In [1]:

```
!pip install pyarrow
```

```
Defaulting to user installation because normal site-packages is not writea
ble
Requirement already satisfied: pyarrow in c:\users\ssd\appdata\roaming\pyt
hon\python39\site-packages (11.0.0)
Requirement already satisfied: numpy>=1.16.6 in c:\annaconda\lib\site-pack
ages (from pyarrow) (1.21.5)
```

IMPORTING LIBRARIES

In [2]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
```

In [3]:

```
import io
%cd "C:\Users\SSD\Desktop\pga 26\green taxi"
```

```
C:\Users\SSD\Desktop\pga 26\green taxi
```

In [4]:

```
greentaxi=pd.read_parquet("green_tripdata_2022-11.parquet")
```

Data Preprocessing

In [5]:

```
greentaxi.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 62313 entries, 0 to 62312
Data columns (total 20 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   VendorID               62313 non-null  int64
 1   lpep_pickup_datetime   62313 non-null  datetime64[ns]
 2   lpep_dropoff_datetime  62313 non-null  datetime64[ns]
 3   store_and_fwd_flag     56192 non-null  object
 4   RatecodeID             56192 non-null  float64
 5   PULocationID           62313 non-null  int64
 6   DOLocationID           62313 non-null  int64
 7   passenger_count        56192 non-null  float64
 8   trip_distance          62313 non-null  float64
 9   fare_amount            62313 non-null  float64
 10  extra                  62313 non-null  float64
 11  mta_tax                62313 non-null  float64
 12  tip_amount             62313 non-null  float64
 13  tolls_amount           62313 non-null  float64
 14  ehail_fee              0 non-null      object
 15  improvement_surcharge  62313 non-null  float64
 16  total_amount           62313 non-null  float64
 17  payment_type           56192 non-null  float64
 18  trip_type              56192 non-null  float64
 19  congestion_surcharge   56192 non-null  float64
dtypes: datetime64[ns](2), float64(13), int64(3), object(2)
memory usage: 9.5+ MB
```

In [6]:

```
greentaxi=greentaxi.drop(["ehail_fee"],axis=1)
# Dropping "ehail_fee" due to the null column
```

In [7]:

```
greentaxi.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 62313 entries, 0 to 62312
Data columns (total 19 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   VendorID               62313 non-null  int64
 1   lpep_pickup_datetime   62313 non-null  datetime64[ns]
 2   lpep_dropoff_datetime  62313 non-null  datetime64[ns]
 3   store_and_fwd_flag     56192 non-null  object
 4   RatecodeID             56192 non-null  float64
 5   PULocationID           62313 non-null  int64
 6   DOLocationID           62313 non-null  int64
 7   passenger_count        56192 non-null  float64
 8   trip_distance          62313 non-null  float64
 9   fare_amount            62313 non-null  float64
 10  extra                  62313 non-null  float64
 11  mta_tax                62313 non-null  float64
 12  tip_amount             62313 non-null  float64
 13  tolls_amount           62313 non-null  float64
 14  improvement_surcharge  62313 non-null  float64
 15  total_amount           62313 non-null  float64
 16  payment_type           56192 non-null  float64
 17  trip_type              56192 non-null  float64
 18  congestion_surcharge   56192 non-null  float64
dtypes: datetime64[ns](2), float64(13), int64(3), object(1)
memory usage: 9.0+ MB
```

In [8]:

```
greentaxi.columns
```

Out[8]:

```
Index(['VendorID', 'lpep_pickup_datetime', 'lpep_dropoff_datetime',
       'store_and_fwd_flag', 'RatecodeID', 'PULocationID', 'DOLocationID',
       'passenger_count', 'trip_distance', 'fare_amount', 'extra', 'mta_ta
x',
       'tip_amount', 'tolls_amount', 'improvement_surcharge', 'total_amoun
t',
       'payment_type', 'trip_type', 'congestion_surcharge'],
      dtype='object')
```

In [9]:

```
# Split data into numeric and categorical variables
numcols=greentaxi[['passenger_count', 'trip_distance', 'fare_amount', 'extra', 'mta_tax',
       'tip_amount', 'tolls_amount', 'improvement_surcharge', 'total_amount','congestion_
```

In [10]:

```
objcols=greentaxi[[ 'store_and_fwd_flag', 'RatecodeID','payment_type', 'trip_type' ]]
```

In [11]:

```
numcols.describe()
```

Out[11]:

	passenger_count	trip_distance	fare_amount	extra	mta_tax	tip_amo
count	56192.000000	62313.000000	62313.000000	62313.000000	62313.000000	62313.000
mean	1.307179	83.301308	14.990903	0.339127	0.422921	2.014
std	0.960456	3374.500924	18.093849	0.620629	0.183723	2.766
min	0.000000	0.000000	-100.000000	-4.500000	-0.500000	-1.160
25%	1.000000	1.180000	7.500000	0.000000	0.500000	0.000
50%	1.000000	2.010000	11.000000	0.000000	0.500000	1.560
75%	1.000000	3.650000	17.500000	0.500000	0.500000	3.000
max	9.000000	241021.090000	2020.200000	4.500000	0.500000	110.880

In [12]:

```
# Finding null values for numerical variables
numcols.isnull().sum().sort_values(ascending=False)/numcols.shape[0]
```

Out[12]:

```
passenger_count          0.09823
congestion_surcharge     0.09823
trip_distance            0.00000
fare_amount              0.00000
extra                    0.00000
mta_tax                  0.00000
tip_amount               0.00000
tolls_amount             0.00000
improvement_surcharge    0.00000
total_amount             0.00000
dtype: float64
```

In [13]:

```
# Median Imputaion for both variable passenger_count and congestion_surcharge
for col in numcols.columns:
    numcols[col]=numcols[col].fillna(numcols[col].median())
```

```
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\469277080.py:3: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  numcols[col]=numcols[col].fillna(numcols[col].median())
```

In [14]:

```
# Finding null values for categorical variables.
objcols.isnull().sum().sort_values(ascending=False)/numcols.shape[0]
```

Out[14]:

```
store_and_fwd_flag    0.09823
RatecodeID            0.09823
payment_type          0.09823
trip_type             0.09823
dtype: float64
```

In [15]:

```
# Null values imputation of objcols.
for col in objcols.columns:
    objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
```

```
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\3362842512.py:3: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\3362842512.py:3: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\3362842512.py:3: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\3362842512.py:3: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols[col]=objcols[col].fillna(objcols[col].value_counts().idxmax())
```

In [16]:

```
# Combine smaller level or categorical into common level/category
objcols.RatecodeID=objcols.RatecodeID.replace([2.0,3.0,4.0,6.0],2346)
```

```
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\1053332944.py:2: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols.RatecodeID=objcols.RatecodeID.replace([2.0,3.0,4.0,6.0],2346)
```

In [17]:

