

Introduction

Flexjet Inc. is a private aviation company that supports the needs of multiple established private jet brands such as providing crew management and scheduling. Planning crew schedules is one of the many challenges they face due to the complex set of requirements such as ensuring that there are enough crew available to meet customers' demands. Additionally, crew preferences are also considered in the scheduling process, and these are collected by a crew-facing mobile application. However, Flexjet's crew services team found many conflicts present in the preferences input which should have been caught when entering them. Therefore, this research aims to develop a crew preference adaptive monitoring system that would track a set of crew preferences, identify if there are any conflicts, and return the conflicting preferences along with supporting information. Our research has concluded that most crew members had conflicts with their preferred workdays in each 28-day bidding period and most conflicts occurred within holiday periods.

Data Analysis

Flexjet has provided a dataset in the form of an excel sheet with a variety of crew preferences from a sample of their crew. The Excel file includes information on Weekday, Tour Length, Days Worked Ranges, Dates, and Ranking preferences. Each of these categories of preferences displays an identifier to match the preferences to a specific crew member. Weekday preferences are represented as 0's and 1's. Figure 1 displays the number of crew who prefer to work or not on each day of the week. The crew preferences for tour length and rest days are visualized in Figure 2 with the number of days corresponding to tour length and rest days plotted along the x-axis, with multicolored bars displaying the tour length and rest day requests. The frequency along the y-axis indicates how many times that specific crew preference was input. The Workday Range data sheet is visualized in Figures 3. This line graph visualizes the minimum and maximum values of days worked during a bidding period separately to show their individual trends over the x-axis of 'Days Worked'. For the Dates preferences, Figure 4 displays a bar plot distribution of the dates that were requested to work ('OnDuty') or not to work ('OffDuty') by the crew member.



