Group Module 1

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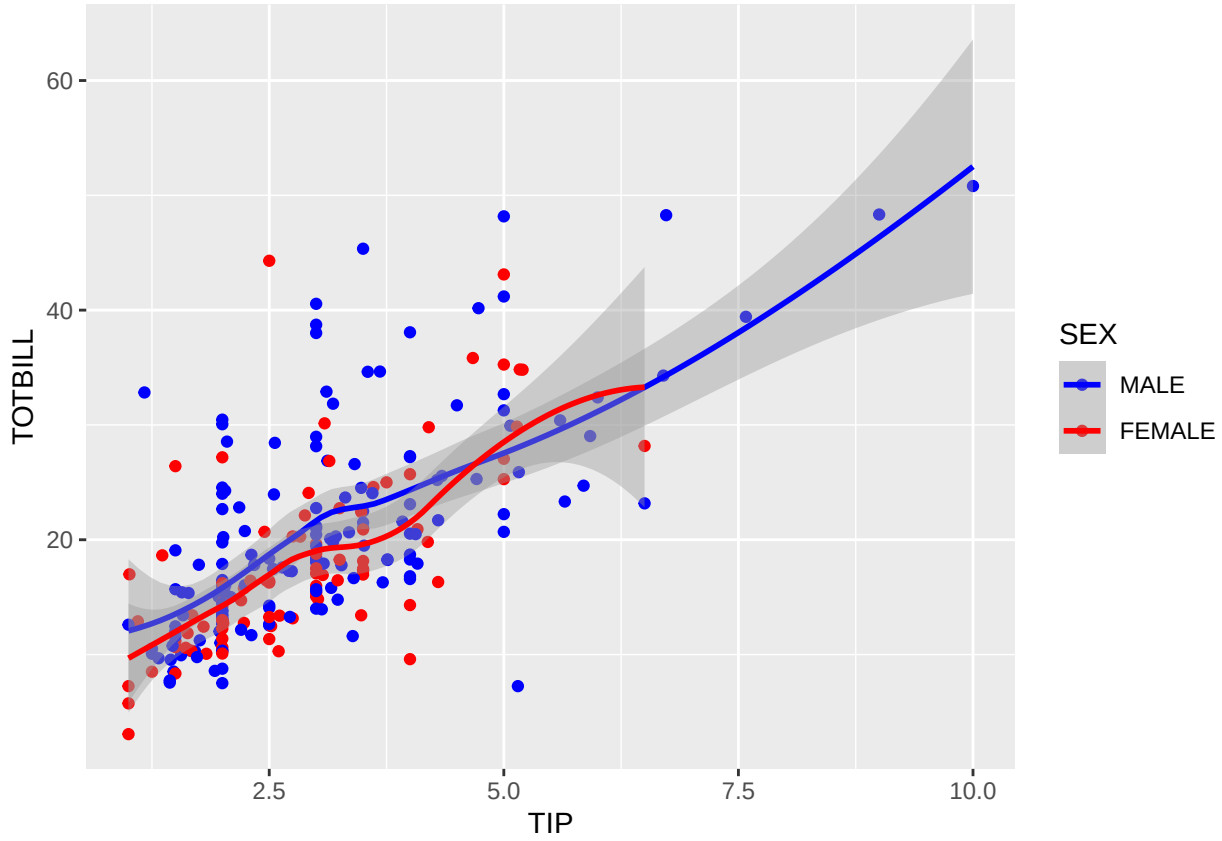
Tipping Changes Across Demographics

Tips by Total Bill Amount

First we look at the relationship between the Tip Amount and Total Bill across both sexes. We see a positive relationship between the total paid and the amount of the tip given.

Additionally, we see that both males and females tip at a similar rate. It initially appears that males do tip more on larger bills.
However, we don't have any data of a primary payment coming from a female with a bill > $45, while we do have data for males. Based on the trends for females and males to tip a similar amount at lower prices, it may be safe to assume that similarity would continue for the higher total bill amounts.

```
## `geom_smooth()` using method = 'loess' and formula 'y ~ x'
```



