Problem Statement

- In the fast paced taxi booking sector, making the most of revenue is essential for long-term success and driver happiness.

- Our goal is to use data-driven to maximise revenue streams for taxi drivers in order to meet this need. Our research aims to determine whether payment methods have an impact on fare pricing by focusing on the relationship between payment type and fare amount.

Research Question

- Is there a relationship between total fare amount and payment types?

- Nudge customer towards payment methhods that generate higher revenue for drivers, without negatively impacting customer experience

Importing Libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

In [2]:
```
df = pd.read_csv(r'C:\Users\Admin\Desktop\Python\Data\Yellow_TripdataProject\yellow
df.head() #shows top 5 rows
```

Out[2]:

	VendorID	tpep_pickup_datetime	tpep_dropoff_datetime	passenger_count	trip_distance
0	1.0	2020-01-01 00:28:15	2020-01-01 00:33:03	1.0	1.2
1	1.0	2020-01-01 00:35:39	2020-01-01 00:43:04	1.0	1.2
2	1.0	2020-01-01 00:47:41	2020-01-01 00:53:52	1.0	0.6
3	1.0	2020-01-01 00:55:23	2020-01-01 01:00:14	1.0	0.8
4	2.0	2020-01-01 00:01:58	2020-01-01 00:04:16	1.0	0.0

In [4]:
```
df.shape #Shows shape of the data set
```

Out[4]:
```
(6405008, 18)
```

In [5]:
```
df.info() #Provide information about data set
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6405008 entries, 0 to 6405007
Data columns (total 18 columns):
 #   Column                 Dtype  
---  ------                 -----  
 0   VendorID               float64
 1   tpep_pickup_datetime   object 
 2   tpep_dropoff_datetime  object 
 3   passenger_count        float64
 4   trip_distance          float64
 5   RatecodeID             float64
 6   store_and_fwd_flag     object 
 7   PULocationID           int64  
 8   DOLocationID           int64  
 9   payment_type           float64
 10  fare_amount            float64
 11  extra                  float64
 12  mta_tax                float64
 13  tip_amount             float64
 14  tolls_amount           float64
 15  improvement_surcharge  float64
 16  total_amount           float64
 17  congestion_surcharge   float64
dtypes: float64(13), int64(2), object(3)
memory usage: 879.6+ MB
```

"tpep_pickup_datetime" & "tpep_dropoff_datetime" data type is objects, they should be datetime data type

In [6]:
```
df['tpep_pickup_datetime'] = pd.to_datetime(df['tpep_pickup_datetime']) #Converting
df['tpep_dropoff_datetime'] = pd.to_datetime(df['tpep_dropoff_datetime']) #Converti
```

In [7]:
```
df.dtypes #checking data types
```

Out[7]:
```
VendorID                        float64
tpep_pickup_datetime     datetime64[ns]
tpep_dropoff_datetime    datetime64[ns]
passenger_count                 float64
trip_distance                   float64
RatecodeID                      float64
store_and_fwd_flag               object
PULocationID                      int64
DOLocationID                      int64
payment_type                    float64
fare_amount                     float64
extra                           float64
mta_tax                         float64
tip_amount                      float64
tolls_amount                    float64
improvement_surcharge           float64
total_amount                    float64
congestion_surcharge            float64
dtype: object
```

In [8]:
```
df['trip_durtation'] = df['tpep_dropoff_datetime']-df['tpep_pickup_datetime'] #Extr
df['trip_durtation'] = df['trip_durtation'].dt.total_seconds()/60 #converting secon
```

In [9]:
```
df.head() #shows top 5 rows
```

Out[9]:

	VendorID	tpep_pickup_datetime	tpep_dropoff_datetime	passenger_count	trip_distance
0	1.0	2020-01-01 00:28:15	2020-01-01 00:33:03	1.0	1.2
1	1.0	2020-01-01 00:35:39	2020-01-01 00:43:04	1.0	1.2
2	1.0	2020-01-01 00:47:41	2020-01-01 00:53:52	1.0	0.6
3	1.0	2020-01-01 00:55:23	2020-01-01 01:00:14	1.0	0.8
4	2.0	2020-01-01 00:01:58	2020-01-01 00:04:16	1.0	0.0