Figure 1: Crew Weekday Preferences

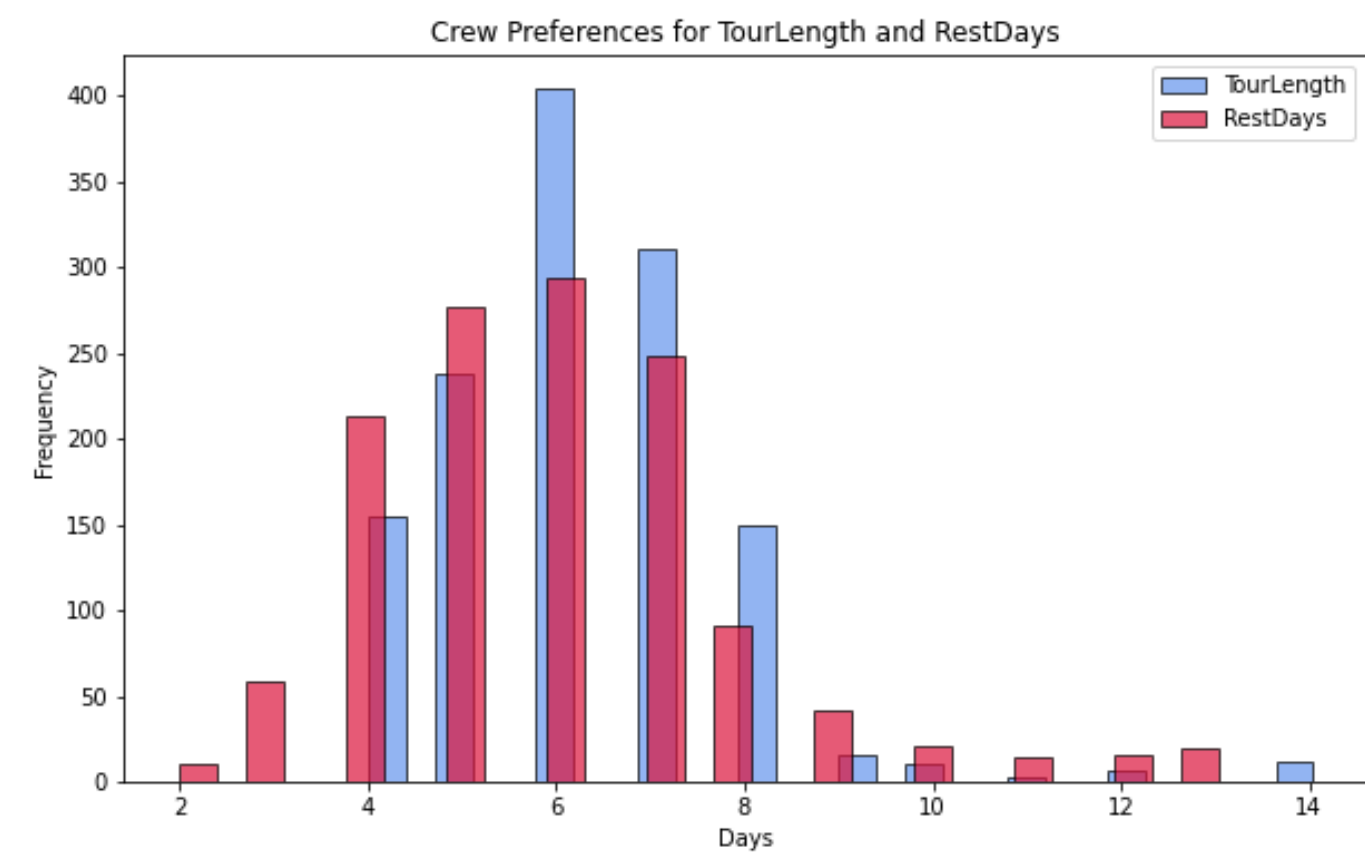


Figure 2: Crew Preferences for Tour Length and Rest Days

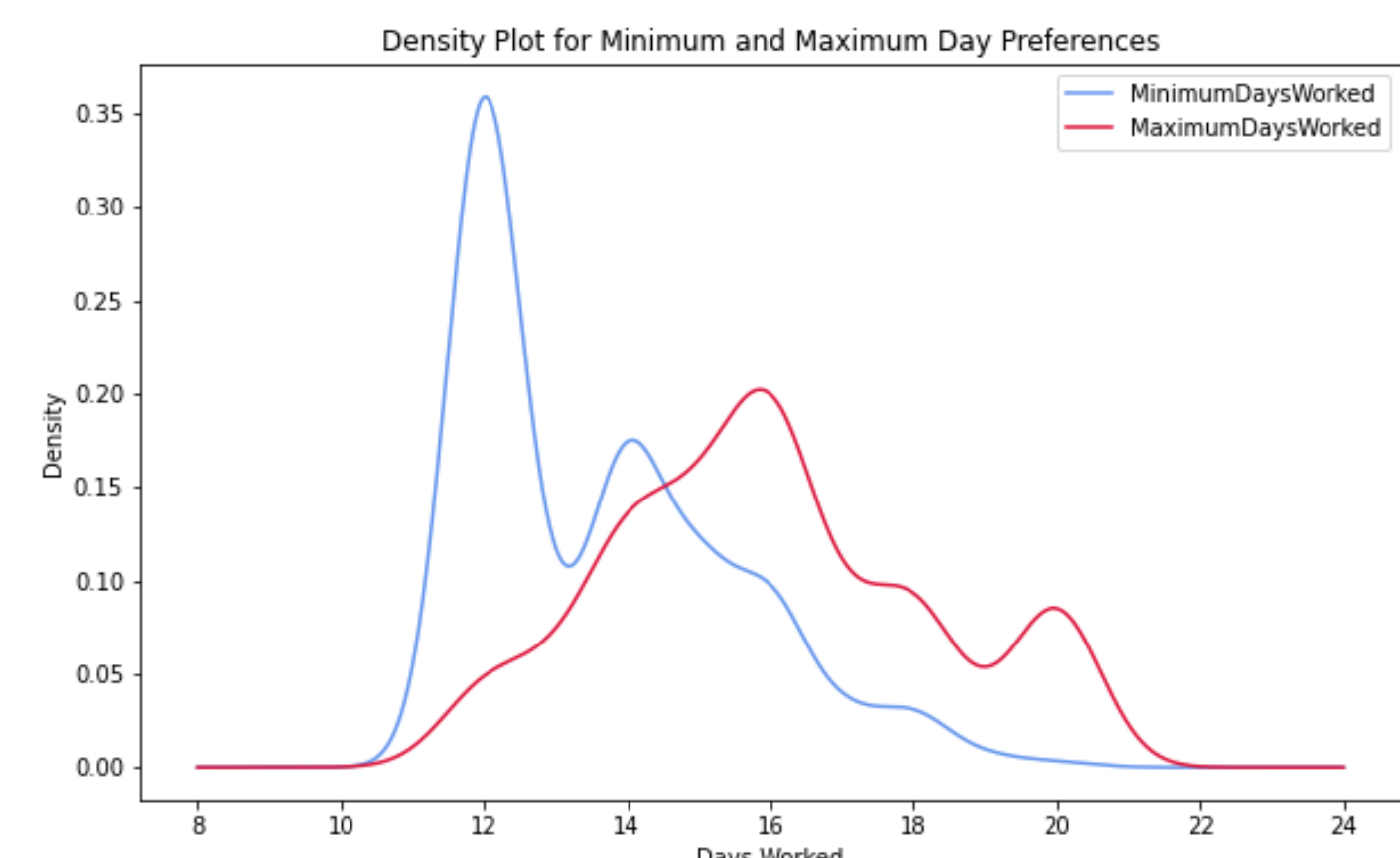


Figure 3: Density Plot for Min/Max Preferences

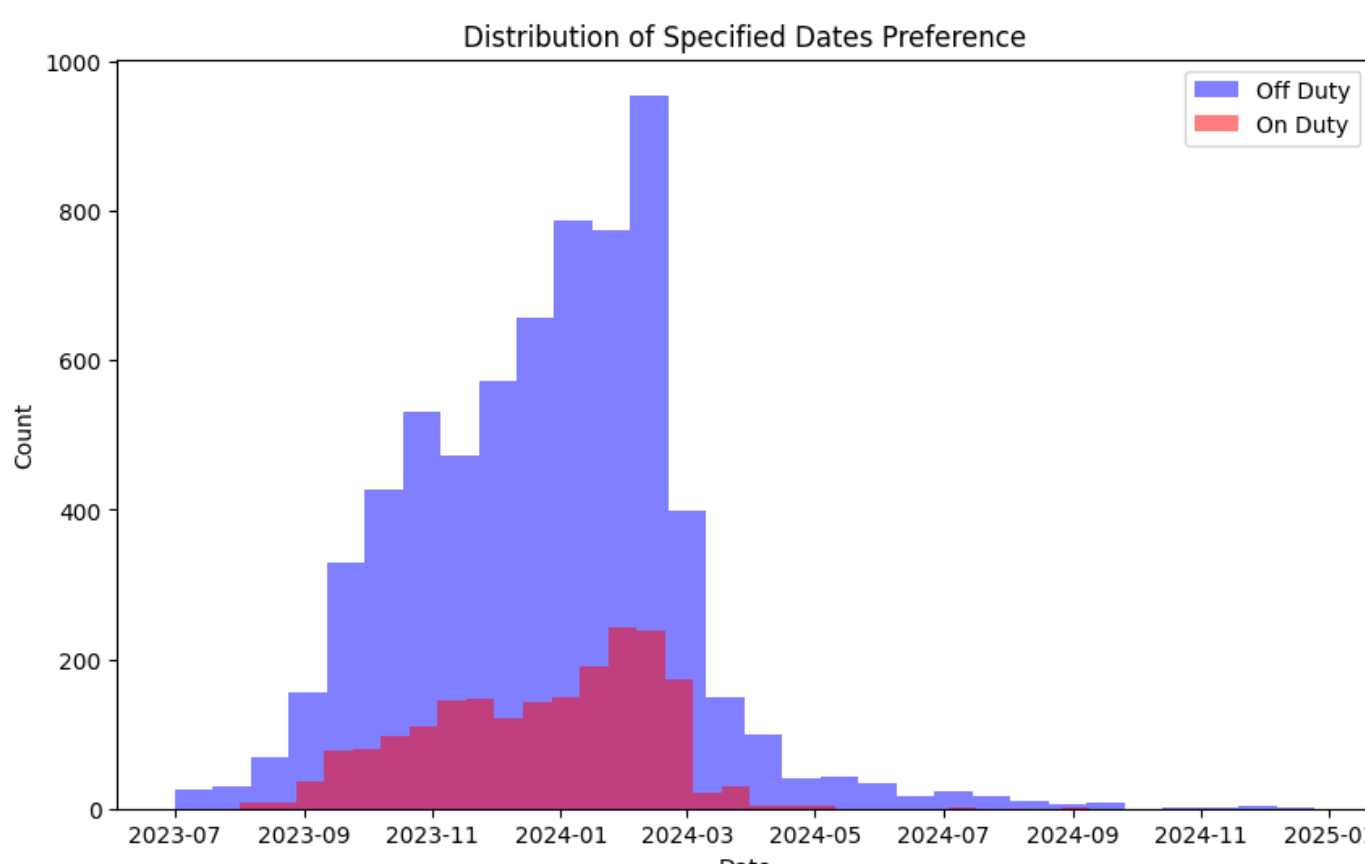


Figure 4: Crew Preferences for Specified Dates

Methodology

Statistical analysis were conducted to find the common conflicts that occurs based on the different preferences logs. All possible pairs of preference logs were compared to identify the conflicts that arise from each pair of preference logs. Figures 5-8 shows the different distributions of each conflict type.

