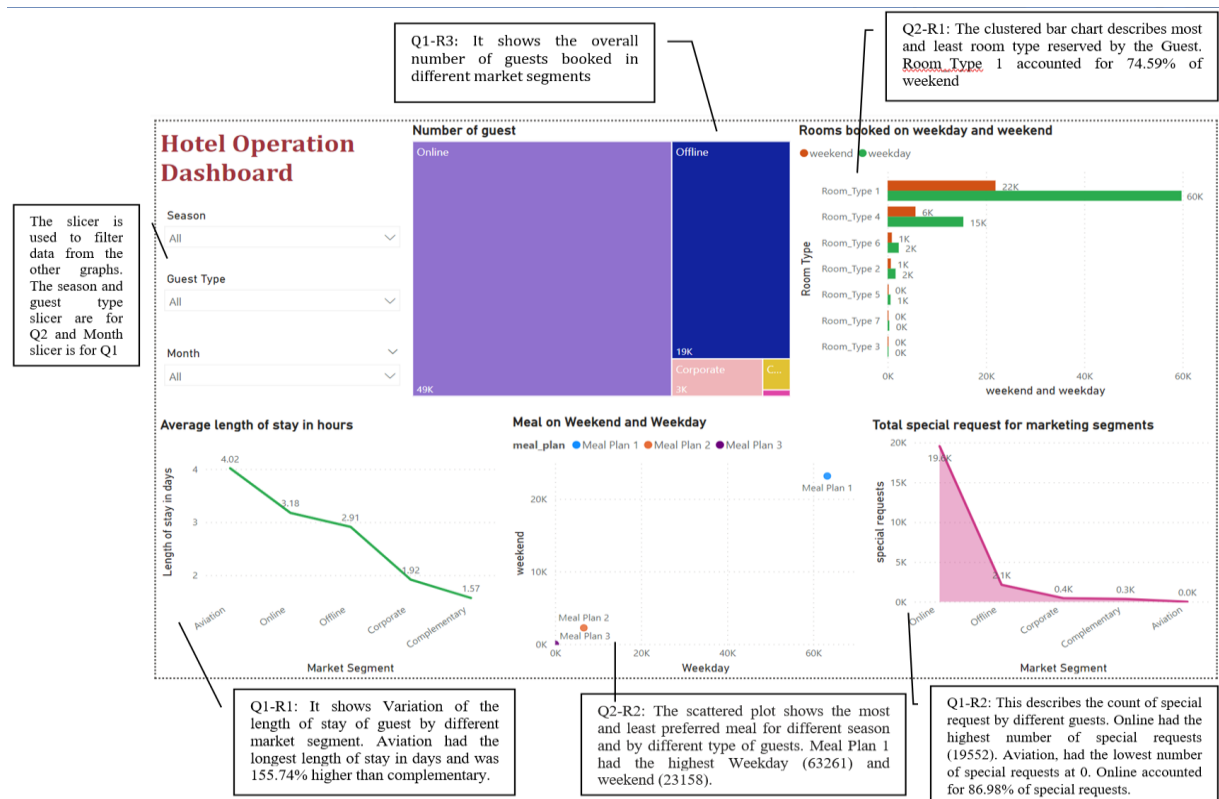
Q1-R3: It shows the overall number of guests booked in different market segments

Q2-R1: The clustered bar chart describes most and least room type reserved by the Guest. Room_Type 1 accounted for 74.59% of weekend

The slicer is used to filter data from the other graphs. The season and guest type slicer are for Q2 and Month slicer is for Q1

Q1-R1: It shows Variation of the length of stay of guest by different market segment. Aviation had the longest length of stay in days and was 155.74% higher than complementary.

Q2-R2: The scattered plot shows the most and least preferred meal for different season and by different type of guests. Meal Plan 1 had the highest Weekday (63261) and weekend (23158).

Q1-R2: This describes the count of special request by different guests. Online had the highest number of special requests (19552). Aviation, had the lowest number of special requests at 0. Online accounted for 86.98% of special requests.