Selecting data as per prolem statement

In [10]:
```
df = df[['passenger_count','payment_type','fare_amount','trip_distance','trip_durta
```

In [11]:
```
df.sample() #shows one random row as a sample
```

Out[11]:

	passenger_count	payment_type	fare_amount	trip_distance	trip_durtation
4746092	2.0	1.0	5.5	0.9	5.066667

In [12]:
```
df.isnull().sum() #Checking null values
```

Out[12]:
```
passenger_count    65441
payment_type       65441
fare_amount            0
trip_distance          0
trip_durtation         0
dtype: int64
```

In [13]:
```
len(df) #shows length of the data
```

Out[13]:
```
6405008
```

In [14]:
```
def per(x): #Creating the fucntion to check percentage of values which are empty
    return (x/len(df))*100
```

In [15]:
```
passenger_count = 65441
payment_type = 65441
print('Percentage of passenger_count:-',per(passenger_count))
print()
print('Percentage of payment_type:-',per(payment_type))
```

```
Percentage of passenger_count:- 1.021716132126611

Percentage of payment_type:- 1.021716132126611
```

1.02% null values, which is very less, they can either be dorpped or filled with mean or median

In [16]:
```
df.dropna(inplace=True) #Droping null values
df.isnull().sum()
```

Out[16]:
```
passenger_count    0
payment_type       0
fare_amount        0
trip_distance      0
trip_durtation     0
dtype: int64
```

In [17]:
```
df.sample(3)
```

Out[17]:

	passenger_count	payment_type	fare_amount	trip_distance	trip_durtation
3067164	1.0	1.0	11.0	1.50	16.000000
898803	6.0	1.0	5.5	0.75	5.066667
4477595	1.0	1.0	13.5	2.10	19.483333

In [18]:
```
df.dtypes
```

Out[18]:
```
passenger_count    float64
payment_type       float64
fare_amount        float64
trip_distance      float64
trip_durtation     float64
dtype: object
```

In [19]:
```
df['passenger_count'] = df['passenger_count'].astype(int) #Convering float to integ
df['payment_type'] = df['payment_type'].astype(int) #Convering float to integer
```

In [20]:
```
df.head() #shows top 5 rows
```

Out[20]:

	passenger_count	payment_type	fare_amount	trip_distance	trip_durtation
0	1	1	6.0	1.2	4.800000
1	1	1	7.0	1.2	7.416667
2	1	1	6.0	0.6	6.183333
3	1	1	5.5	0.8	4.850000
4	1	2	3.5	0.0	2.300000

In [21]:
```
df.duplicated().sum() #Checking duplicates values
```

Out[21]:
```
3331706
```

In [22]:
```
df.drop_duplicates(inplace=True) #Dropping duplicates values
```

In [23]:
```
df.duplicated().sum()#Checking duplicates values
```

Out[23]:
```
0
```

In [24]:
```
df.shape #Show shape of the data set
```

Out[24]:
```
(3007861, 5)
```

In [25]:
```
df['passenger_count'].value_counts(normalize=True) #shows values by its perentage
```

Out[25]:
```
passenger_count
1    0.581981
2    0.190350
3    0.066360
5    0.062937
6    0.039272
4    0.036046
0    0.023033
7    0.000009
9    0.000006
8    0.000006
Name: proportion, dtype: float64
```

In [26]:
```
df['payment_type'].value_counts(normalize=True) #shows values by its perentage
#1- Credit Card
#2- Cash
#3- No Charge
#4- Dispute
#5- Unkown
#6- Voided Trip
```

Out[26]:
```
payment_type
1    6.782670e-01
2    3.075731e-01
3    8.721480e-03
4    5.438084e-03
5    3.324622e-07
Name: proportion, dtype: float64
```

In [27]:
```
df = df[df['payment_type'].isin([1,2])] #Selecting data as per problem statement
df = df[df['passenger_count'].isin([1,2,3,4,5])] #Selecting data as per problem sta
df
```