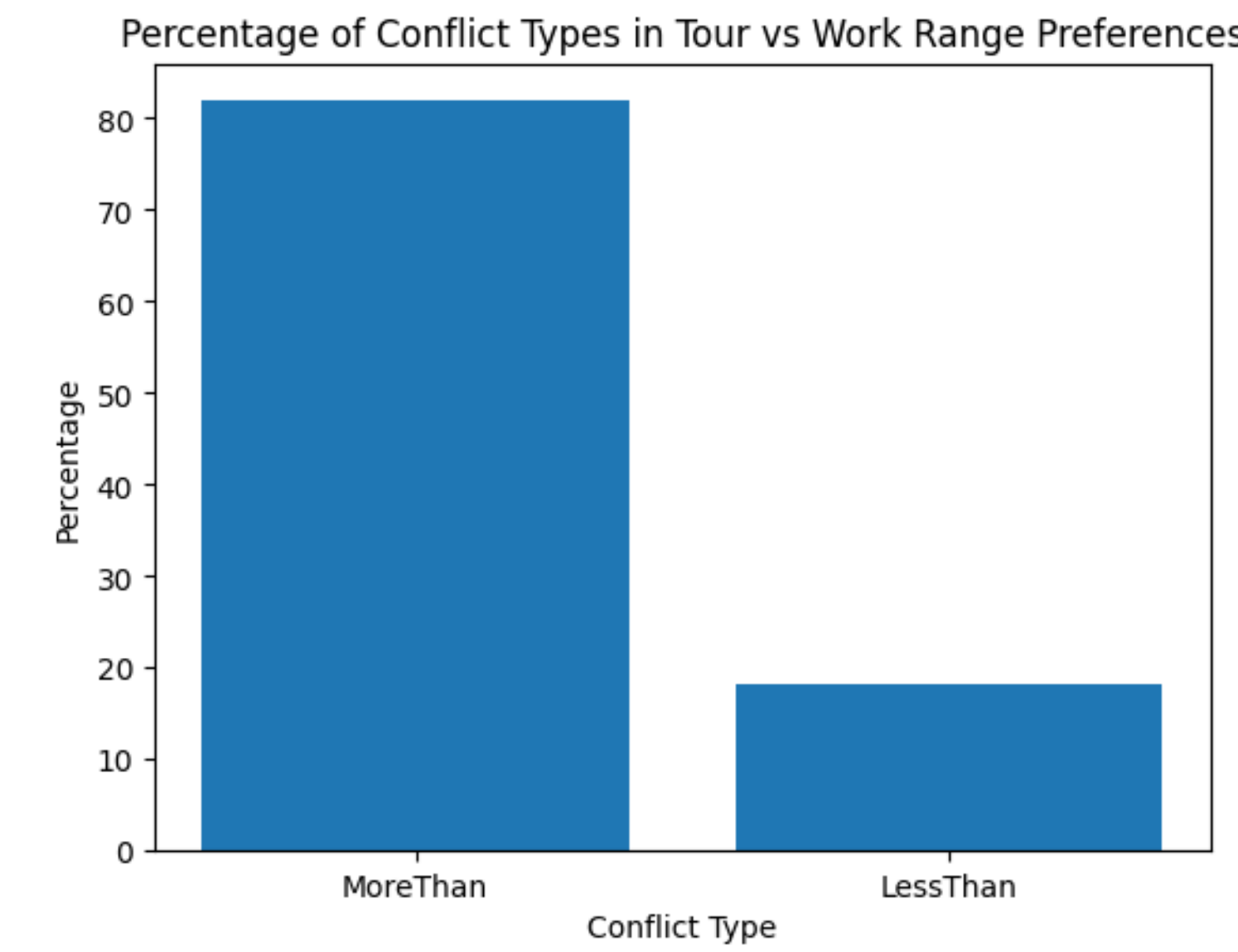


Figure 5: Conflict Status when Tour Lengths are MoreThan or LessThan the Work Range Preferences