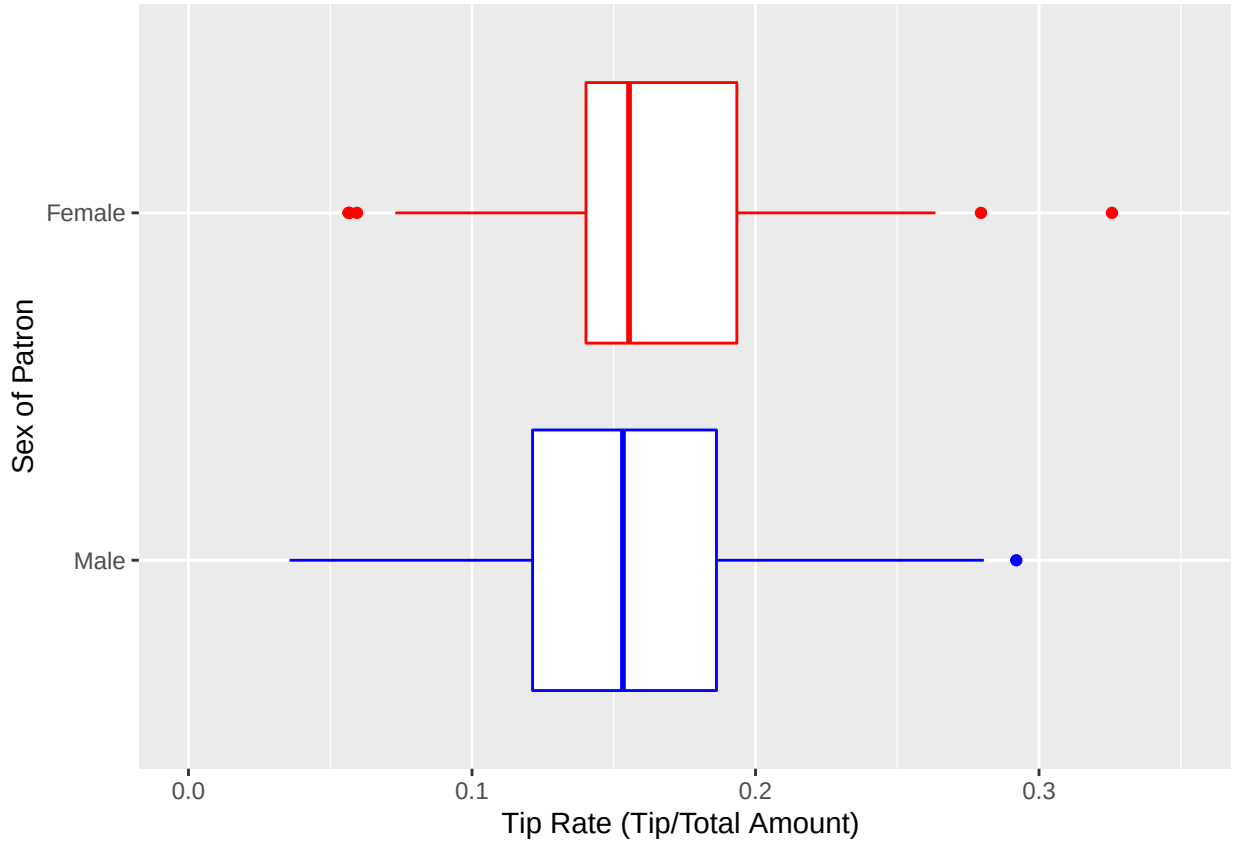
Using Tip Rate Over Tip Amount

Instead of looking at a raw dollar value for tips, we chose to look at the Tip Rate %, calcualted as Tip Amount / Total Bill. Doing so allowed us to extract some additional information from the data, and exposed differences in behaviour that were not visible when comparing the Tip Amount across each group.

Average Tipping Across Sexes

Here we see that the average tip rate of male and female patrons is fairly close, with females tipping at a slightly higher percentage than males. Males appeared to have a larger spread for their tip rates.