Figure 3, Power BI implementation of Dashboard

4. Walkthrough:

Report for research question 1:

a) The graph illustrates the fluctuation in the duration of guests' visits across various market categories throughout the year, showing variations on a monthly basis. According to the chart, aviation visitors stay the longest on average, with a duration of 96.38 hours.
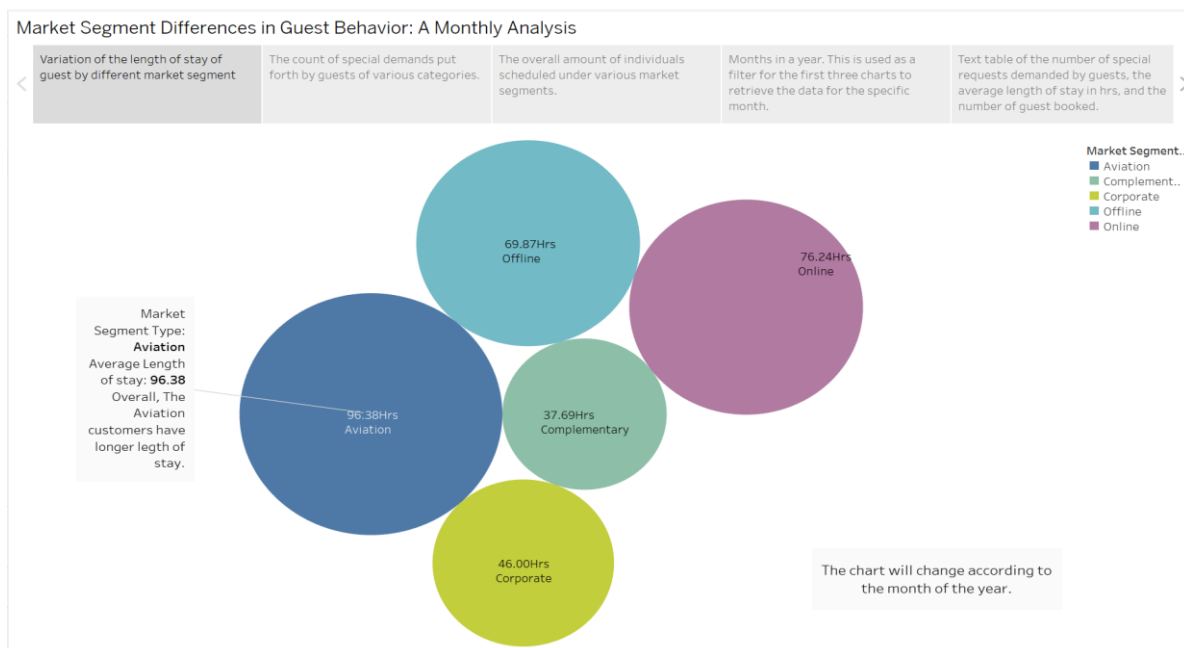

Figure 4, Q1-R1 Story

b) The graph shows data on the number of special requests made by visitors in various categories. Couples have the most special requests overall, according to the graph. Additionally, with more than three-quarters of the total count, the online market category has the biggest number of specific requests. The graphic also shows that online-booked guests made the most special demands, whereas clients who travelled by airplane made no requests at all.
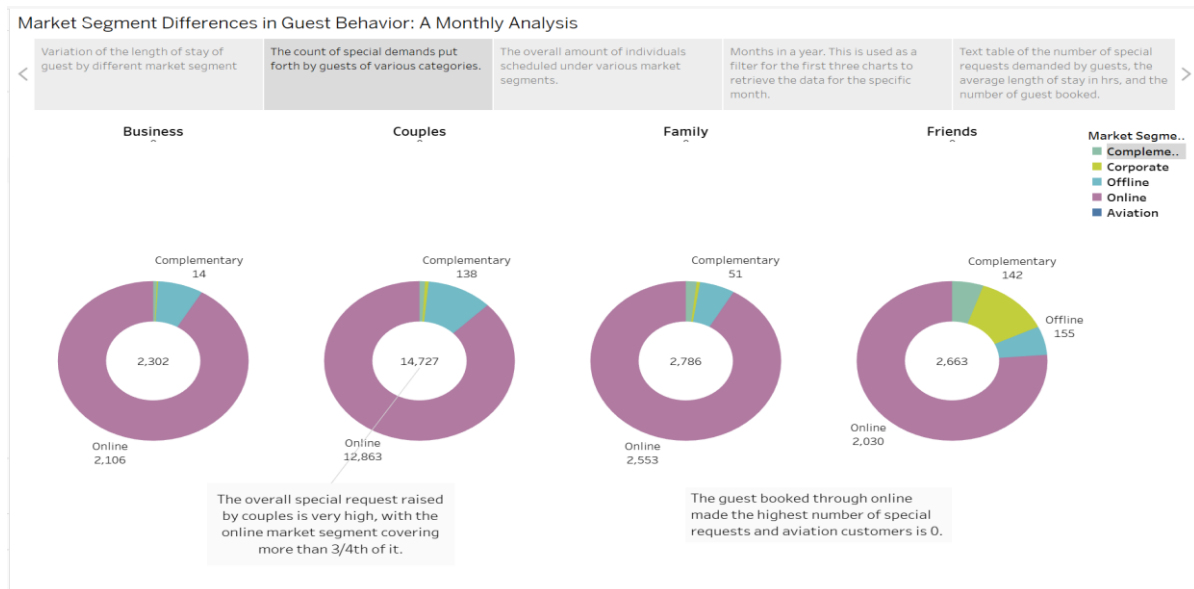