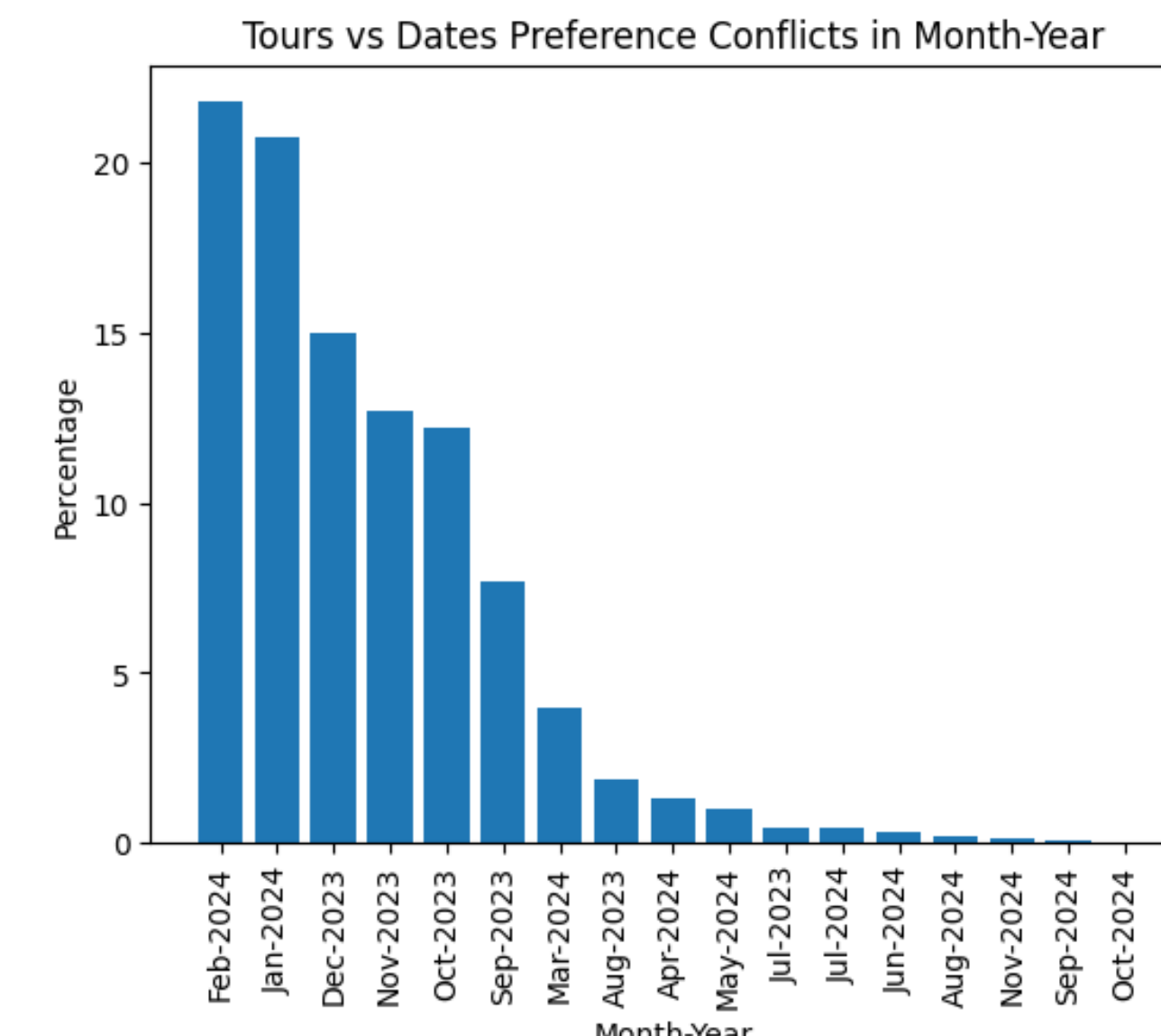


Figure 6: Percentages of Tours and Dates Preference Conflicts by Month-Year

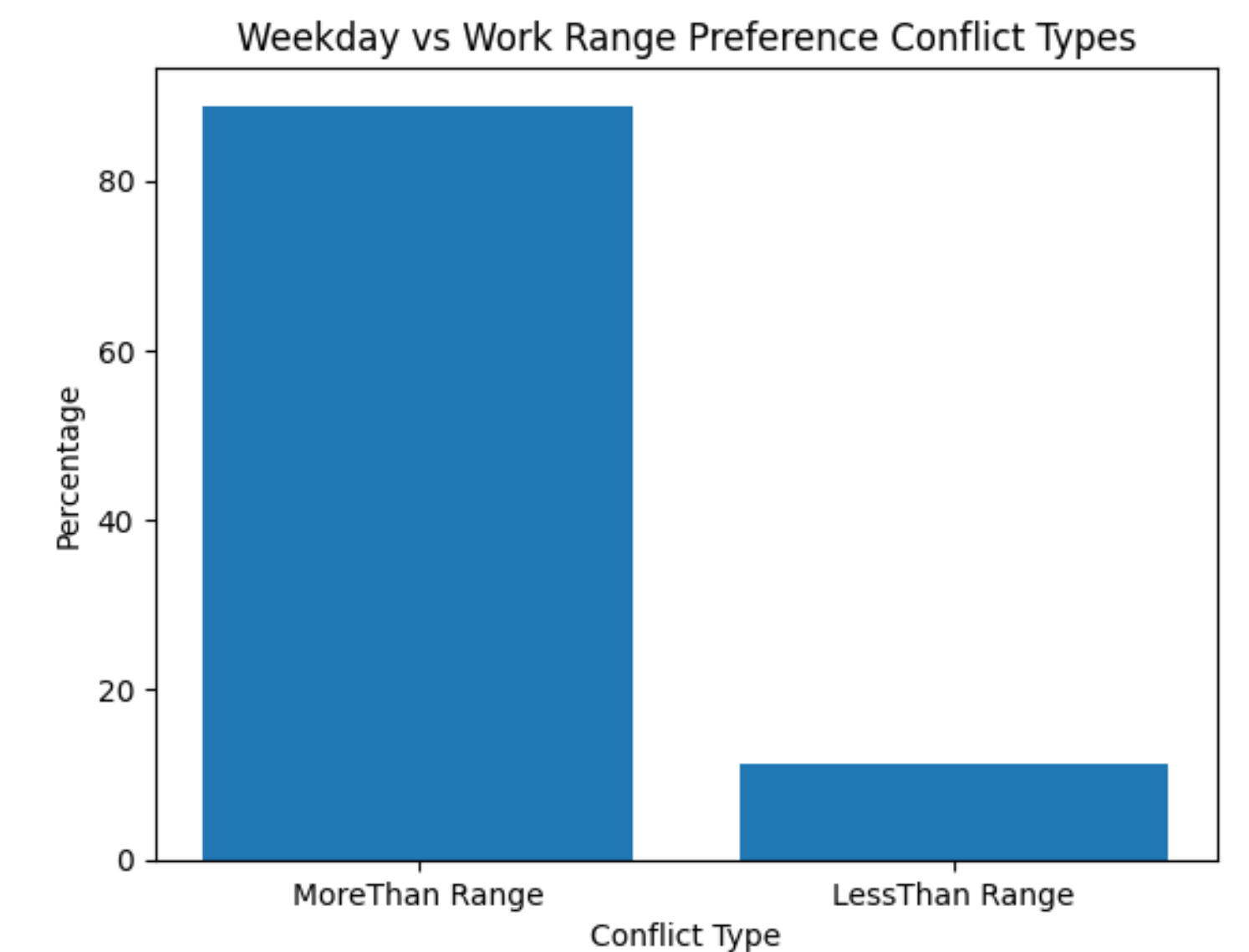


Figure 7: Conflict Status When the # of Weekdays Available are MoreThan or LessThan the Work Range Preferences

