Summary

Projected lifetime is `384 days` and Gross Profit per Day (GPD) for $Driver_k$ at Day_i can be checked under folder `drivers/`.

Factors are **Daily Activity Length**, **Daily Activity Consistency**, and **Activity during Prime Hours**. Drivers do not act alike - those who drive longer hours and who drive more frequently during prime hours relatively generate more value for Lyft.

As for business strategy, it is important to keep drivers **motivated**: 1. Attract more users, more drivers, but fewer drivers than users 2. Make sure drivers are paid above minimum wage, up to the income level of a school teacher maybe 3. stress the extra benefits to drivers if they drive during peak hours.

1. Recommend a Driver's Lifetime Value

Please find our code for this part at `Driver Value per Day.ipynb` and `Projected Lifetime.ipynb`

Our formula for calculating a driver's Lifetime Value.

We define:

T := The duration of time when the driver brings value to lyft (per day)

V := Driver's value (in dollar per day)

DV := Driver's lifetime value to Lyft (in dollars)

such that

$$DV = T \times V$$

This formula is intuitive since we can associate each driver's lifetime value with their average daily value and their working time respectively. For example, $Driver_k$'uses Lyft to make money for 300 days in total. Each day k can earn an average of 120 dollars. Then k's lifetime value is 300×120 which is $36000.

Our Methodology

The reasoning befind our formula is based on the assumption that Lyft subtracts a fixed percent of revenue from each driver's Gross Profit (GP). Since the percentage is fixed (and same) for all drivers, we can ignore this percent and only consider the GP for each driver. Thus,the question to find driver's lifetime value can be reduced to two simpler questions:

- How to calculate drivers' average Gross Profit per Day (GPD)?
- How to calculate drivers' average lifetime?

We have calculated the Gross Profit per Day (GPD) for $Driver_k$ at day i, which can be checked under folder `drivers/`.

In short

$$GPD_k = \frac{1}{n_k} \sum_{i=1}^{n_k} GPD_{(i,k)}$$

Where n_k is the number of day we have $Driver_k$'s GPD data, and $GPD_{(i,k)}$ is the GPD for $Driver_k$ at day i.

Thus, the first question is solved.

The second question appears more challenging for us. In order to calculate a driver's lifetime, we should have a start date and end date. Although the data contains clear start dates, we were at lost at first on how to find the end date. How could we tell when the driver leaves Lyft?

Prediction!

Linear Least Square Regression ($LLSR$) is the method we leverage to predict driver's quit time. This prediction is fast yet accurate. The procedures to do a Least Square are as follows:

1. Plot $Driver_k$'s GPD respect to k's starting working day
2. Find the best-fit line of these data using least square technique
3. Find the intersection of the line and x-axis to predict the quit time Q for $Driver_k$
4. Caculate the mean of Q to get drivers' average lifetime to Lyft

In such manner, we are able to calculate driver's lifetime value to Lyft given a limited dataset. Our model gives `384 days` as the projected lifetime.

What are the main factors that affect a driver's lifetime value?

Our code for this part can be found at `Graph Driver.ipynb`

$Factor_1$ Daily Activity Length

- Driving to make a living: 7 - 10 hours
- Driving to earn extra income: 3 - 4 hours
- Car-sharing to and from work: 1 - 2 hours
- Driving for excitement: highly variable

$Factor_2$ Daily Activity Consistency

- Drivers who drive consistently last longer

$Factor_3$ Activity during Prime Hours

- Drivers who drive frequently during prime hours generate greater value

Do all drivers act alike? Are there specific segments of drivers that generate more value for Lyft than the average driver?

Drivers do not act alike.

Drivers who drive long hours generate more value. There are different motives behind driving as shown by the different lengths of daily active time. To making a living, to earn some extra, or to seek excitement? Some drive for full-time (more than 8 hours), some drive for extra income (3 - 4 hours), while others are car-sharing commuters or simply for excitements and drive for a shorter amount of time.

Drivers who drive frequently during prime hours generate more value. Those driving for excitement are less likely to drive during peak hours, and commuters doing car-sharing will only drive one time during peak hours.

What actionable recommendations are there for the business?

On the **algorithm** side, it is definitely crucial for Lyft to work on improving real-time routing for drivers, so that they could serve more passengers during finite time, such as during prime hours.

On the other hand, it is important to keep drivers **motivated**.

- The total number of Lyft drivers registered vs. the estimated users of Lyft service decides supply vs. demand. If oversupply, Lyft drivers get demotivated. the best scenario is a shortage, like 90% users will

get a Lyft. But if Lower than 90%, users will decamp to Uber.
- Out of every $10 fare, how much goes to the driver? If he drives 8 hours a day, how much can he make? How does his income compare with minimum wage, or a full-time but relatively low-paying job, like a school teacher? If the income is lower than minimum wage, drivers won't stay long.

Therefore, our suggestions are that Lyft should attract more users, more drivers, but fewer drivers than users; secondly, make sure drivers are paid above minimum wage, up to the income level of a school teacher maybe; and stress the extra benefits to drivers if they drive during peak hours.

There are also things can be done on the passenger side! Ask passengers to wait for pickups at easily recognizable locations to save drivers' time looking for them. If they do, especially during prime hours, they get credits that can be used for next ride.