Out[27]:

	passenger_count	payment_type	fare_amount	trip_distance	trip_durtation
0	1	1	6.0	1.20	4.800000
1	1	1	7.0	1.20	7.416667
2	1	1	6.0	0.60	6.183333
3	1	1	5.5	0.80	4.850000
4	1	2	3.5	0.00	2.300000
...	...	...	...	...	...
6339555	3	1	10.0	2.09	14.800000
6339561	1	1	17.5	4.11	21.500000
6339563	1	1	13.0	2.13	19.000000
6339564	1	1	12.5	2.55	16.283333
6339566	1	1	0.0	0.00	1.066667

2780283 rows × 5 columns

In [28]:
```
df['payment_type'].value_counts()
#1-credit card
#2-Cash
```

Out[28]:
```
payment_type
1    1907801
2     872482
Name: count, dtype: int64
```

In [29]:
```
#Creating function to replacing 1 with "Card" & 2 with "Cash"
def chang(x):
    if x ==1:
        return 'Card'
    else:
        return 'Cash'
```

In [30]:
```
df['payment_type'] = df['payment_type'].apply(chang) #Replacing Values in payment_t
```

In [31]:
```
df.sample(8) #Show 8 random samples
```

Out[31]:

	passenger_count	payment_type	fare_amount	trip_distance	trip_durtation
2518400	1	Card	26.5	8.73	25.433333
3641180	1	Card	10.5	2.39	10.766667
2490840	1	Card	15.5	3.81	19.283333
4358717	1	Card	14.5	2.76	20.133333
416256	1	Cash	34.5	10.70	37.233333
1615897	1	Card	9.5	1.32	13.683333
4612199	1	Card	13.0	3.78	13.500000
2118602	2	Card	6.0	1.07	5.200000

In [32]:
```
df.describe() #Shows descriptive values
```

Out[32]:

	passenger_count	fare_amount	trip_distance	trip_durtation
count	2.780283e+06	2.780283e+06	2.780283e+06	2.780283e+06
mean	1.733386e+00	1.780567e+01	4.536729e+00	2.415478e+01
std	1.176652e+00	1.506997e+01	4.895890e+00	9.260031e+01
min	1.000000e+00	-5.000000e+02	-2.218000e+01	-2.770367e+03
25%	1.000000e+00	9.000000e+00	1.500000e+00	9.883333e+00
50%	1.000000e+00	1.300000e+01	2.730000e+00	1.573333e+01
75%	2.000000e+00	2.100000e+01	5.470000e+00	2.336667e+01
max	5.000000e+00	4.265000e+03	2.628800e+02	8.525117e+03

"fare_amount", "trip_distance" & "trip_durtation" can not be negative & columns are having outliers

In [33]:
```
df = df[df['fare_amount']>0] #Removing negative values
df = df[df['trip_distance']>0] #Removing negative values
df = df[df['trip_durtation']>0] #Removing negative values
```