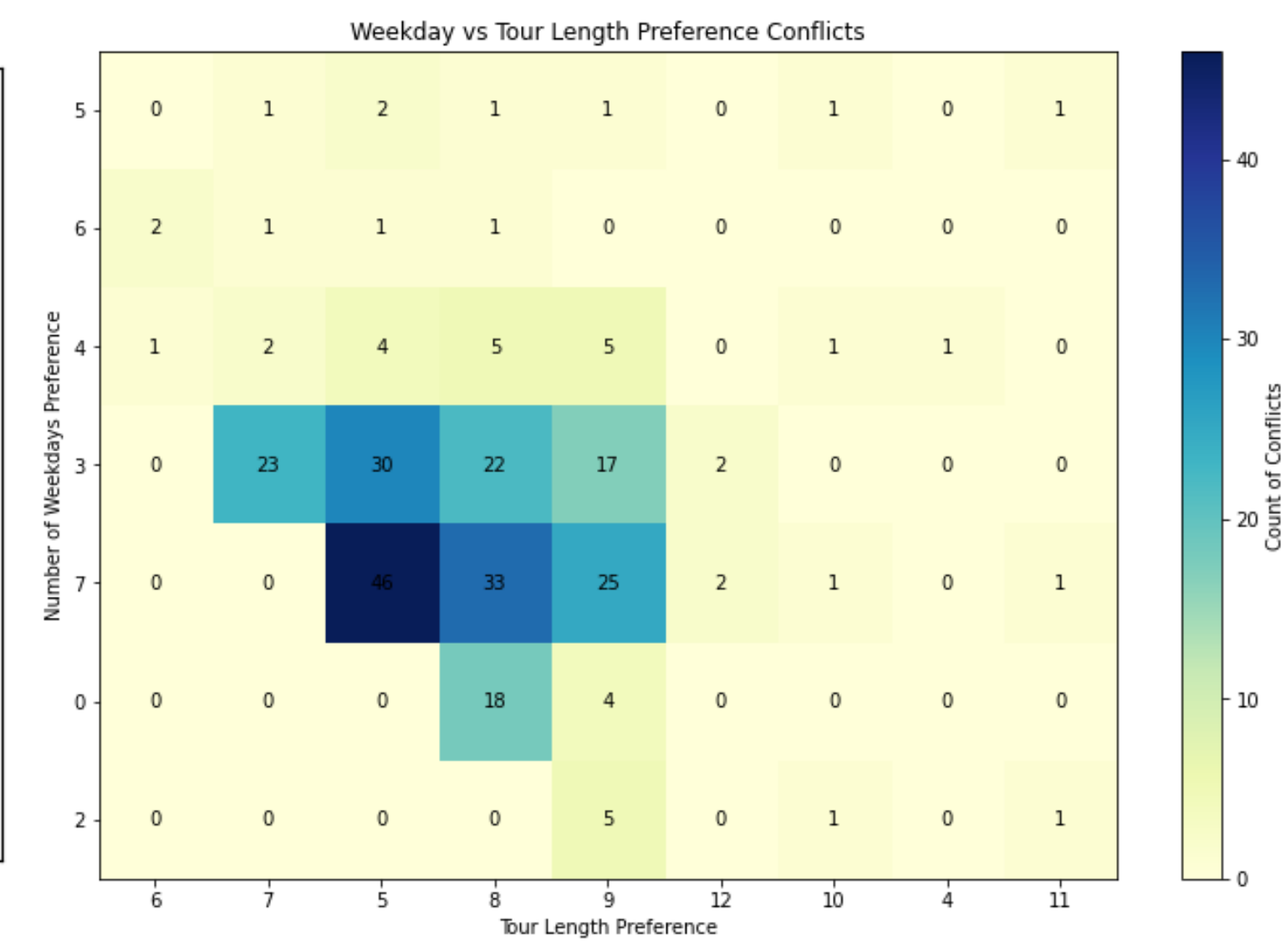


Figure 8: Heatmap of Weekday and Tour Length Preference Conflicts

These figures show that the majority of conflicts that occur are due to preference types not fitting into the Workday Range preferences, and Dates/Weekdays requested off do not fit into the Tour Length preferences.

A potential key indicator of a work schedule conflict can be found by comparing the dates indicated by crew members and the weekdays that they have designated as a preference as well. To illustrate the number of timeline conflicts a calendar of the distribution of conflicts has been made for the years 2023 and 2024. The numbers on the calendar represent the number of conflicts that occurred on that day.

