```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import datetime as dt

df = pd.read_csv("uber.csv")
df.head()
```

```
   Unnamed: 0                            key  fare_amount  \
0    24238194    2015-05-07 19:52:06.0000003          7.5   
1    27835199    2009-07-17 20:04:56.0000002          7.7   
2    44984355   2009-08-24 21:45:00.00000061         12.9   
3    25894730    2009-06-26 08:22:21.0000001          5.3   
4    17610152  2014-08-28 17:47:00.000000188         16.0   

           pickup_datetime  pickup_longitude  pickup_latitude  \
0  2015-05-07 19:52:06 UTC        -73.999817        40.738354   
1  2009-07-17 20:04:56 UTC        -73.994355        40.728225   
2  2009-08-24 21:45:00 UTC        -74.005043        40.740770   
3  2009-06-26 08:22:21 UTC        -73.976124        40.790844   
4  2014-08-28 17:47:00 UTC        -73.925023        40.744085   

   dropoff_longitude  dropoff_latitude  passenger_count  
0         -73.999512         40.723217                1  
1         -73.994710         40.750325                1  
2         -73.962565         40.772647                1  
3         -73.965316         40.803349                3  
4         -73.973082         40.761247                5  
```

```
df.columns
```

```
Index(['Unnamed: 0', 'key', 'fare_amount', 'pickup_datetime',
       'pickup_longitude', 'pickup_latitude', 'dropoff_longitude',
       'dropoff_latitude', 'passenger_count'],
      dtype='object')
```

```
df.drop(columns=['Unnamed: 0','key'],inplace=True)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200000 entries, 0 to 199999
Data columns (total 7 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   fare_amount        200000 non-null  float64
 1   pickup_datetime    200000 non-null  object 
 2   pickup_longitude   200000 non-null  float64
 3   pickup_latitude    200000 non-null  float64