Figure 5, Q1-R2 story.

c) The graph reveals that there were 48551 guests who made online reservations, which is a fairly high amount. The size of the area corresponds to the number of guests, and the chart also uses different colours or labels to show various market segments. The graph offers useful information about the number of visitors planned for each market group.
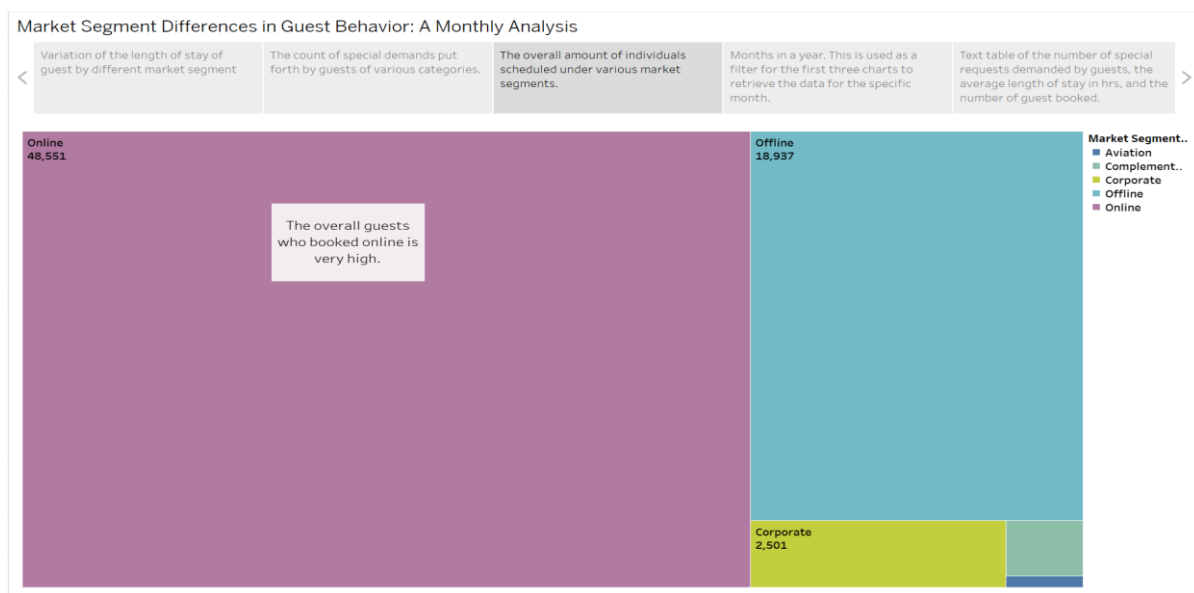
Figure 6, Q1-R3 story.

d) The first three charts can be filtered using the chart's method for choosing a certain month in a year to receive data for that month. The chart enables the user to see the 12 months of the year, which are normally organised on a horizontal or vertical axis, and choose a particular month by clicking or tapping on it.