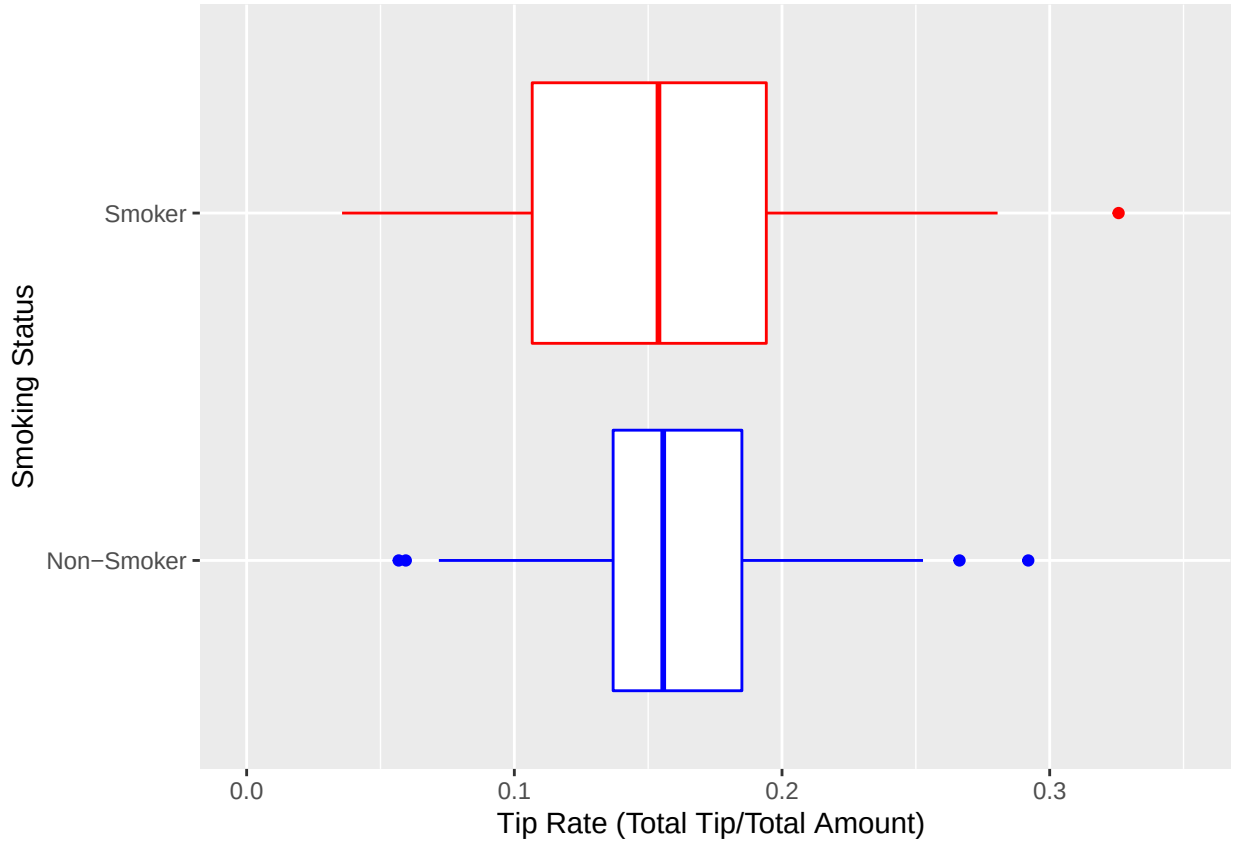
NOTE: To ensure the plots are easier to view, we have truncated the graph at a Tip Rate of 0.35. As a result, 2 observations in the 'Male' category are not listed.



Average Tipping Across Smoking Categories

We see that the average tip rate of somkers and non-smokers are nearly identical, however smokers tended to hve a wider range for their tip rates compared to non-smokers.

