**Univariate Analysis**

**Summary Statistics:**

skewness and kurtosis analysis:

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High Positive Skewness in Delays: Both departure and arrival delays exhibit very high positive skewness, indicating that while most flights are on time or have minimal delays, there are occasional flights with extremely long delays. This skewed pattern suggests that the majority of the inconvenience is caused by a few significantly delayed flights.

Extremely High Kurtosis in Delays: The departure and arrival delays not only have high skewness but also very high kurtosis. This points to a very sharp peak and thick tails in the distribution, suggesting that outliers (long delays) are not just infrequent but also extreme. These extreme values can have a disproportionately negative impact on overall passenger satisfaction.

Moderate to Low Kurtosis in Service Ratings: Most service-related variables (like inflight wifi, seat comfort, and cleanliness) have kurtosis values around or below 3, indicating distributions that are less prone to outliers and generally more uniformly spread around the mean. This suggests that passenger experiences with these services are relatively consistent.

These observations indicate that improving management and reduction of extreme delay incidents could significantly enhance overall passenger satisfaction, as the delays are not typical but when they occur, they're highly disruptive. Additionally, maintaining consistent service quality in other areas seems to be effective as indicated by the more uniform distribution of service ratings.

**Visualization:**

**Pie chart – key categorical variable “Class”**

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Description automatically generated**

**class presentation:**

we can see from the pie chart, our passengers are almost evenly split between Business and Eco classes, demonstrating the diversity in preferences for comfort and affordability among our travelers. Interestingly, only a small fraction, 7.2%, opts for Eco Plus, indicating a potential area for us to explore further. Understanding the reasons behind these choices can help us tailor our services to better meet our passengers' needs and identify opportunities for growth in the underrepresented Eco Plus category.

**Inference:**

The pie chart reveals that Business and Eco classes are almost equally preferred by passengers, while Eco Plus is chosen less frequently. This suggests a market divided fairly evenly between those seeking premium and standard services, with a smaller segment opting for upgraded economy options.

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**class presentation:**

We've taken a close look at our passengers' travel preferences and satisfaction levels. Our data reveals a varied age demographic, suggesting our services cater to a wide range of travelers. Most flights are short-haul, which are the bread and butter of our operations. There's noticeable room for improvement in inflight wifi service, as indicated by the mid to lower end ratings from our customers. On a positive note, the majority of our flights depart on schedule, showcasing our commitment to timely operations.

Our passenger age distribution suggests varied travel needs, while a preference for short-haul flights indicates a strong regional market. Feedback on inflight wifi signals a chance for enhancement, and although punctuality is generally high, some notable delays highlight opportunities for operational improvements. These insights will guide our efforts to refine passenger experience and service efficiency.

**Inference:**

After examining 'Class', the following observations emerge from other key variables:

- Age Distribution: Passengers are diverse in age, with clusters around young adulthood and mid-life indicating varied travel purposes.

- Flight Distance: A higher frequency of short-haul flights is indicated, with long-distance travel being less common.

- Inflight Wifi Service: There's a spread in satisfaction, with many passengers rating the service in the mid to lower range, suggesting room for improvement.

- Departure Delays: Most flights depart with minimal delay, signifying efficient operations for the majority of services.

These distributions provide insights into demographic patterns, travel preferences, service quality, and operational efficiency.

noteworthy patterns in the data:

- The \*\*Age Distribution\*\* appears multi-modal, which might indicate distinct groups or types of travelers such as families, business travelers, and retirees.

- \*\*Inflight Wifi Service Ratings\*\* show a potential negative skew, with a lean towards lower satisfaction scores, which is an area that could be improved.

- \*\*Departure Delays\*\* are highly right-skewed, with most flights departing on time, but with a long tail of flights experiencing significant delays, suggesting infrequent but notable operational disruptions.

**Box Plot for Outliers and Variance**

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The box plots for departure and arrival delays highlight a common central trend with most flights experiencing minimal delays. However, both plots reveal numerous outliers, indicating that a significant number of flights are subject to substantial delays. These outliers, which represent exceptional cases of extended wait times, are critical points for operational review to improve overall punctuality and customer satisfaction.

Inference:

The box plots for departure and arrival delays display a tightly clustered median, suggesting that most flights adhere to the schedule, yet the presence of outliers indicates instances of substantial delays. This pattern underscores an operational focus area—while general punctuality is achieved, attention to the outliers could enhance reliability and customer satisfaction.