Figure 7, Q1-R4 story.

e) The three major indicators in the text table—the number of special requests made by visitors, the average duration of stay in hours, and the number of guests booked—are important to the allocation manager in the hospitality sector. The operation manager can compare and analyse the data by using the table, which summarises these KPIs for various market groups or types of visitors.

Figure 8, Q1-R5 story.

Report for research question 2:

a) The most and least room type reserved by the Guest:
The bar graph is sorted descending by the sum of 'no of week nights' within the 'room type reserved' so that we can easily identify which room type is most and least booked by the guest. The preferred meal type is identified for different seasons and customer types.

According to the chart, we can conclude:

- Room_1 is highly booked on both weekends and weekdays for all four seasons.
- Room_4 is mostly preferred by business guests and Room_1 is preferred by all other types of guests.
- Room_3 and Room_7 are the least booked rooms for all seasons.
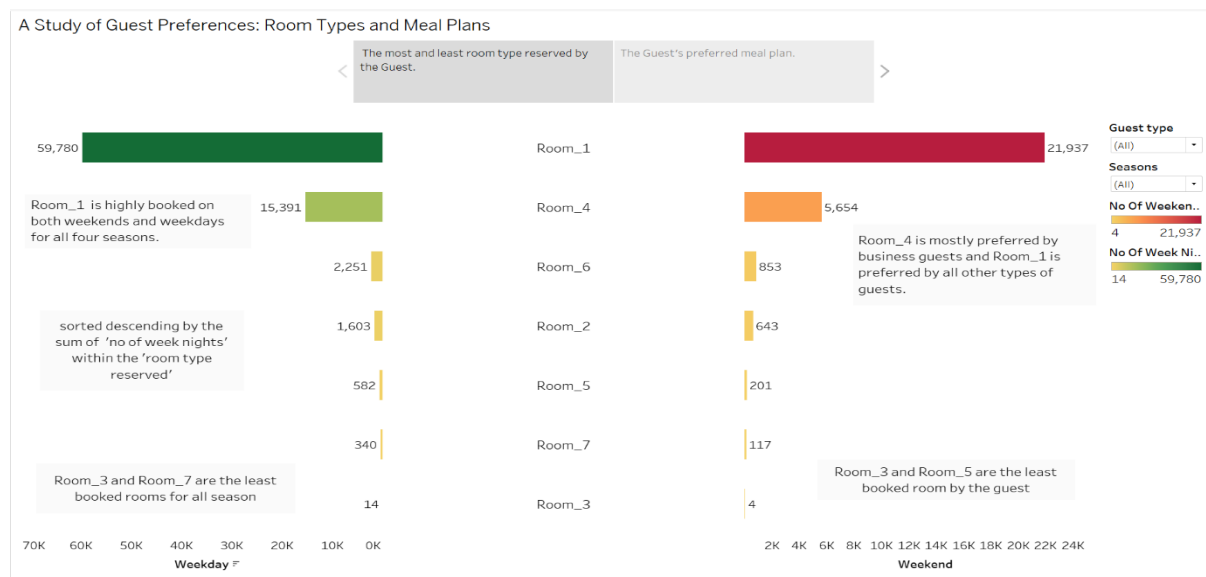- Room_3 and Room_5 are the least booked rooms by the guest.

Figure 9, Q2-R1 story.

b) The guest's preferred meal plan:
The preferred meal plan is visualized using the scattered plot. From the tableau story we can infer the following:

- Meal Plan 1 is highly preferred in all seasons and by all guest types with 63261 orders on a weekday and 23158 orders on weekends.
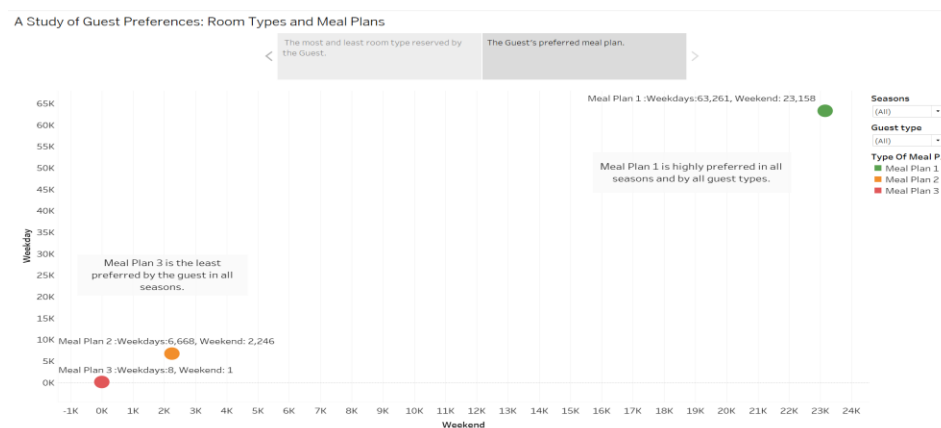- Meal plan 3 is least preferred, with overall 8 orders on weekdays and 1 order on weekends.