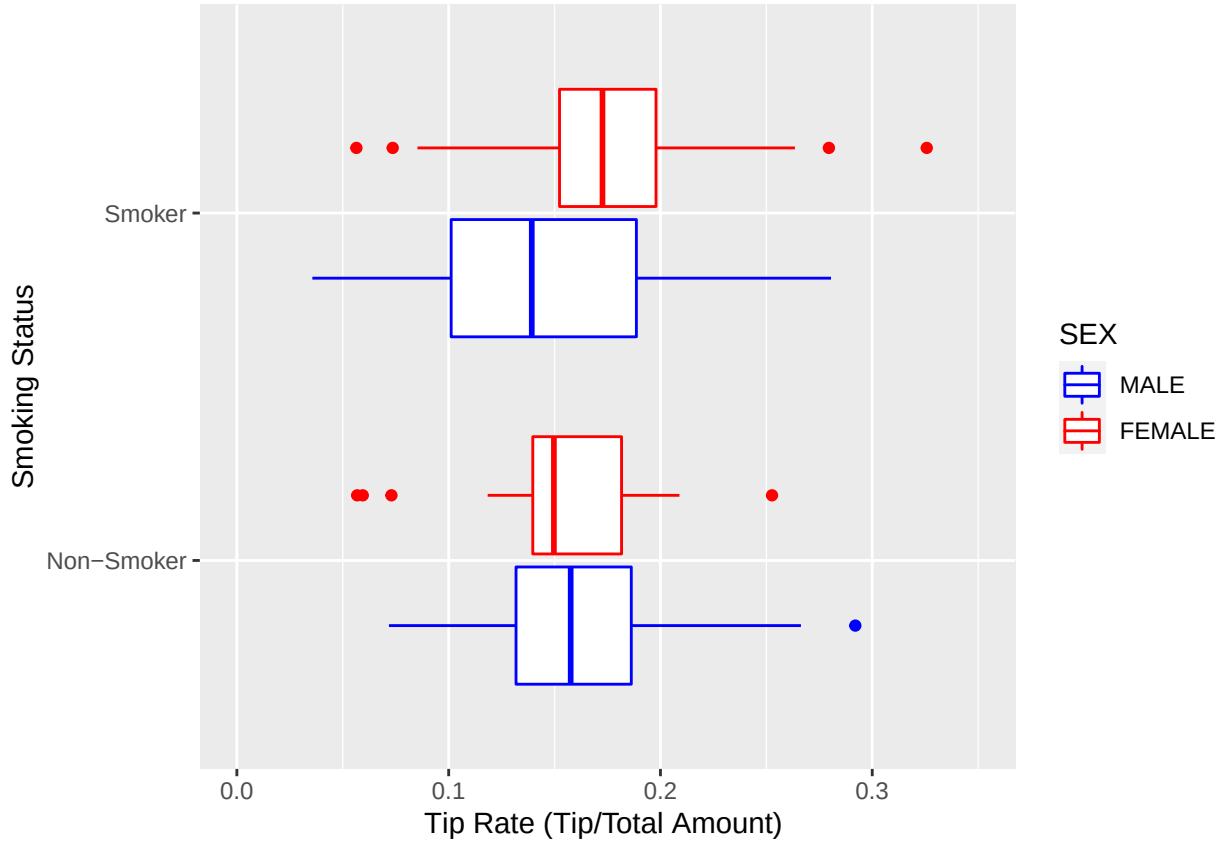
NOTE: To ensure the plots are easier to view, we have truncated the graph at a Tip Rate of 0.35. As a result, 1 observation in the 'Smoker' category are not listed.



Average Tipping Across Smoking Categories and Sexes

Here we start to see larger differences between the indivdual groups. We see that male smokers have the lowest average tip-rate, while Female Smokers have the highest. The variance in tip rates is higher for smokers than non-smokers, and higher for males than females.

NOTE: To ensure the plots are easier to view, we have truncated the graph at a Tip Rate of 0.35. As a result, 1 observation in the 'Female Smoker', and 1 observation in the 'Male Non-Smoker' category are not listed.



Average Tip Rate Across Group Sizes

Factoring by Group Size In order to accomodate this analysis we needed to to provide levels for the group sizes. When looknig at the data, we see that there are very few instances where 1 person dines, as well as very few instancse with a party size of 5 or 6. It's impossible to get truly equal levels as the number of parties with 2 people has so many observations, but we are able to get roughly equal groupings for the rest of the orders with the following breakdown:

1-2 Persons

3 Persons

4-5 Persons

The differnces in the number of groups may be explained by the amount of time each group takes to dine. If that is the case, then a server needs to account for how many tables they are able to wait during a given shift.

```
##
##   1   2   3   4   5   6
##   4 156  38  37   5   4
```

```
##
## 1-2 Persons   3 Persons 4-6 Persons
##         160          38          46
```

Tips Across Group Size and Time

With the factoring from above we see significant differences in tip ratse across the group sizes and dining time. For all groups, dining at night time had the highest variance, with a slightly lower mean tip rate than

day time dining.