In [34]:
```
df.describe()
```

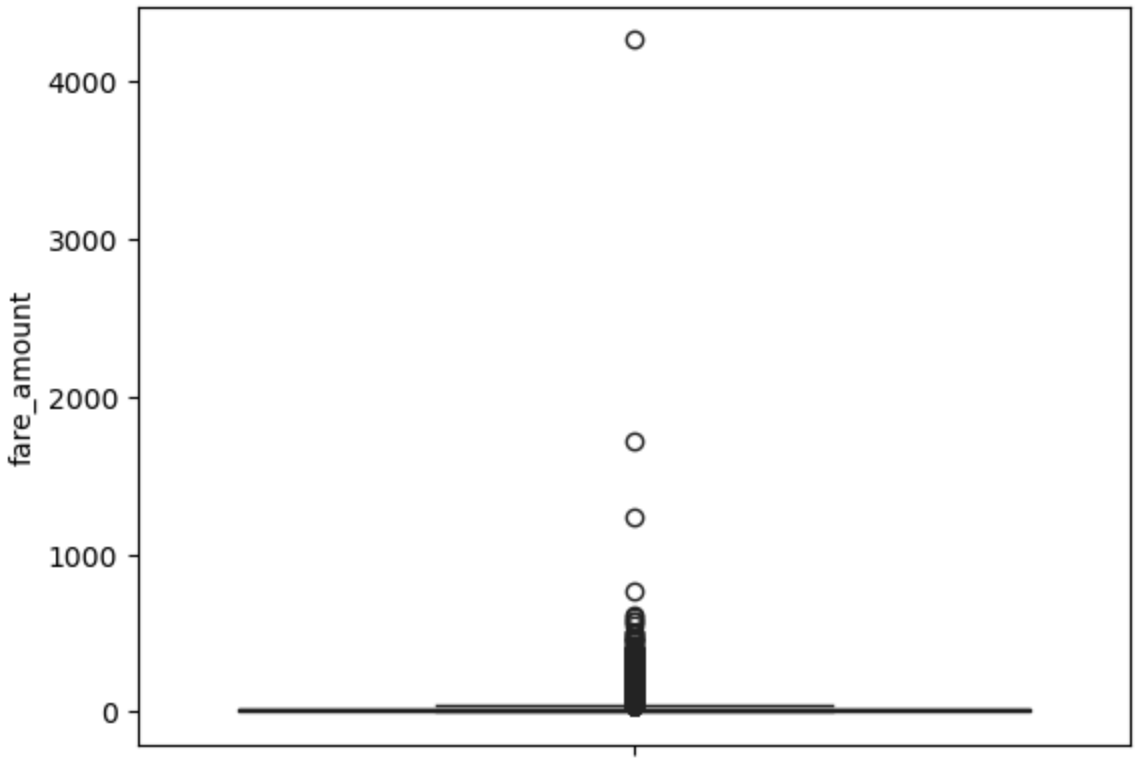
Out[34]:

	passenger_count	fare_amount	trip_distance	trip_durtation
count	2.748932e+06	2.748932e+06	2.748932e+06	2.748932e+06
mean	1.738151e+00	1.766835e+01	4.583313e+00	2.418261e+01
std	1.179440e+00	1.447531e+01	4.897806e+00	9.272285e+01
min	1.000000e+00	1.000000e-02	1.000000e-02	1.666667e-02
25%	1.000000e+00	9.000000e+00	1.530000e+00	9.950000e+00
50%	1.000000e+00	1.300000e+01	2.770000e+00	1.575000e+01
75%	2.000000e+00	2.100000e+01	5.500000e+00	2.333333e+01
max	5.000000e+00	4.265000e+03	2.628800e+02	8.525117e+03

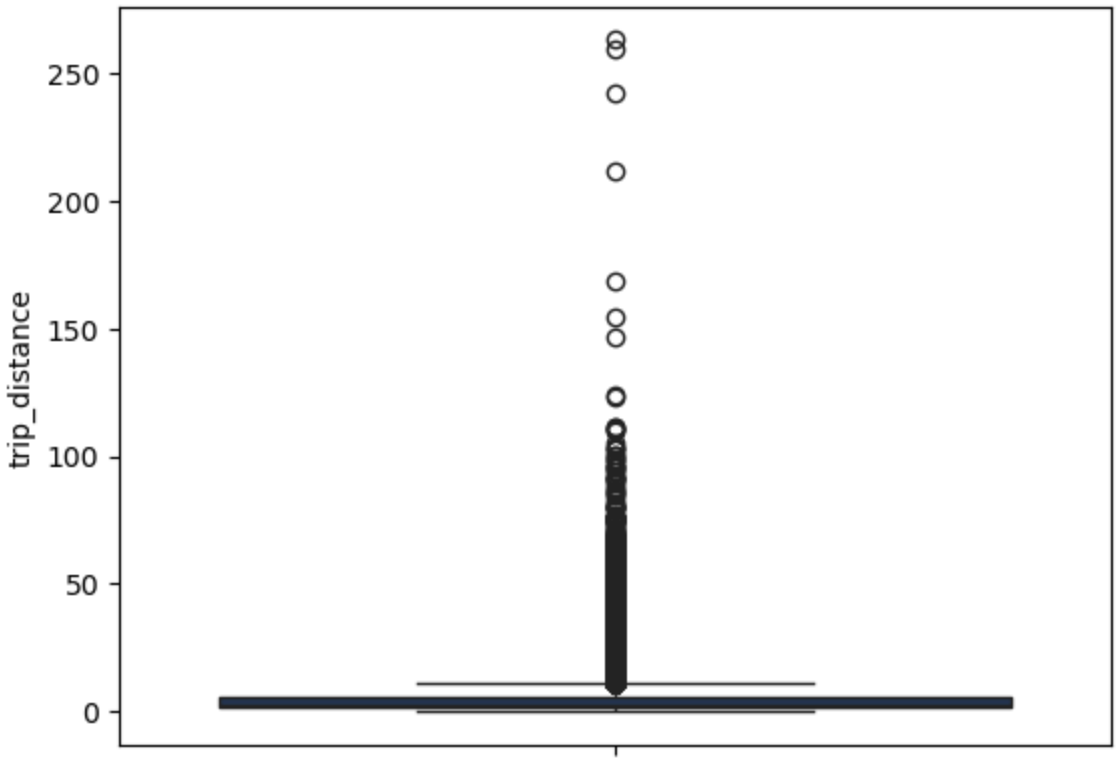
In [35]:
```
q1 = np.percentile(df['fare_amount'],25)
q1
```