Figure 10, Q2-R2 Story.

5. Reflection:

Evaluation of overall project success:
The project, which aimed to offer insights into visitors' behaviour in the hospitality business based on different market segments, lodging preferences, and meal plans, has succeeded in general in fulfilling its intended goals. The operation manager was able to compare and analyse the data thanks to these visualizations, which helped the hotel sector better understand the behaviours of its customers and develop effective customer service plans.

Advantages and disadvantages of Tableau in comparison to Power BI:
Tableau also provides a variety of visualisation choices, such as charts, graphs, maps, and tables, all of which may be tailored to suit particular requirements. Tableau also provides seamless connectivity with a wide range of data sources, making it simple to connect to different databases and spreadsheets (Murray., 2013)
The absence of advanced analytics tools like predictive modelling and machine learning algorithms is a serious drawback. Additionally, some businesses, particularly those with a big number of users, may find Tableau's price plan to be prohibitively expensive.

Reflective learning experience:
The session offered insights into data analysis, a skill that is essential in today's data-driven environment. I have improved my critical thinking abilities and my capacity to analyse and evaluate data through the many tasks and projects.

Personal learning:
Improving my skills in data storytelling and data analysis and modelling is one personal learning objective I would like to achieve soon.

6. Conclusion:

In conclusion, the goal of this study was to examine hotel data and use data visualisation techniques to respond to two research questions. We used Tableau and Power BI to develop engaging and instructive reports in order to accomplish this goal.

We developed visualisations to comprehend the average length of stay of guests, the number of guests by arrival date, and the number of special requests made by guests of various categories for the first research question. Additionally, we used filters to let consumers engage with the data and browse the information in accordance with their preferences.

For the second study question, we analysed the rooms and meals booked on weekends and weekdays by various guest kinds and seasons using butterfly charts and scatter plots. The visualisation enabled us to comprehend the most popular room categories on weekends and weekdays, as well as the kind of meals that were most popular with visitors.

The development of interactive reports that offered relevant data about hotel visitors' tastes and behaviour was the project's main accomplishment. The hotel management may use these reports to better understand demand trends and make data-driven decisions that will improve client satisfaction, increase occupancy rates, and maximise income. The project, in its entirety, demonstrated the capacity of data visualisation to extract useful insights from data and make wise business decisions.

7. Reference:

1. Saabith, A., Vinothraj, T. and Fareez, M., 2022. Business Intelligence Tools–Systematic Review. International Journal of Research in Engineering and Science (IJRES). www. ijres. org, 10(10), pp.394-408.

2. Batt, S., Grealis, T., Harmon, O. and Tomolonis, P., 2020. Learning Tableau: A data visualization tool. The Journal of Economic Education, 51(3-4), pp.317-328.

3. Becker, L.T. and Gould, E.M., 2019. Microsoft power BI: extending excel to manipulate, analyze, and visualize diverse data. Serials Review, 45(3), pp.184-188.

4. Ali, S.M., Gupta, N., Nayak, G.K. and Lenka, R.K., 2016, December. Big data visualization: Tools and challenges. In 2016 2nd International Conference on Contemporary Computing and Informatics (IC3I) (pp. 656-660). IEEE.

5. Murray, D.G., 2013. Tableau your data!: fast and easy visual analysis with tableau software. John Wiley & Sons.

6. www.kaggle.com. (n.d.). Hotel Reservations Dataset. [online] Available at: https://www.kaggle.com/datasets/ahsan81/hotel-reservations-classification-dataset.