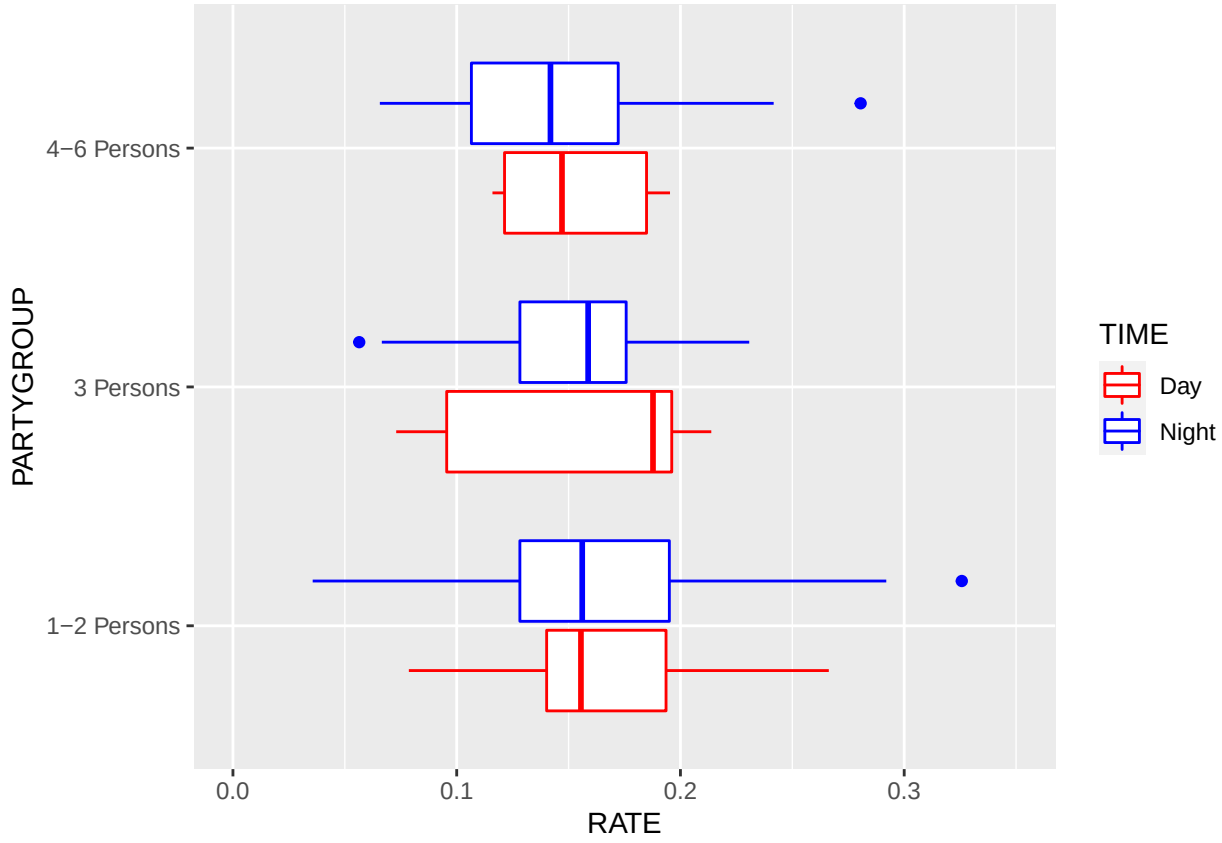
Groups of 1-2 Persons have a mean tip rate that is nearly identical day and night.

Groups of 3 persons seem to tip the most, with the highest mean tip rate during the day time.

Groups of 46 have the lowest tip rate, but follow the same trend of having a higher tip rate during the day and a larger variance at night.

Tip Means hover between 13%-16%

NOTE: To ensure the plots are easier to view, we have truncated the graph at a Tip Rate of 0.35. As a result, 2 observations in the '1-2 Persons, Night' category are not listed.



Per Person Order Amount by Group Size

Lastly we wanted to look at the average bill per person within the categories to try and narrow down some of the behaviour we saw in the graphs related to tip rate. By looking at the total bill divided among the number of members in the party, we are able to get a rough estimate of the amount paid per person.