Out[35]: 9.0

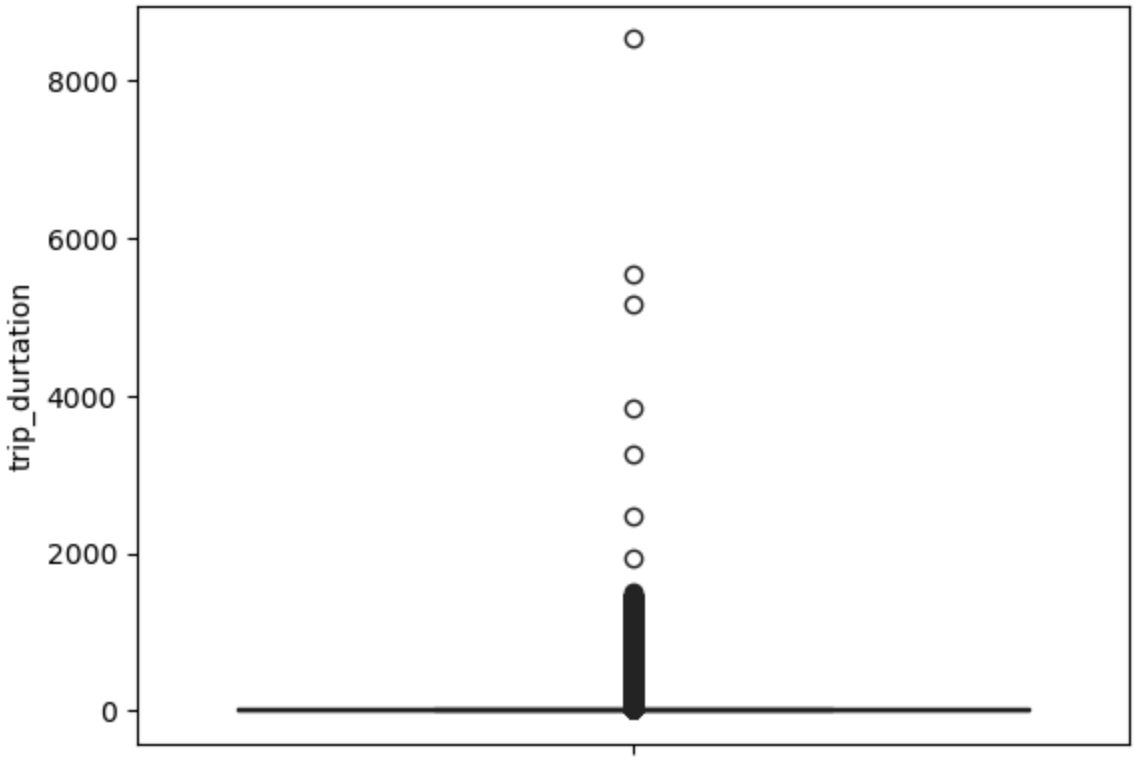
In [36]:
```
sns.boxplot(df['fare_amount'], color='#1D3557') #Checking Outliers
plt.show()
```