```
objcols.payment_type=objcols.payment_type.replace([3.0,4.0,5.0],345)
```

```
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\1547926158.py:1: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols.payment_type=objcols.payment_type.replace([3.0,4.0,5.0],345)
```

Exploratory Data Analysis

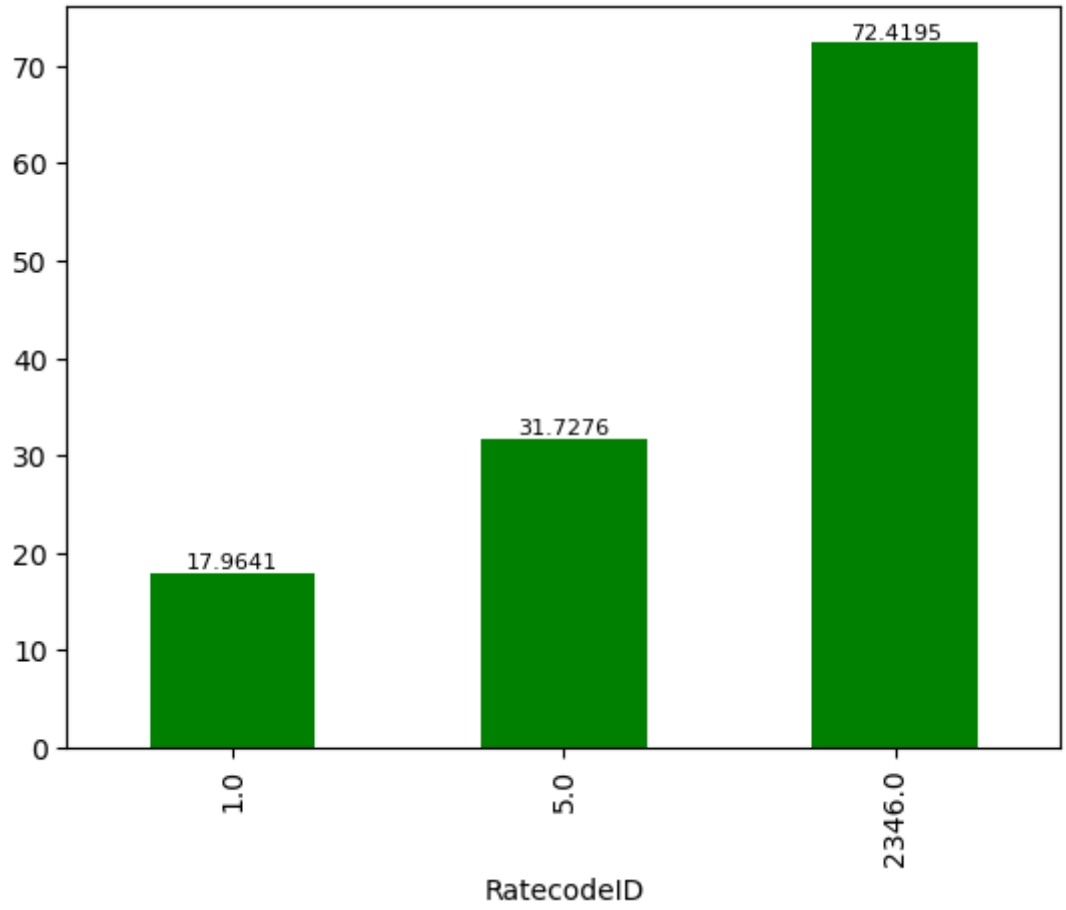
Combining both dataframes for furthher EDA

In [18]:

```
greentaxidf=pd.concat([numcols,objcols],axis=1)
```

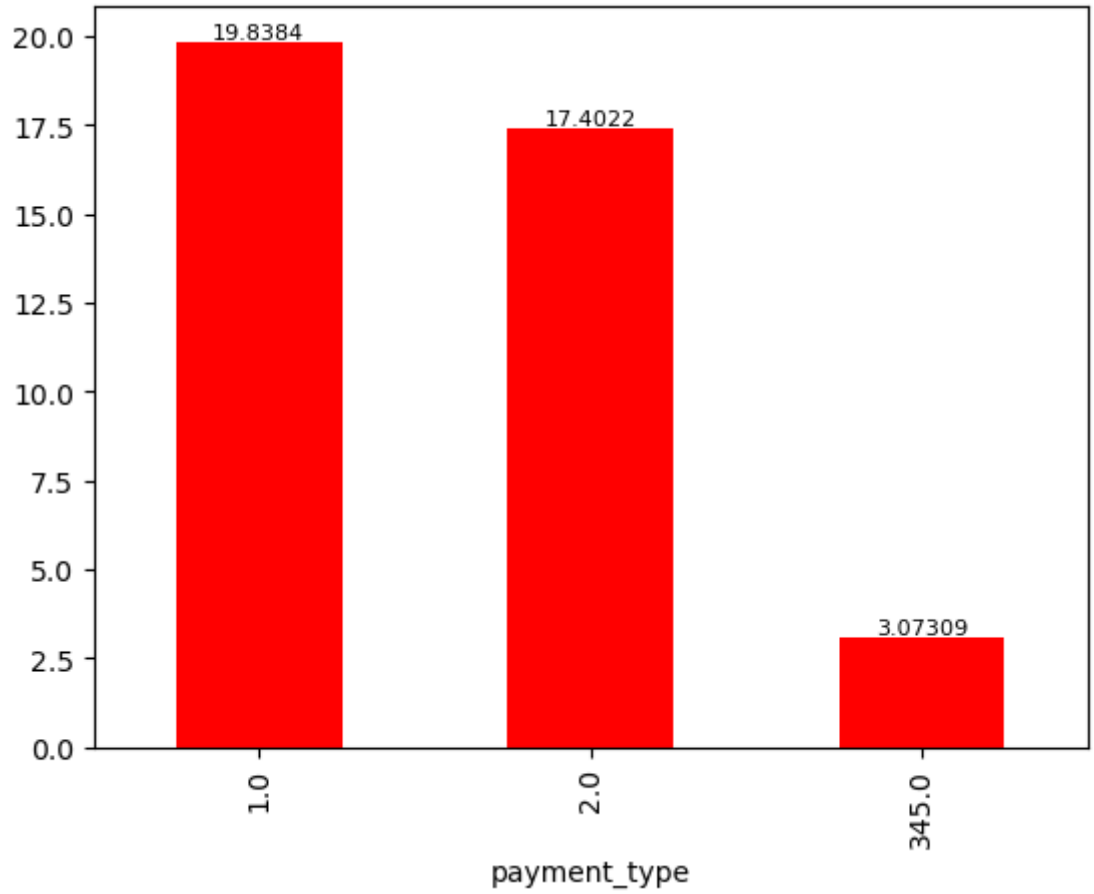
In [19]:

```
# Finding the average total_amount of ratecodeID
ax=greentaxidf.total_amount.groupby(greentaxidf.RatecodeID).mean().plot(kind="bar",color=
for i in ax.containers:
    ax.bar_label(i,fontsize=8)
```



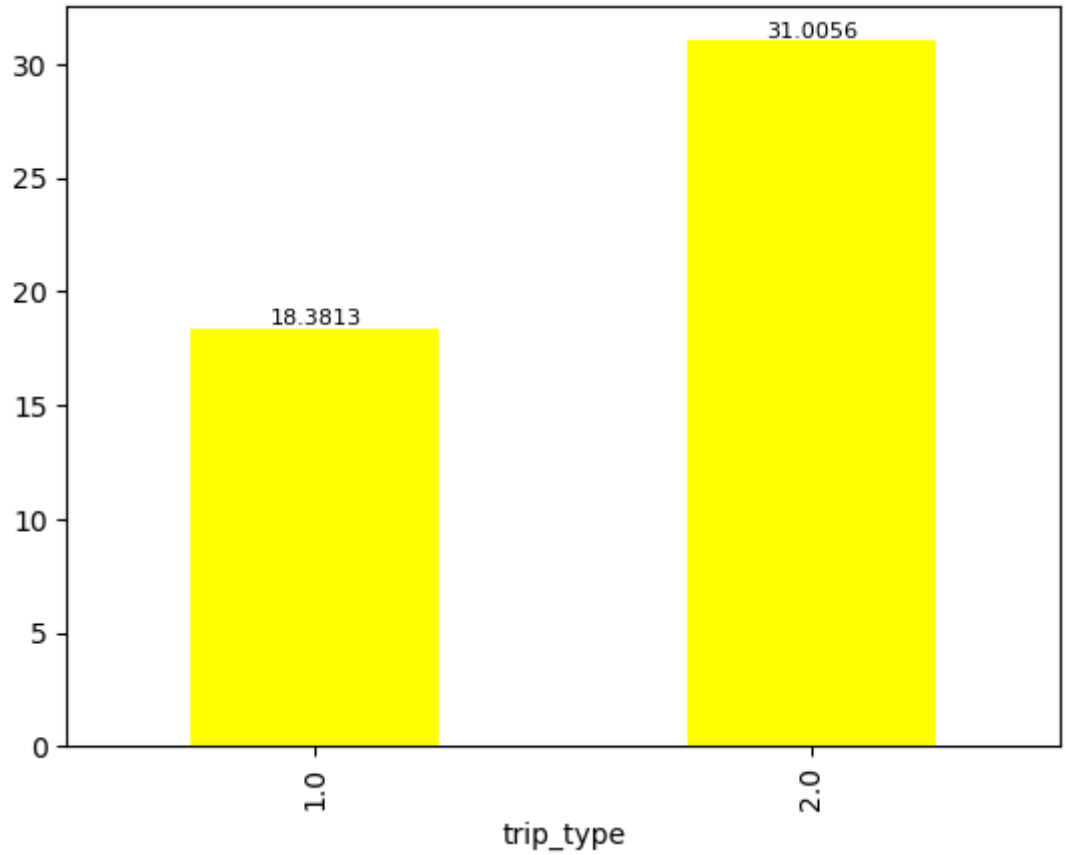
In [20]:

```
# Finding the average total-amount of payment_type
ax=greentaxidf.total_amount.groupby(greentaxidf.payment_type).mean().plot(kind="bar",colo
for i in ax.containers:
    ax.bar_label(i,fontsize=8)
```



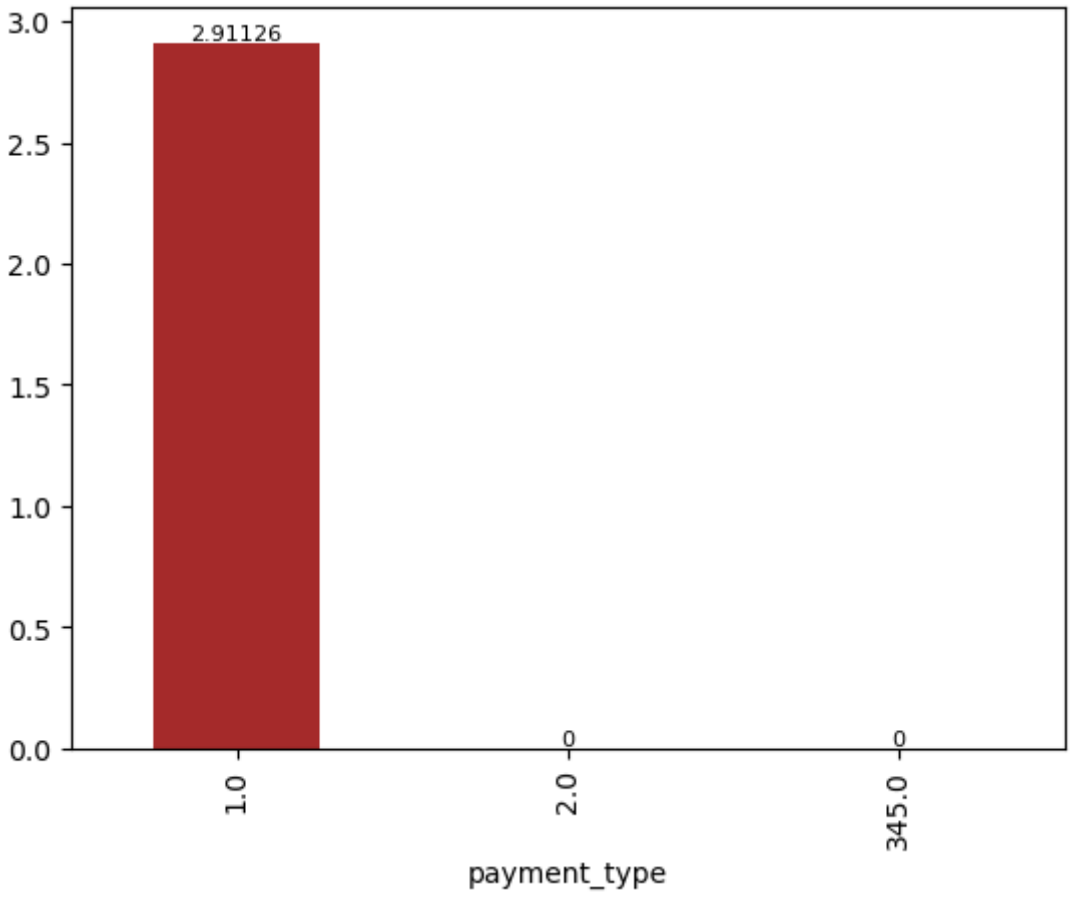
In [21]:

```
# Finding the average total-amount of trip_type
ax=greentaxidf.total_amount.groupby(greentaxidf.trip_type).mean().plot(kind="bar",color='
for i in ax.containers:
    ax.bar_label(i,fontsize=8)
```



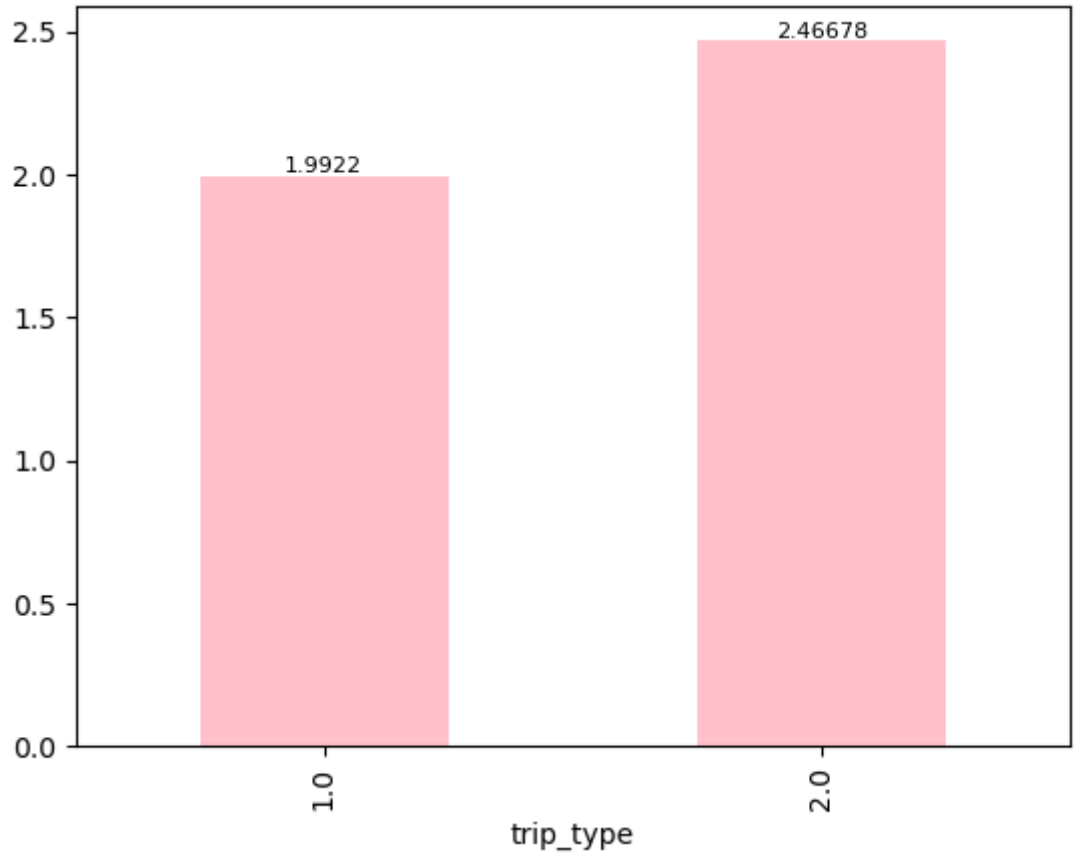
In [22]:

```
# Tips Analysis
# The average tip_amoount of payment_type
ax=greentaxidf.tip_amount.groupby(greentaxidf.payment_type).mean().plot(kind="bar",color=
for i in ax.containers:
    ax.bar_label(i,fontsize=8)
```



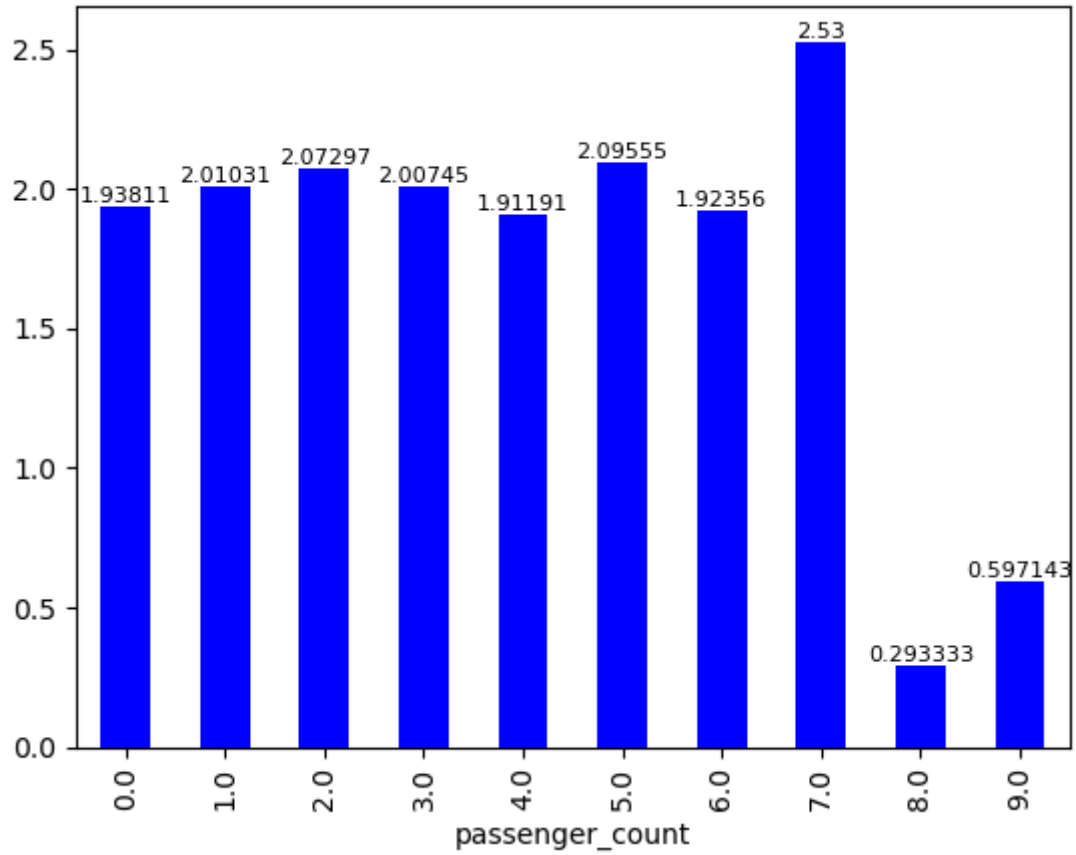
In [23]:

```
# The average tip_amount of trip_type
ax=greentaxidf.tip_amount.groupby(greentaxidf.trip_type).mean().plot(kind="bar",color="pi
for i in ax.containers:
    ax.bar_label(i,fontsize=8)
```



In [24]:

```
# The average trip_amount of passenger_counts
ax=greentaxidf.tip_amount.groupby(greentaxidf.passenger_count).mean().plot(kind="bar",col
for i in ax.containers:
    ax.bar_label(i,fontsize=8)
```



In [25]:

```
# relationship b/w trip_amount and trip_distance
greentaxidf[["tip_amount","trip_distance"]].corr()
```

Out[25]:

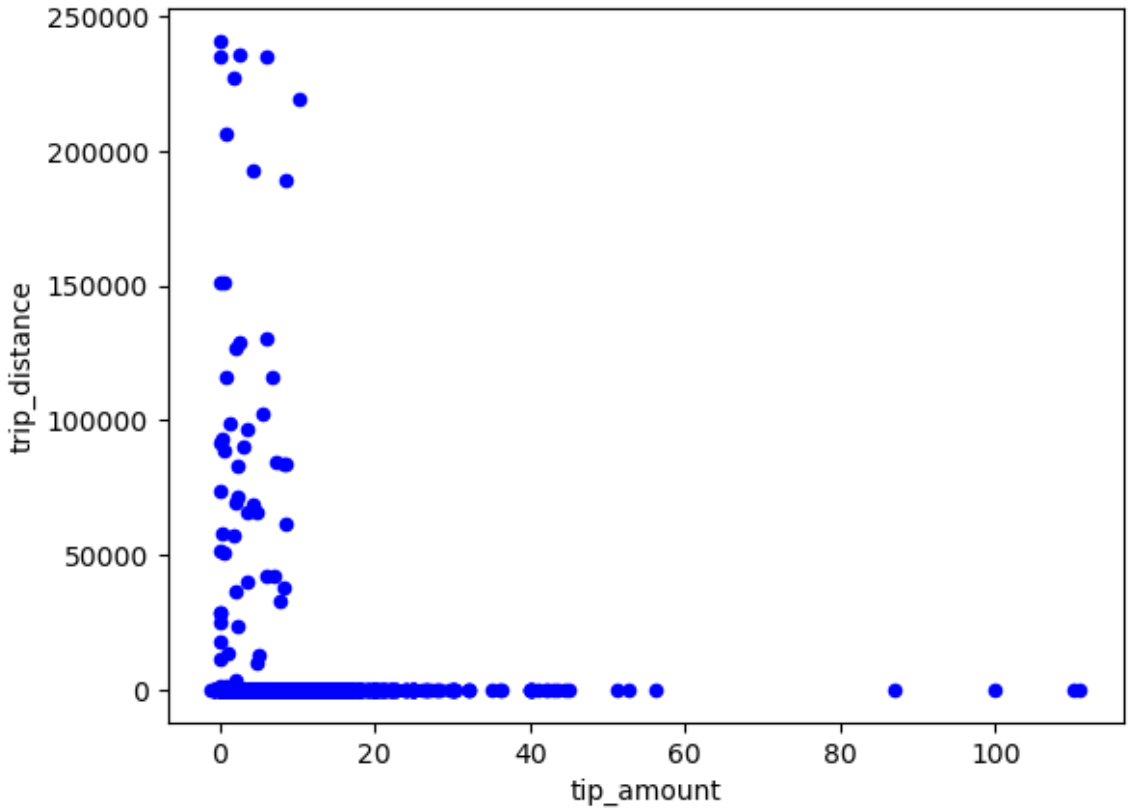
	tip_amount	trip_distance
tip_amount	1.000000	0.011214
trip_distance	0.011214	1.000000

In [26]:

```
greentaxidf.plot(x="tip_amount",y="trip_distance",kind="scatter",color="blue")
```

Out[26]:

```
<AxesSubplot:xlabel='tip_amount', ylabel='trip_distance'>
```



In [27]:

```
# 5. Is there relationship b/w tip_amount and total_amount
greentaxidf[["tip_amount","total_amount"]].corr()
```

Out[27]:

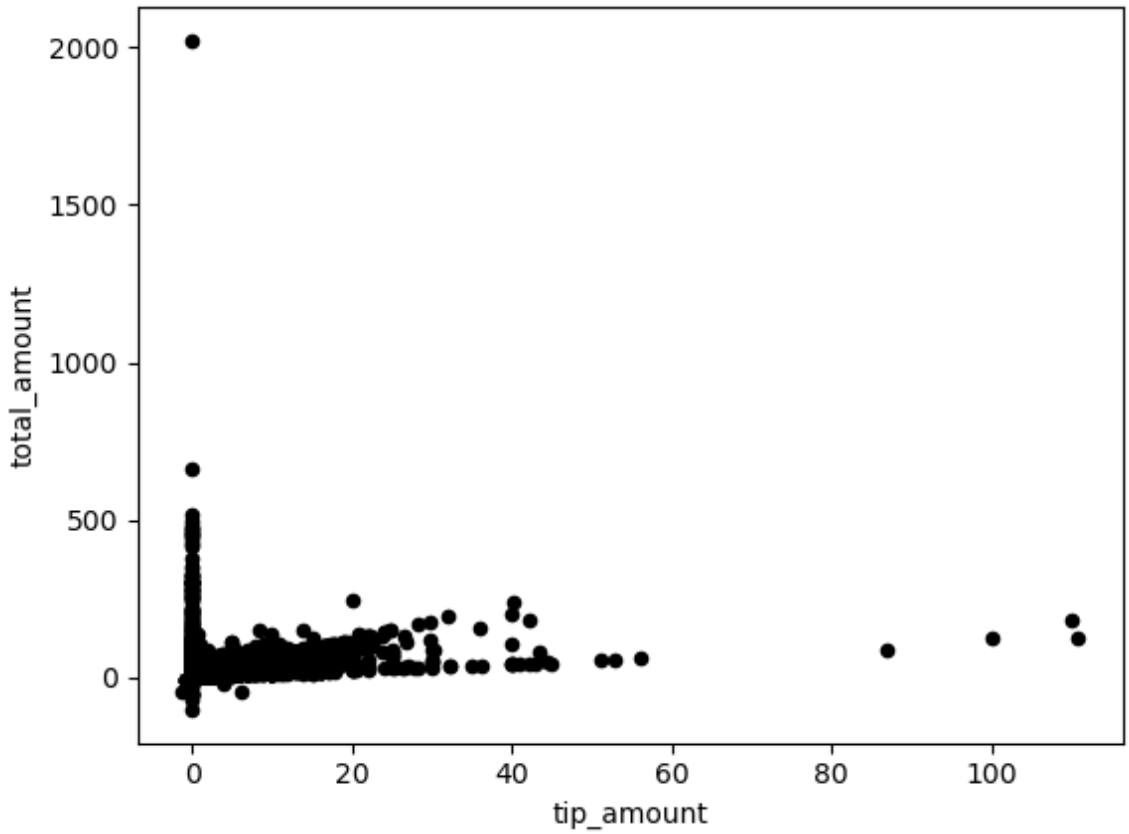
	tip_amount	total_amount
tip_amount	1.000000	0.375997
total_amount	0.375997	1.000000

In [28]:

```
greentaxidf.plot(x="tip_amount",y="total_amount",kind="scatter",color="black")
```

Out[28]:

```
<AxesSubplot:xlabel='tip_amount', ylabel='total_amount'>
```



HYPOTHESIS TESTING

In [29]:

```
greentaxidf.total_amount.groupby(greentaxidf.trip_type).mean()
```

Out[29]:

```
trip_type
1.0    18.381265
2.0    31.005553
Name: total_amount, dtype: float64
```

In [30]:

```
triptype1=greentaxidf[greentaxidf.trip_type==1]
triptype2=greentaxidf[greentaxidf.trip_type==2]
```

In [31]:

```
from scipy.stats import ttest_ind
# Hypothesi Testing using ttest due to categorical variable with 2 levels.
```

In [32]:

```
ttest_ind(triptype1.total_amount,triptype2.total_amount,equal_var=False)
# Since pvalue=2.9000305773811394e-88 is less than 0.05, Reject null hypothesis.
```

Out[32]:

```
Ttest_indResult(statistic=-20.589897092606734, pvalue=2.9000305773811394e-
88)
```

In [33]:

```
greentaxidf.tip_amount.groupby(greentaxidf.trip_type).mean()
```

Out[33]:

```
trip_type
1.0    1.992197
2.0    2.466779
Name: tip_amount, dtype: float64
```

In [34]:

```
triptype1=greentaxidf[greentaxidf.trip_type==1]
triptype2=greentaxidf[greentaxidf.trip_type==2]
```

In [35]:

```
ttest_ind(triptype1.tip_amount,triptype2.tip_amount,equal_var=False)
# since pvalue=3.715666661105563e-09 less than 0.05, Reject null hypothesis
```

Out[35]:

```
Ttest_indResult(statistic=-5.913719401052093, pvalue=3.715666661105563e-0
9)
```

In [36]:

```
greentaxidf.total_amount.groupby(greentaxidf.payment_type).mean()
```

Out[36]:

```
payment_type
1.0      19.838426
2.0      17.402194
345.0     3.073086
Name: total_amount, dtype: float64
```

In [37]:

```
paymenttype1=greentaxidf[greentaxidf.payment_type==1.0]
paymenttype2=greentaxidf[greentaxidf.payment_type==2.0]
paymenttype345=greentaxidf[greentaxidf.payment_type==345.0]
```

In [38]:

```
from scipy.stats import f_oneway
# Hypothesi Testing using f_oneway due to categorical variable with more than 2 levels.
```

In [39]:

```
f_oneway(paymenttype1.total_amount,paymenttype2.total_amount,paymenttype345.total_amount)
# since pvalue=4.358850591808613e-118 less than 0.05, Reject null Hypothesis
```

Out[39]:

```
F_onewayResult(statistic=271.40820378356426, pvalue=4.358850591808613e-11
8)
```

In [40]:

```
greentaxidf.trip_distance.groupby(greentaxidf.payment_type).mean()
```

Out[40]:

```
payment_type
1.0      119.056262
2.0        3.029354
345.0      0.778354
Name: trip_distance, dtype: float64
```

In [41]:

```
paymenttype1=greentaxidf[greentaxidf.payment_type==1.0]
paymenttype2=greentaxidf[greentaxidf.payment_type==2.0]
paymenttype345=greentaxidf[greentaxidf.payment_type==345.0]
```

In [42]:

```
f_oneway(paymenttype1.trip_distance,paymenttype2.trip_distance,paymenttype345.trip_distar
# Since 0.00038613931224988884 less than 0.05, Reject null hypothesis
```

Out[42]:

```
F_onewayResult(statistic=7.8603037386391525, pvalue=0.000386139312249888
4)
```

In [43]:

```
pd.crosstab(greentaxidf.trip_type,greentaxidf.payment_type)
```

Out[43]:

payment_type	1.0	2.0	345.0
trip_type			
1.0	41115	17816	445
2.0	2005	891	41

In [44]:

```
from scipy.stats import chi2_contingency
 # Hypothesi Testing using chisqare contingency due to categorical variable.
```

In [45]:

```
chi2_contingency(pd.crosstab(greentaxidf.trip_type,greentaxidf.payment_type))
# Since P-value=0.000433351106066754 less than 0.05, Reject null hypothesis
```

Out[45]:

```
(15.48792458004721,
 0.000433351106066754,
 2,
 array([[4.10876241e+04, 1.78252826e+04, 4.63093351e+02],
        [2.03237591e+03, 8.81717443e+02, 2.29066487e+01]]))
```

In [46]:

```
pd.crosstab(greentaxidf.passenger_count,greentaxidf.payment_type)
```

Out[46]:

payment_type	1.0	2.0	345.0
passenger_count			
0.0	189	99	8
1.0	37588	15715	397
2.0	3151	1780	62
3.0	484	281	4
4.0	167	89	1
5.0	901	363	6
6.0	633	372	8
7.0	1	1	0
8.0	4	2	0
9.0	2	5	0

In [47]:

```
chi2_contingency(pd.crosstab(greentaxidf.passenger_count,greentaxidf.payment_type))
# Since P-value=7.001525314283775e-28 less than 0.05, Reject null hypothesis
```

Out[47]:

```
(175.63617422665558,
 7.001525314283775e-28,
 18,
 array([[2.04829169e+02, 8.88622278e+01, 2.30860334e+00],
        [3.71598864e+04, 1.61212893e+04, 4.18824322e+02],
        [3.45510824e+03, 1.49894967e+03, 3.89420827e+01],
        [5.32140645e+02, 2.30861666e+02, 5.99768909e+00],
        [1.77841542e+02, 7.71540289e+01, 2.00442925e+00],
        [8.78827853e+02, 3.81266991e+02, 9.90515623e+00],
        [7.00986311e+02, 3.04112962e+02, 7.90072698e+00],
        [1.38398087e+00, 6.00420458e-01, 1.55986712e-02],
        [4.15194261e+00, 1.80126137e+00, 4.67960137e-02],
        [4.84393305e+00, 2.10147160e+00, 5.45953493e-02]]))
```

In [48]:

```
objcols.columns
```

Out[48]:

```
Index(['store_and_fwd_flag', 'RatecodeID', 'payment_type', 'trip_type'], d
type='object')
```

In [49]:

```
greentaxi.lpep_dropoff_datetime.head()
# We can exetract variables from datetime like year, month, quarter, weekday, hour
```

Out[49]:

```
0   2022-11-01 00:31:56
1   2022-11-01 01:12:50
2   2022-11-01 00:55:38
3   2022-11-01 00:12:28
4   2022-11-01 00:22:03
Name: lpep_dropoff_datetime, dtype: datetime64[ns]
```

In [50]:

```
greentaxi.lpep_dropoff_datetime.tail()
```

Out[50]:

```
62308   2022-11-30 23:53:00
62309   2022-12-01 00:01:00
62310   2022-11-30 23:46:00
62311   2022-11-30 23:30:00
62312   2022-11-30 23:23:00
Name: lpep_dropoff_datetime, dtype: datetime64[ns]
```

In [51]:

```
# Inbuilt library in pandas called datetime (dt)
objcols["weekday"]=greentaxi.lpep_dropoff_datetime.dt.weekday
```

```
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\2600347749.py:2: SettingWi
thCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols["weekday"]=greentaxi.lpep_dropoff_datetime.dt.weekday
```

In [52]:

```
objcols.weekday.head()
```

Out[52]:

```
0    1
1    1
2    1
3    1
4    1
Name: weekday, dtype: int64
```

In [53]:

```
objcols.weekday.value_counts()

# 0-mon, 1-tue, 2-wed, 3-thur, 4-fri, 5-sat, 6-sun
```

Out[53]:

```
2    11529
1    11085
4     8652
3     8584
0     8440
5     7597
6     6426
Name: weekday, dtype: int64
```

In [54]:

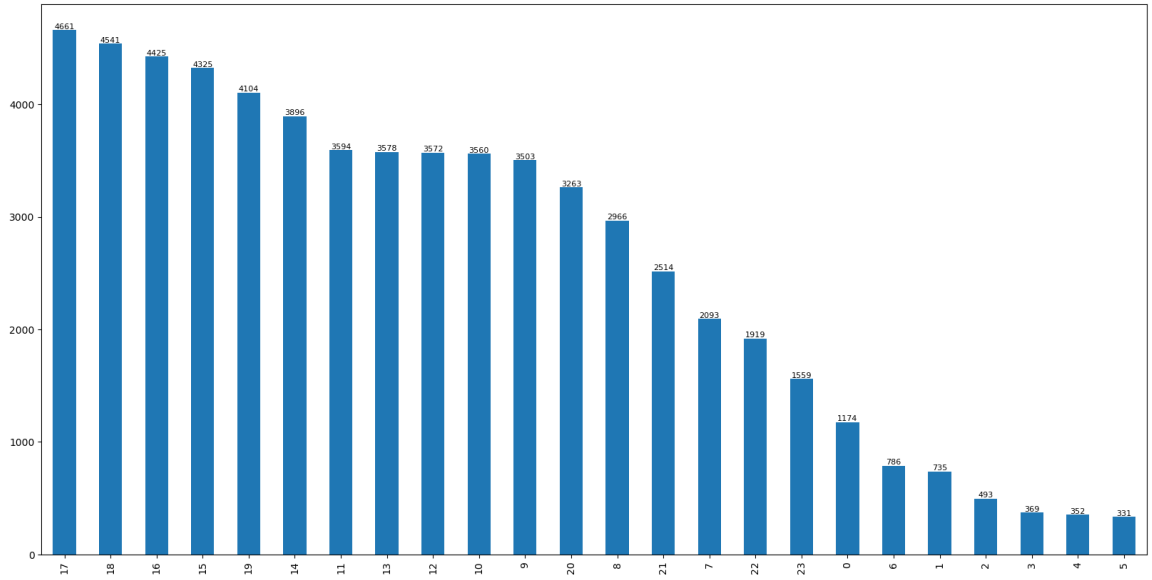
```
objcols["hourofday"]=greentaxi.lpep_dropoff_datetime.dt.hour
```

```
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\989381064.py:1: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  objcols["hourofday"]=greentaxi.lpep_dropoff_datetime.dt.hour
```

In [55]:

```
plt.figure(figsize=(20,10))
ax=objcols.hourofday.value_counts().plot(kind="bar")
for i in ax.containers:
    ax.bar_label(i,fontsize=8)
```



In [56]:

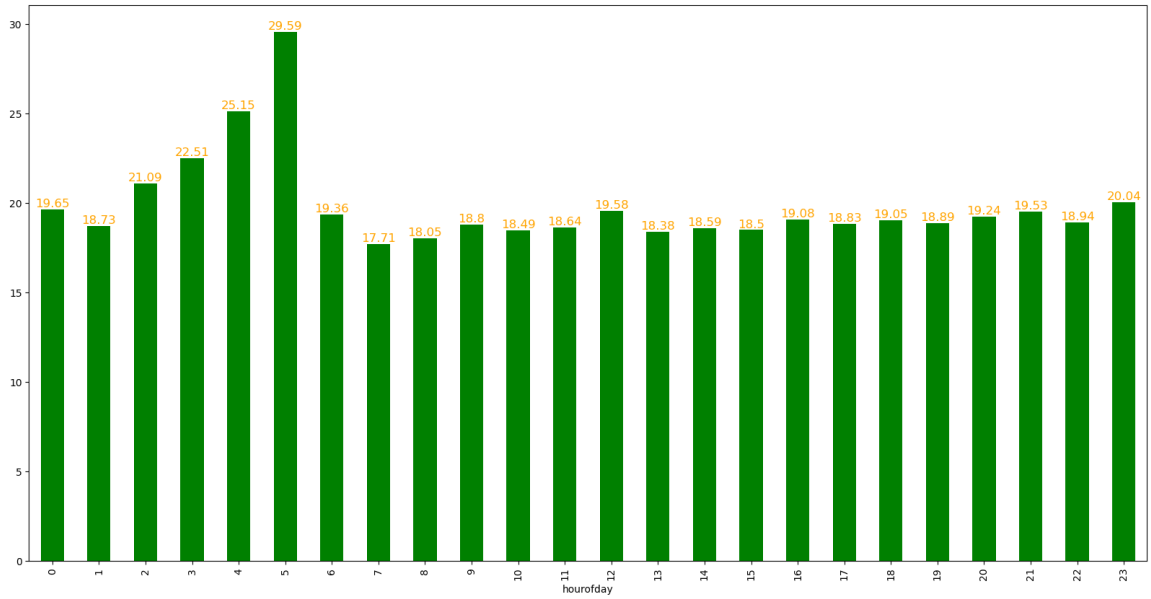
```
greentaxidf.total_amount.groupby(objcols.hourofday).mean()
```

Out[56]:

```
hourofday
0     19.647768
1     18.725401
2     21.090446
3     22.505095
4     25.151051
5     29.594864
6     19.361794
7     17.707066
8     18.048635
9     18.801113
10    18.487008
11    18.639068
12    19.576123
13    18.375660
14    18.587264
15    18.499385
16    19.076881
17    18.832821
18    19.051262
19    18.892125
20    19.242421
21    19.534893
22    18.937285
23    20.035266
Name: total_amount, dtype: float64
```

In [57]:

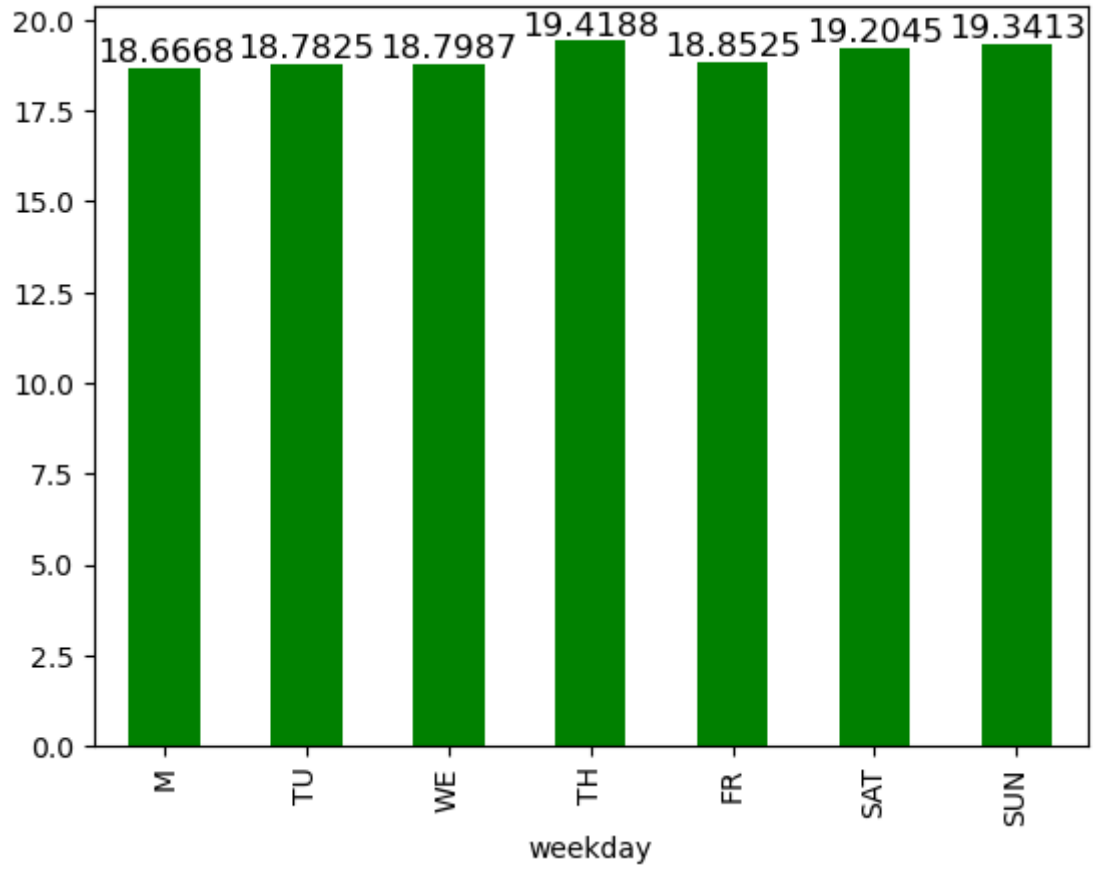
```
plt.figure(figsize=(20,10))
ax=np.round(greentaxidf.total_amount.groupby(objcols.hourofday).mean(),2).plot(kind="bar"
for i in ax.containers:
    ax.bar_label(i,fontsize=12,color="orange")
```



In [58]:

```
ax=greentaxidf.total_amount.groupby(objcols.weekday).mean().plot(kind="bar",color="green"

for i in ax.containers:
    ax.bar_label(i,fontsize=12)
    ax.set_xticklabels(["M","TU","WE","TH","FR","SAT","SUN"])
```



In [59]:

```
numcols["trip_duration"]=greentaxi.lpep_dropoff_datetime-greentaxi.lpep_pickup_datetime
```

```
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\702863654.py:1: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  numcols["trip_duration"]=greentaxi.lpep_dropoff_datetime-greentaxi.lpep_
pickup_datetime
```

In [60]:

```
numcols.trip_duration=numcols.trip_duration.dt.seconds/60
```

```
C:\Users\SSD\AppData\Local\Temp\ipykernel_10428\437933021.py:1: SettingWit
hCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-doc
s/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://
pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-
view-versus-a-copy)
  numcols.trip_duration=numcols.trip_duration.dt.seconds/60
```

In [61]:

```
numcols.trip_duration.head()
```

Out[61]:

```
0     3.316667
1    21.800000
2     3.800000
3     8.933333
4     4.283333
Name: trip_duration, dtype: float64
```

In [62]:

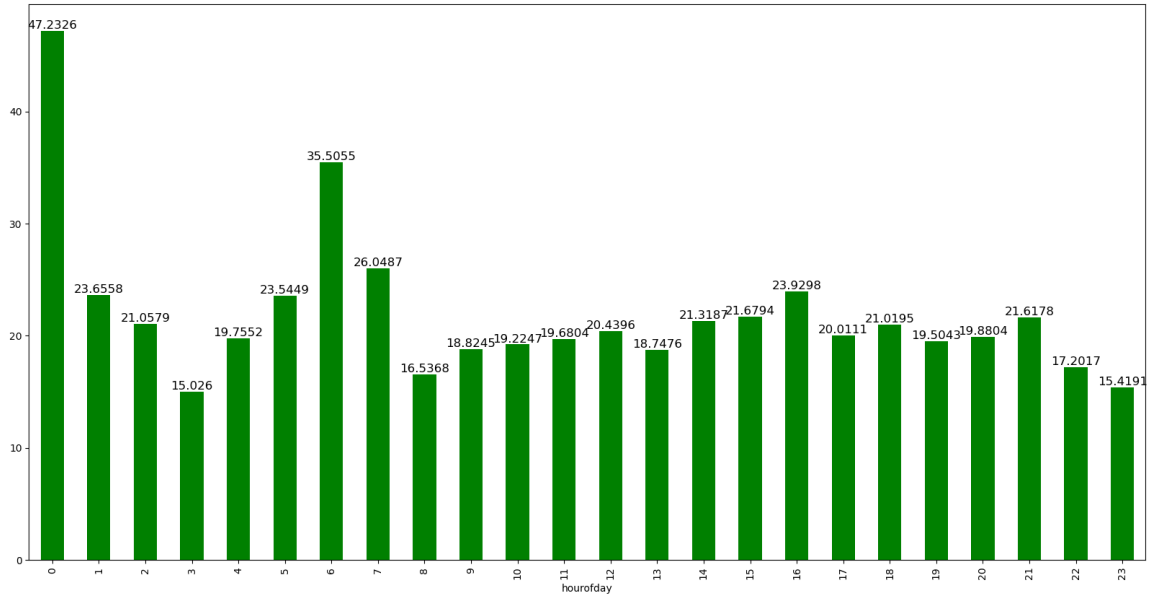
```
objcols.hourofday.groupby(numcols.trip_duration).value_counts()
```

Out[62]:

```
trip_duration  hourofday
0.000000       15           14
               11           11
               14            8
               18            8
               12            7
                           ..
1438.433333    14            1
1438.783333    19            1
1439.116667    21            1
1439.266667    17            1
1439.816667    21            1
Name: hourofday, Length: 28926, dtype: int64
```

In [63]:

```
plt.figure(figsize=(20,10))
ax=numcols.trip_duration.groupby(objcols.hourofday).mean().plot(kind="bar",color="green")
for i in ax.containers:
    ax.bar_label(i,fontsize=12)
```



In [64]:

```
objcols.columns
```

Out[64]:

```
Index(['store_and_fwd_flag', 'RatecodeID', 'payment_type', 'trip_type',
       'weekday', 'hourofday'],
      dtype='object')
```

In [65]:

```
# Dummy Encode  object colums compulsory else cannot build model
# with object data
objcols_dummy=pd.get_dummies(objcols,columns=['store_and_fwd_flag',
    'RatecodeID', 'payment_type', 'trip_type','weekday', 'hourofday'])
```

In [66]:

```
objcols_dummy.shape
```

Out[66]:

```
(62313, 41)
```

Scaling

In [67]:

```
from sklearn.preprocessing import StandardScaler
```

In [68]:

```
stdscr=StandardScaler()
```

In [69]:

```
numcols_stdscr=stdscr.fit_transform(numcols)
```

In [70]:

```
numcols_stdscr=pd.DataFrame(numcols_stdscr,columns=numcols.columns)
```

In [71]:

```
numcols_stdscr.head()
```

Out[71]:

	passenger_count	trip_distance	fare_amount	extra	mta_tax	tip_amount	tolls_amou
0	-0.302200	-0.024475	-0.579810	0.259212	0.419540	-0.204103	-0.16965
1	0.788757	-0.022653	1.658538	-0.546429	-2.301968	2.745915	-0.16965
2	0.788757	-0.024514	-0.579810	0.259212	0.419540	-0.728309	-0.16965
3	-0.302200	-0.023874	-0.248203	0.259212	0.419540	-0.728309	-0.16965
4	-0.302200	-0.024416	-0.552176	0.259212	0.419540	-0.157105	-0.16965

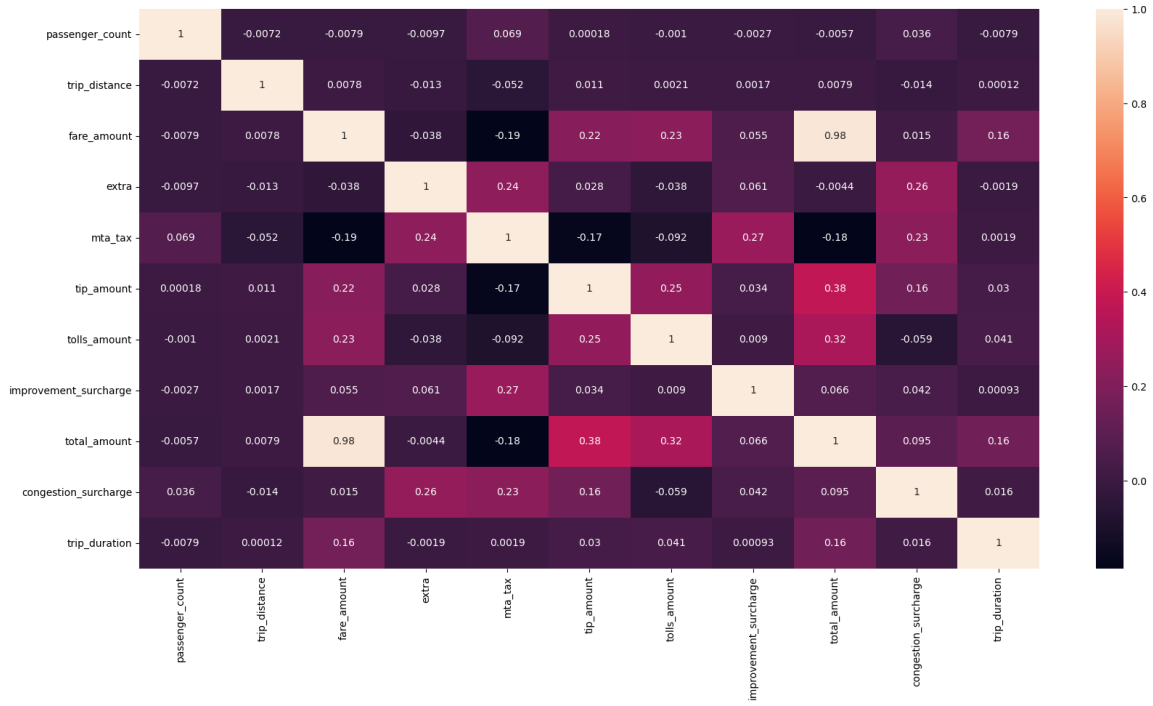
Correlation of numeric categorical features

In [72]:

```
plt.figure(figsize=(20,10))
import seaborn as sns
sns.heatmap(numcols.corr(),annot=True)
```

Out[72]:

<AxesSubplot:>



In [73]:

```
# Due to multi-collinearity dropping fare_amount.
numcols=numcols.drop("fare_amount",axis=1)
```

In [74]:

```
combindf=pd.concat([objcols_dummy,numcols],axis=1)
```

Spliting The Data in to Dependent(y) and Independent(X) Variables

In [75]:

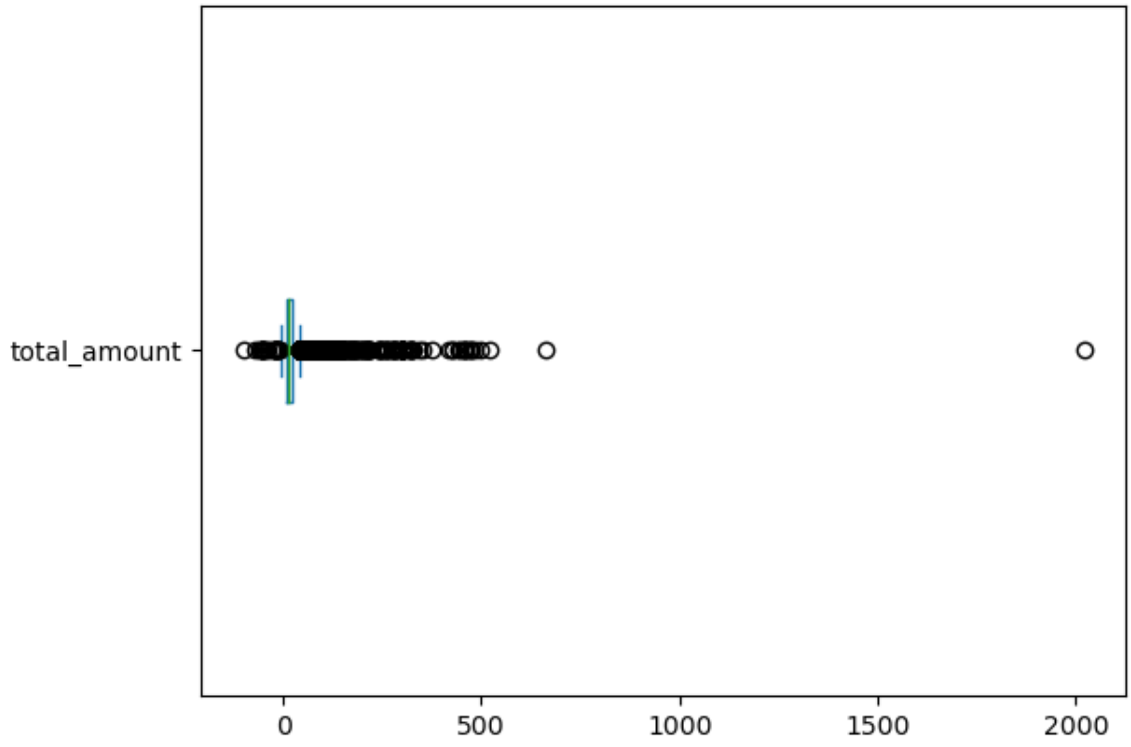
```
y=combindf.total_amount
X=combindf.drop('total_amount',axis=1)
```

In [76]:

```
y.plot(kind="box",vert=False)
```

Out[76]:

<AxesSubplot:>



In [77]:

```
from sklearn.model_selection import train_test_split
```

In [78]:

```
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.30,random_state=42)
```

Model Building

1) Linear Regression

In [79]:

```
from sklearn.linear_model import LinearRegression
```

In [80]:

```
lireg=LinearRegression()
```

In [81]:

```
lireg_model=lireg.fit(X_train,y_train)
```

In [82]:

```
lireg_model.score(X_train,y_train)
```

Out[82]:

```
0.2705820847602599
```

2) Decision TreeRegressor

In [83]:

```
from sklearn.tree import DecisionTreeRegressor
```

In [84]:

```
dtr=DecisionTreeRegressor(max_depth=8)
```

In [85]:

```
dtr_model=dtr.fit(X_train,y_train)
```

In [86]:

```
dtr_model.score(X_train,y_train)
```

Out[86]:

```
0.8582820530501439
```

In [87]:

```
from sklearn.model_selection import cross_val_score
```

In [88]:

```
cross_val_score(dtr,X_train,y_train)
```

Out[88]:

```
array([0.50315258, 0.27698597, 0.7259837 , 0.64239335, 0.62751585])
```

3) RandomForestRegressor

In [89]:

```
from sklearn.ensemble import RandomForestRegressor
```

In [90]:

```
Rf=RandomForestRegressor(n_estimators=1000)
```

In [91]:

```
Rfmodel=Rf.fit(X_train,y_train)
```

In [92]:

```
Rfmodel.score(X_train,y_train)
```

Out[92]:

```
0.9424392526319314
```