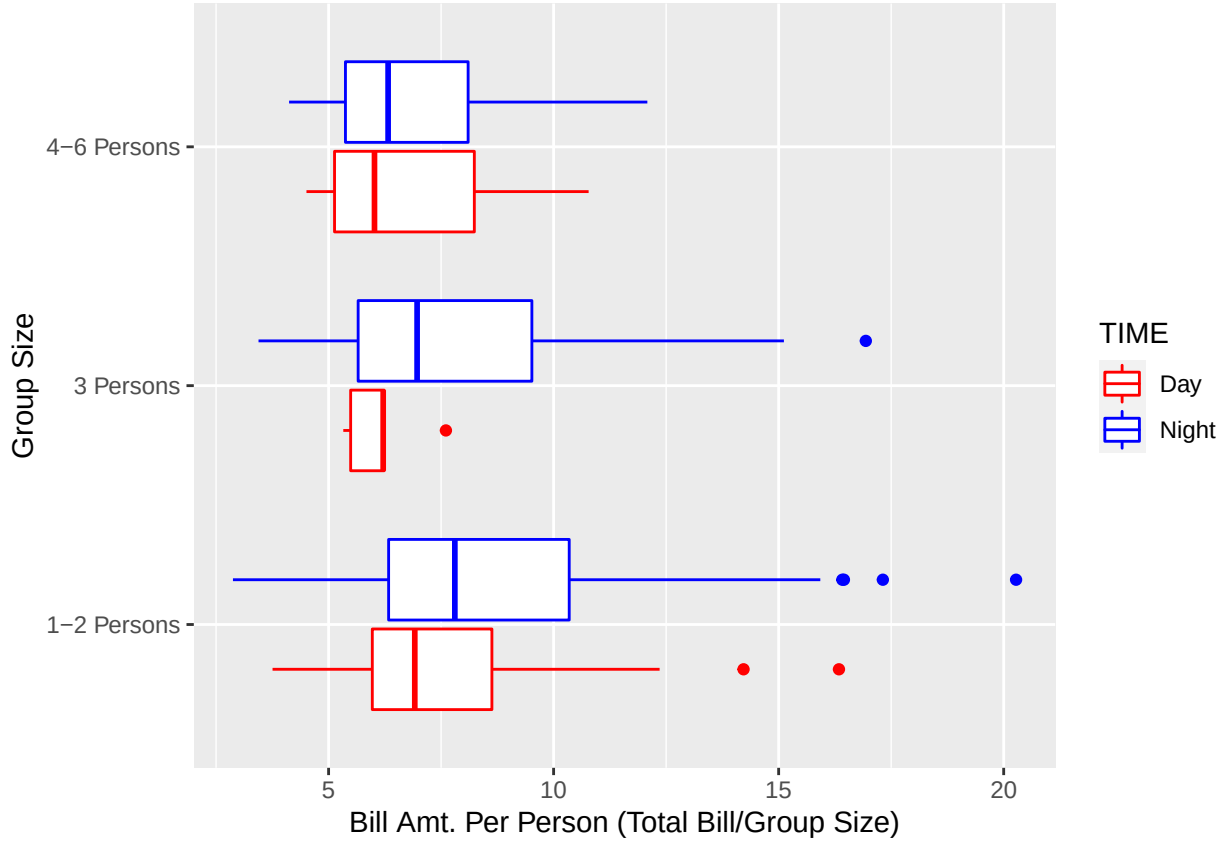
With this, we see some similarities to the previous graphs. The variances of bill per person are much larger at night than during the day. However, they differ from the tip rate graphs in that the means during the night are higher than they are during the day. This may explain why the tip rates are a bit lower during the night, as they are paying a larger dollar value and aren't as willing to tip above ~15%.

Outside of this, we see that smaller groups tend to order more per person than larger groups, possibly because larger groups tend to share plates reducing cost per person.

Groups of 1-2 Persons pay signficiantly more per person than any other group, with a much larger variance than the other groups.

Groups of 3 persons during the day stand out has having an extremely small variance and a relatively small mean cost per person, while at nighttime the mean and variance are both significantly higher.

Groups of 4-6 persons have very similar patterns during the day time and night time, with close means and the closests variances, suggesting that these may be the same types of groups during day or night.



Recommendations

If a server is trying to maximise the amount earned, they should consider working during the nights, and prioritize parties of 4-6 persons. However, if the turnover rate for parties of 4-6 is very slow (they take much longer to finish their meals) compared to parties of 1-2 persons, then the server should prioritize parites of 1-2 persons, as the volume of tables waited will likey compensate for the smaller bill size for those tables, leading to a higher amount of tips taken home.