In [37]:
```
sns.boxplot(df['trip_distance'], color='#1D3557') #Checking Outliers
plt.show()
```



In [38]:
```
sns.boxplot(df['trip_durtation'],color='#1D3557')#Checking Outliers
plt.show()
```



Removing Outliers

In [39]:
```
#Creating function to remove outliers
for i in ['fare_amount','trip_distance','trip_durtation']:
```

```
    q3 = np.percentile(df[i],75)
    q1 = np.percentile(df[i],25)
    IQR = q3-q1
    upper_bound = q3 + 1.5*IQR
    lower_bound = q1 - 1.5*IQR
    df = df[(df[i]<=upper_bound) & (df[i]>=lower_bound)]
```

In [40]:
```
df.describe()
```

Out[40]:

	passenger_count	fare_amount	trip_distance	trip_durtation
count	2.297908e+06	2.297908e+06	2.297908e+06	2.297908e+06
mean	1.788903e+00	1.266990e+01	2.864790e+00	1.465181e+01
std	1.211896e+00	5.807998e+00	1.975755e+00	7.315283e+00
min	1.000000e+00	1.000000e-02	1.000000e-02	1.666667e-02
25%	1.000000e+00	8.000000e+00	1.380000e+00	9.050000e+00
50%	1.000000e+00	1.150000e+01	2.330000e+00	1.391667e+01
75%	2.000000e+00	1.650000e+01	3.830000e+00	1.946667e+01
max	5.000000e+00	3.900000e+01	8.970000e+00	3.598333e+01

In [64]:
```
df
```

Out[64]:

	passenger_count	payment_type	fare_amount	trip_distance	trip_durtation
0	1	Card	6.0	1.20	4.800000
1	1	Card	7.0	1.20	7.416667
2	1	Card	6.0	0.60	6.183333
3	1	Card	5.5	0.80	4.850000
5	1	Cash	2.5	0.03	0.883333
...	...	...	...	...	...
6339550	4	Card	10.5	2.40	12.383333
6339555	3	Card	10.0	2.09	14.800000
6339561	1	Card	17.5	4.11	21.500000
6339563	1	Card	13.0	2.13	19.000000
6339564	1	Card	12.5	2.55	16.283333