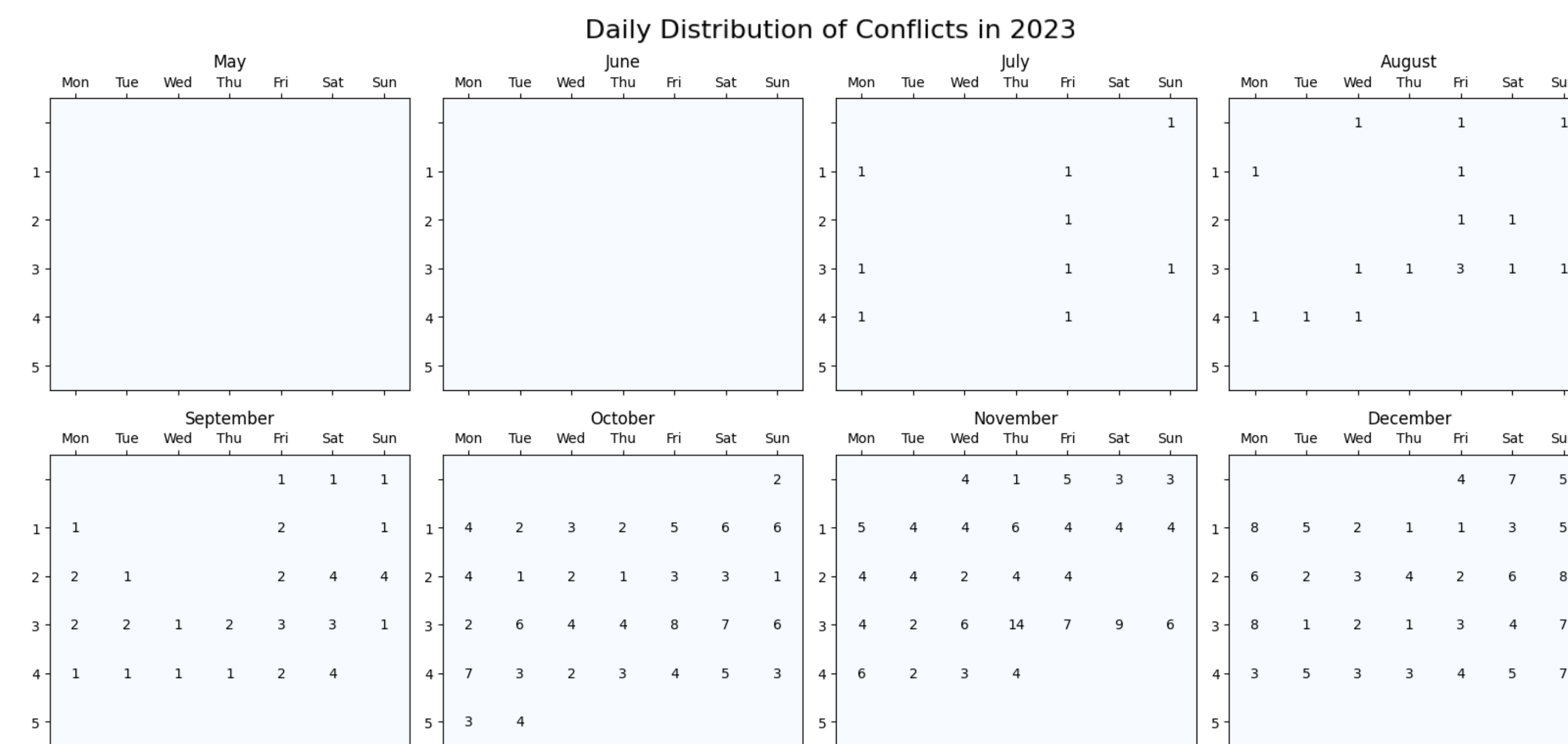


Figure 9: The daily distribution of crew member preference conflicts in 2023

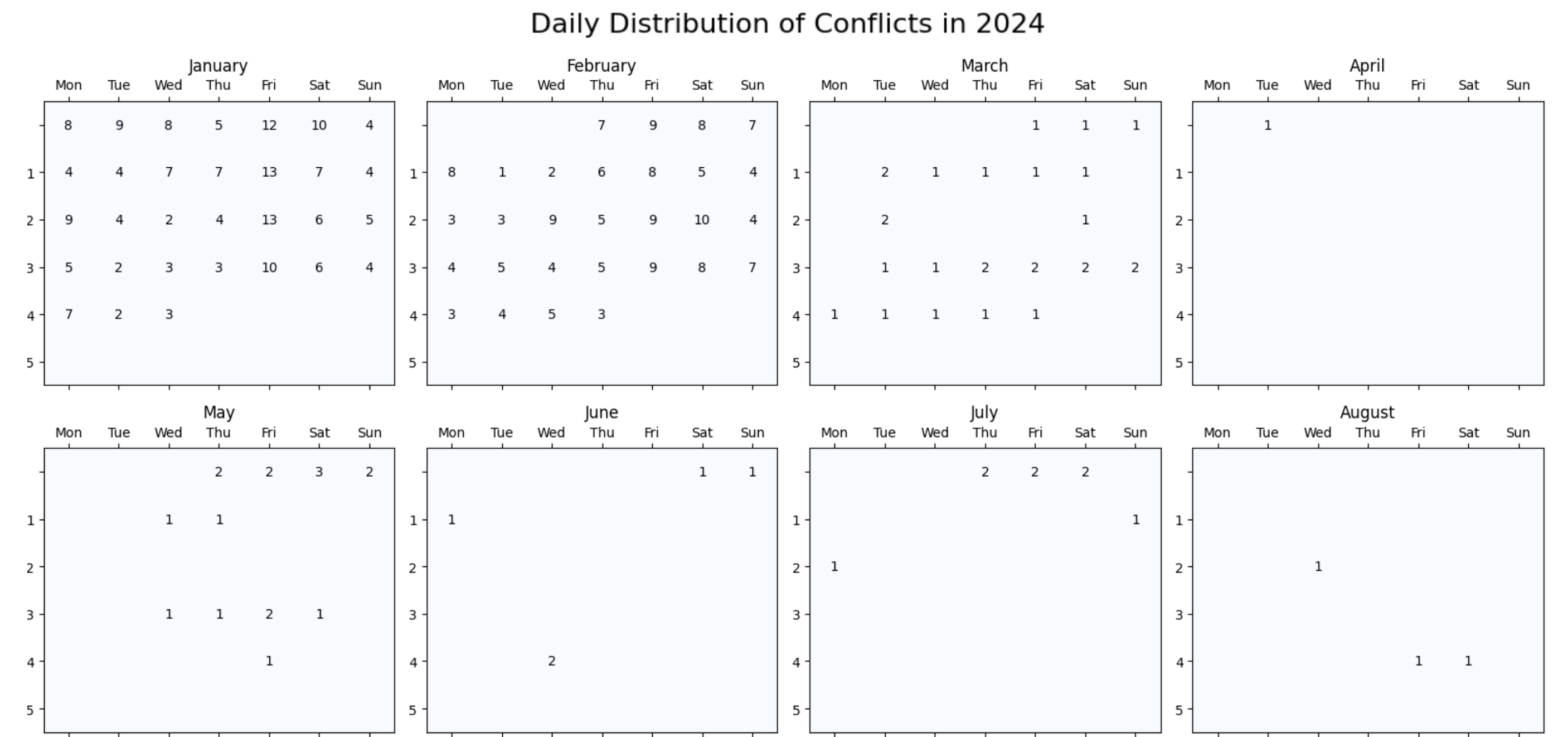


Figure 10: The daily distribution of crew member preference conflicts in 2024

In both the 2023 and 2024 plots we can see that most conflicts occur on Saturdays and Sundays for weekdays. Also, most conflicts occur on holidays including Thanksgiving, Christmas and New Years weeks.