**Stacked bar plot for flight services:**

**Pre-flight Services:**

Departure/Arrival time convenient

Ease of Online booking

Gate location

Check-in service

A group of bars with different colors

Description automatically generated with medium confidence

Presenation:

In reviewing the pre-flight service ratings for an airline, it's observed that passengers are generally satisfied with check-in services and the convenience of departure and arrival times, with many high ratings. However, there's a notable opportunity for improvement in the online booking experience, despite a decent number of favorable responses. Gate locations received a more neutral response, suggesting that while not a significant pain point, there is room for enhancement in this area. These insights highlight specific targets for the airline to improve its pre-flight services and enhance overall customer satisfaction.

Inference:

The visual analysis of pre-flight service ratings reveals insightful trends: Passengers are generally satisfied with the check-in service and the convenience of departure/arrival times, as indicated by the predominance of higher ratings. The online booking experience, while still favorably rated, shows a broader spread across the rating spectrum, suggesting some passengers face challenges, which could be an area for improvement. Gate location evaluations are more evenly distributed, indicating no strong consensus on satisfaction or dissatisfaction, pointing to an opportunity for a deeper dive into passenger preferences in this area.

**In-flight Services:**

Entertainment Services:

Inflight entertainment

Comfort Services:

Seat comfort

Leg room service

Hospitality Services:

Food and drink

On-board service

Cleanliness

Connectivity and Handling Services:

Inflight wifi service

Online boarding

Baggage handling

Inflight service

A graph of different colored bars

Description automatically generated with medium confidence

The chart presents satisfaction ratings for various airline services. Inflight entertainment and seat comfort have high counts of positive ratings, showing areas of strength. Food and drink, along with on-board service, show a balanced spread across ratings, suggesting variability in passenger experiences. Notably, inflight wifi and baggage handling received mixed feedback, with significant counts at lower ratings, indicating potential areas for improvement. These insights reveal passengers' priorities and service aspects that require attention to enhance overall satisfaction.

Inference:

The stacked bar charts clearly show that inflight entertainment and seat comfort are areas where passengers are most satisfied, with a significant number of high ratings. On the other hand, inflight wifi service and baggage handling have received lower ratings, signaling that these are the areas where passengers are less satisfied and where the airline could focus its improvement efforts. These visual indicators are crucial for quickly pinpointing service strengths and weaknesses.

**Understand Variable Relationships with Pair Plot**

**A chart of different colored dots

Description automatically generated with medium confidence**

**The key takeaway for the airline from this plot is that higher customer satisfaction is closely linked to better ratings for inflight wifi service, seat comfort, and cleanliness. Focusing on enhancing these aspects of the customer experience could significantly improve overall satisfaction.**

**Another important relationship evident from the plot is that customer satisfaction seems to be adversely affected by longer departure and arrival delays. Minimizing these delays could be another critical factor for improving passenger satisfaction.**

**Pair plot:**

The pair plot displays several interesting observations:

Most prominently, there is a distinct clustering of points between satisfied and neutral or dissatisfied customers across several service quality variables, such as inflight wifi service, seat comfort, and cleanliness. Satisfied customers tend to give higher ratings in these areas, indicating a strong correlation between these factors and overall satisfaction. Additionally, there's a wide distribution of ages across satisfaction levels, suggesting age is not a primary determinant of satisfaction. Flight distance does not show a clear trend with satisfaction, indicating that longer flights do not necessarily lead to decreased satisfaction. Delays in departure and arrival do show some impact, with higher satisfaction generally associated with shorter delays, although the relationship is not as pronounced as with the service quality variables. This insight can inform airline service improvements focusing on customer experience elements directly linked to satisfaction.

Heat map:

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The heatmap shows strong positive correlations between variables related to inflight services—such as seat comfort, inflight entertainment, and on-board service—which suggests that improvements in one of these areas are likely to enhance the others, thereby potentially increasing overall passenger satisfaction. There is also a notable positive correlation between ease of online booking and departure/arrival time convenience, indicating that a user-friendly online booking system might influence passengers' perception of their overall travel experience. These insights can be crucial for the airline to focus on interconnected areas that could lead to higher customer satisfaction and loyalty.

The heatmap indicates that variables related to customer service, such as seat comfort, inflight entertainment, and cleanliness, have strong positive correlations with each other, implying that improvements in one area are likely to enhance the others. Moreover, higher correlations are observed between online booking, gate location, and departure/arrival time convenience, suggesting that a streamlined booking experience is associated with overall convenience perceptions. There are also high correlations within service quality aspects, indicating these are closely interlinked in influencing customer experiences.