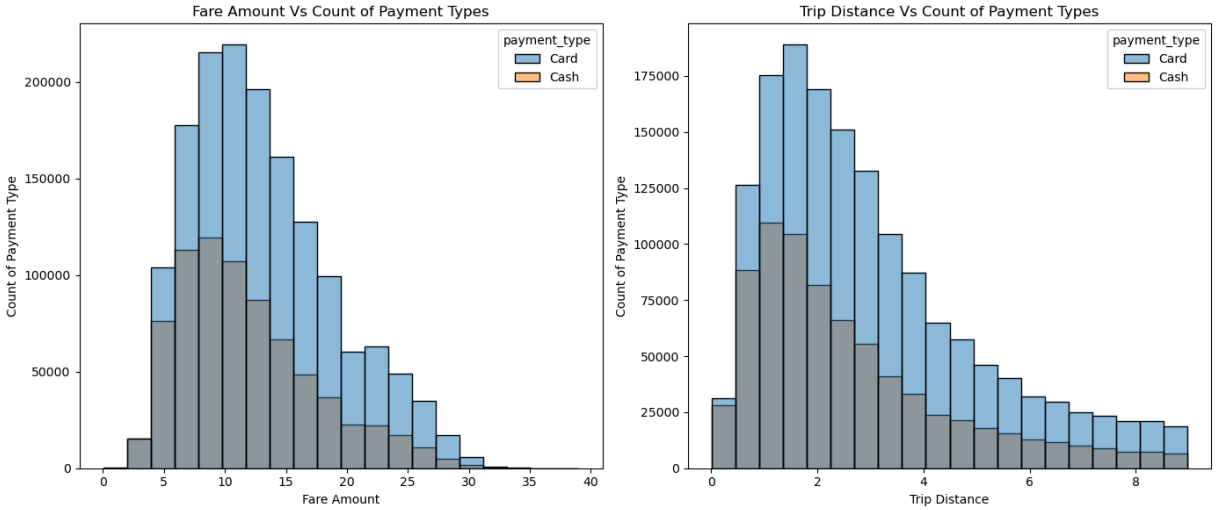
2297908 rows × 5 columns

In [115…
```
# Set up the figure with two columns
fig, axes = plt.subplots(1, 2, figsize=(14, 6))  # 1 row, 2 columns
```

```
# Plot the first histogram in the first column
sns.histplot(data=df, x='fare_amount', hue='payment_type', bins=20, ax=axes[0])
axes[0].set_title('Fare Amount Vs Count of Payment Types')
axes[0].set_xlabel('Fare Amount')
axes[0].set_ylabel('Count of Payment Type')

# Plot the second histogram in the second column
sns.histplot(data=df, x='trip_distance', hue='payment_type', bins=20, ax=axes[1])
axes[1].set_title('Trip Distance Vs Count of Payment Types')
axes[1].set_xlabel('Trip Distance')
axes[1].set_ylabel('Count of Payment Type')

# Display the plots
plt.tight_layout()
plt.show()
```



custmers are more likely to pay by card as compare to cash

Customers are more likely to pay card than cash as distance is increasing

In [117…
```
#Checking mean and standard deviation to Card and Cash payment
df.groupby('payment_type')[['fare_amount','trip_distance']].agg(['mean', 'std'])
```

Out[117…

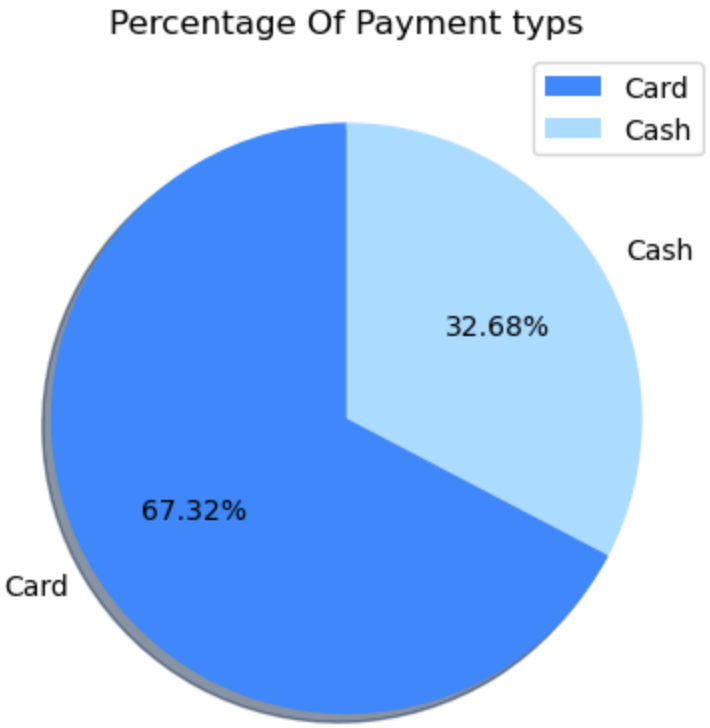
	fare_amount		trip_distance	
	mean	std	mean	std
payment_type				
Card	13.112493	5.849281	2.992237	1.99274
Cash	11.758005	5.613038	2.602207	1.91372

In [118…
```
r5 = df['payment_type'].value_counts() #Shows count of values
r5
```

Out[118…
```
payment_type
Card    1547039
Cash     750869
Name: count, dtype: int64
```

Creating Pie Chart

In [119…
```
plt.pie(r5.values,autopct='%.2f%%', labels = r5.index, shadow=True, colors = ['#3F8
plt.title('Percentage Of Payment typs') #Shows titile of the graph
plt.legend() #Shows label of the graph
plt.show()
```