Results

Using all six of the conflicts we found including work schedule conflict we created a singular excel workbook containing six sheets, one for each conflict type, that lists all of the conflicts that have been registered under that crew member. The graph below illustrates the distribution of conflicts for each type using a bar graph. Our results shows that Workday and Specific Date preferences pairing has caused the most conflicts, followed by the pair of Tour Length with Specific Date preferences.

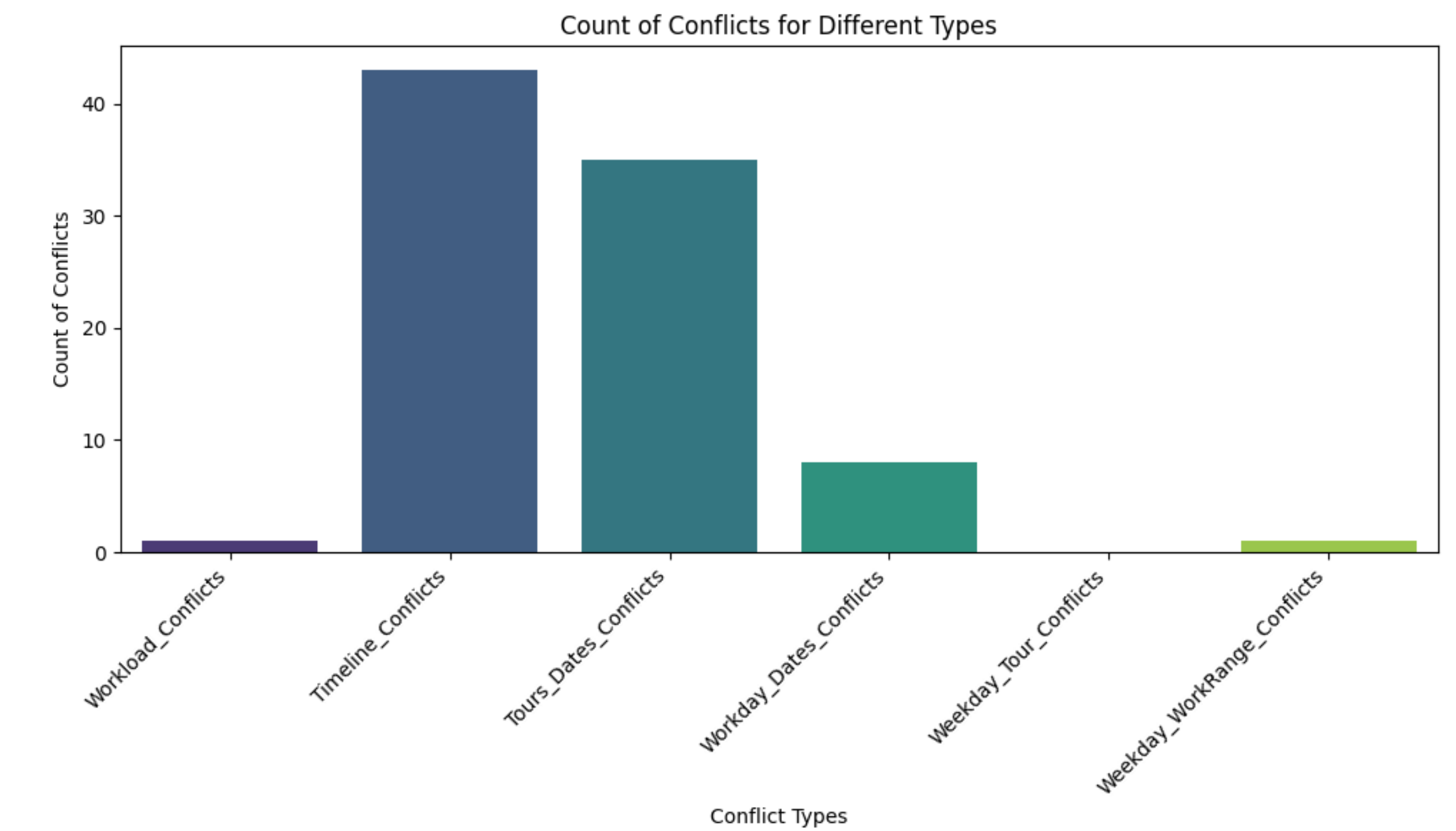


Figure 11: The number of conflicts for a single crew member with each type of conflict.

Our result has provided insights for Flexjet to improve their program. In response to our results, their team has eliminated the Workday Preference from the program. Another reason they mentioned for this removal is due to the low ranking of the Weekday On/Off preference overall. Flexjet then supplied us with an updated dataset following the removal of the Weekday preference for further analysis.

Further Research

Future work will include adapting the functioning algorithm to work with future data sets. The program that has been created efficiently detects conflicts for the initial data set we have been provided, however the program should be able to detect conflicts for data sets with different preference entries as well as varying preference types. Another future development would be updating the program to accept user inputs for individual crew preferences. This will allow for crew members to input preferences and receive immediate feedback if there are any conflicts with the preferences they are submitting.