Percentage of card payment is more that cash payment

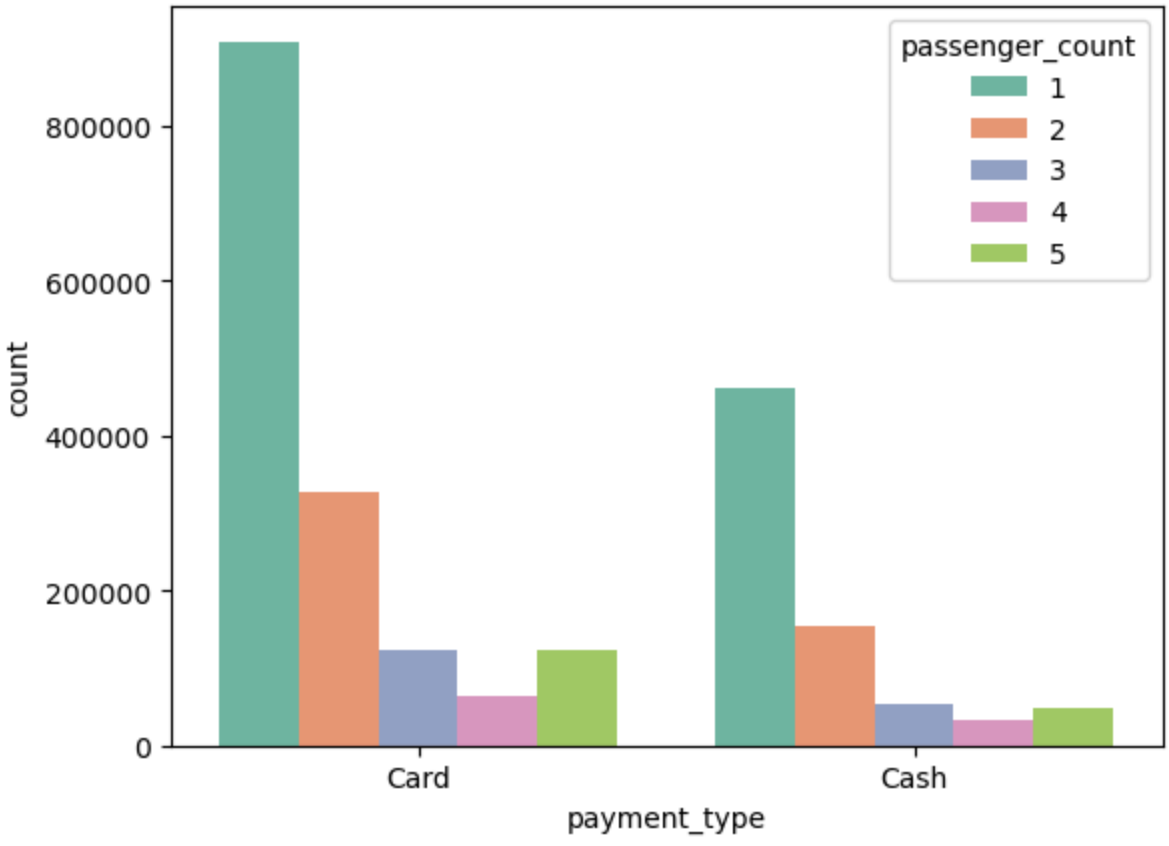
In [143…
```
r6 = df.groupby(['payment_type','passenger_count'])[['passenger_count']].count()
r6.rename(columns={'passenger_count':'count'}, inplace=True)
r6.reset_index(inplace=True)
r6
```

Out[143…

	payment_type	passenger_count	count
0	Card	1	909245
1	Card	2	327661
2	Card	3	122412
3	Card	4	63676
4	Card	5	124045
5	Cash	1	460550
6	Cash	2	155472
7	Cash	3	54506
8	Cash	4	32715
9	Cash	5	47626

In [162…

```
sns.barplot(data=r6, x='payment_type', y='count', hue='passenger_count', palette='S
plt.show()
```



In passenger count customers perfering paying by card than cash