 4   dropoff_longitude  199999 non-null  float64
 5   dropoff_latitude   199999 non-null  float64
 6   passenger_count    200000 non-null  int64
dtypes: float64(5), int64(1), object(1)
memory usage: 10.7+ MB
```

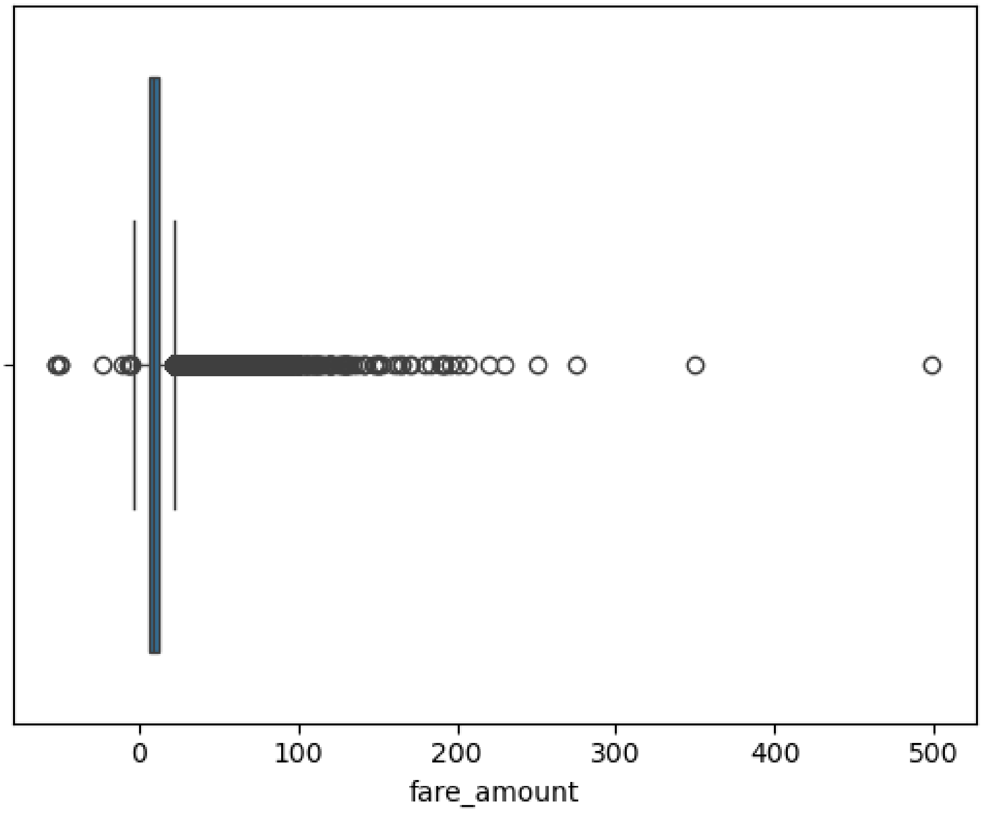
```
df.dropna(how='any',inplace=True)
```

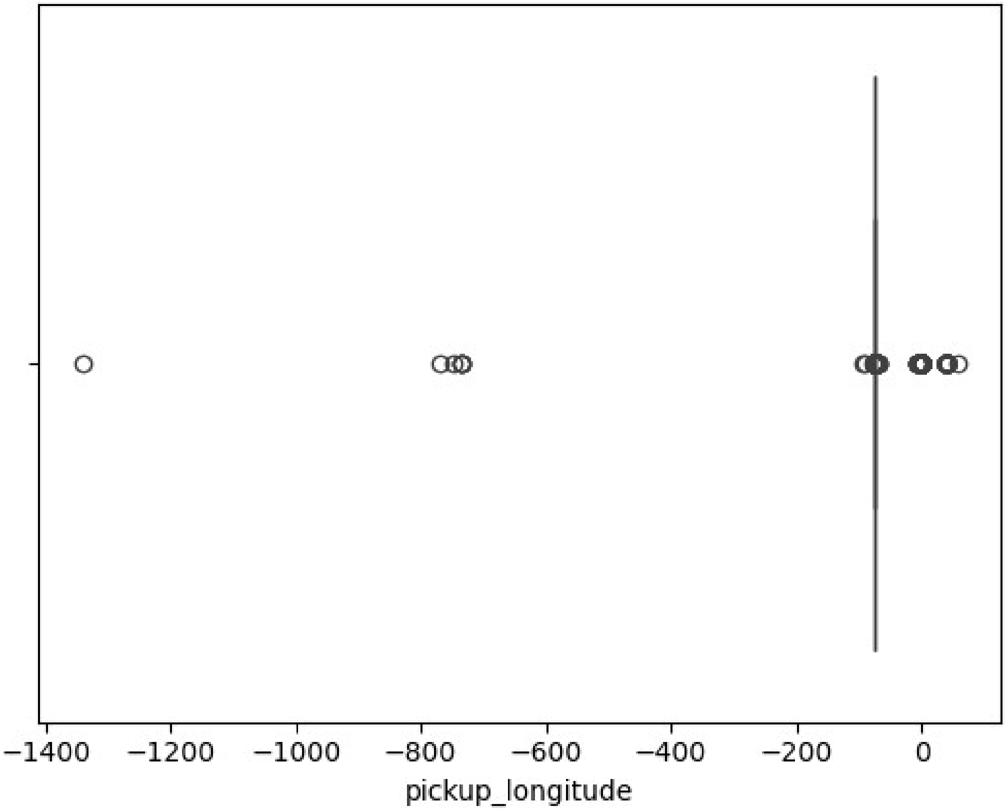
```
df.isnull().sum()
```

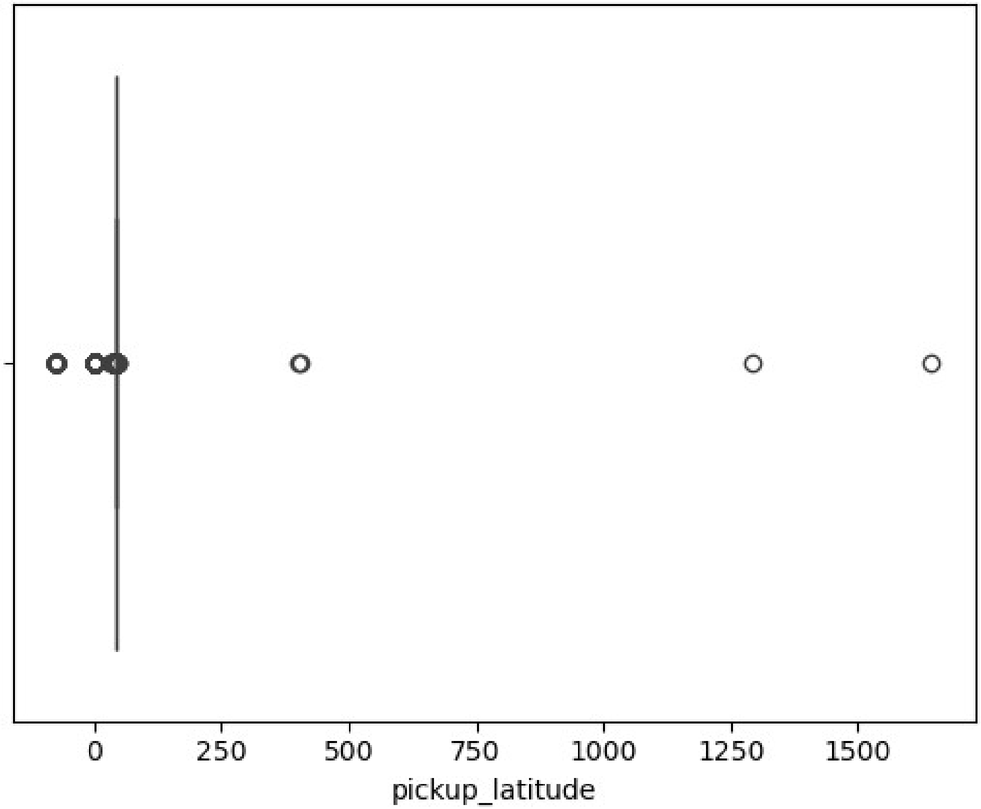
```
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
dtype: int64
```

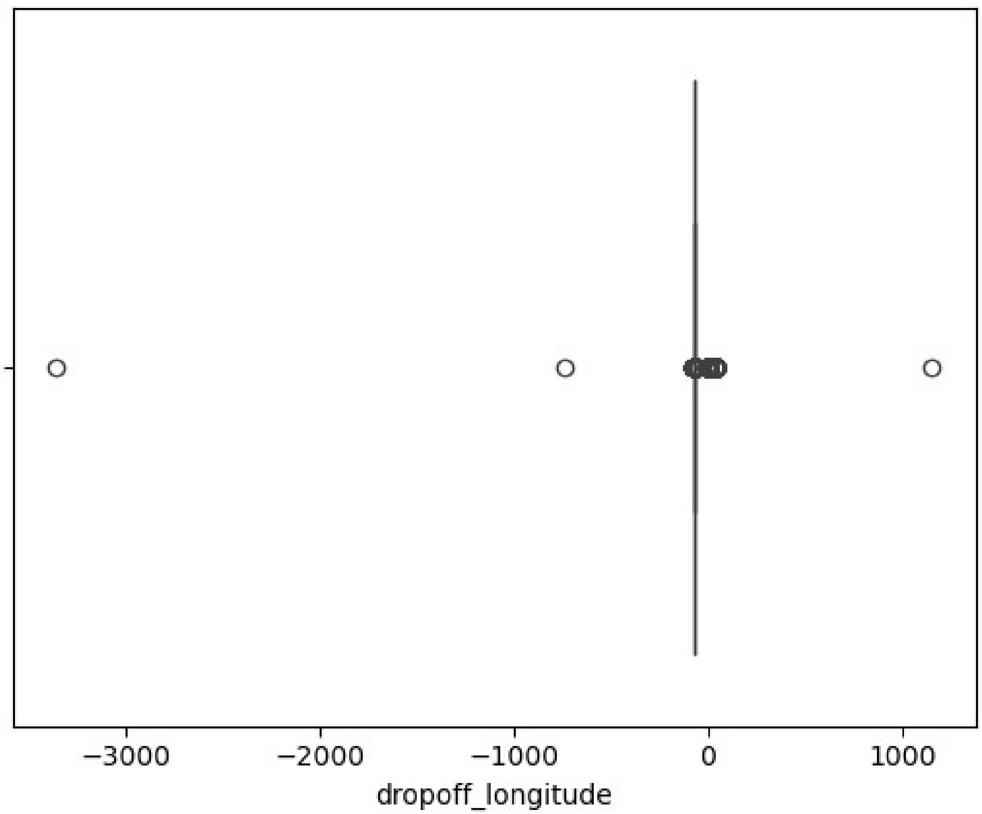
Box Plots

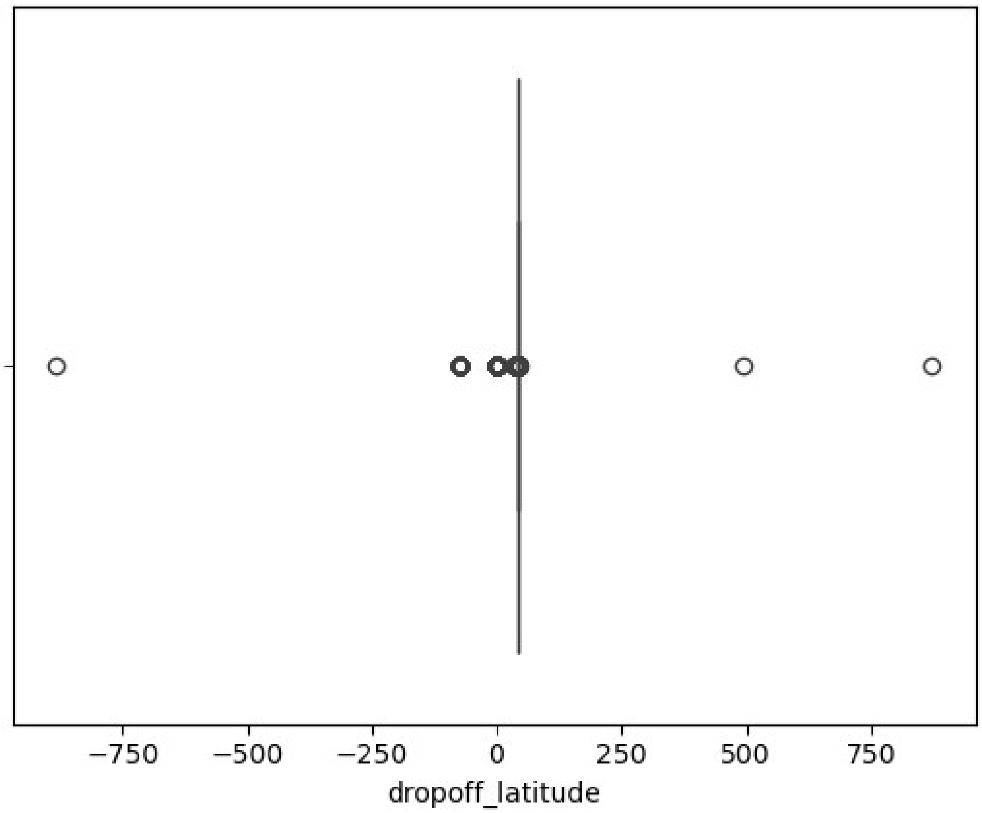
```
for col in df.select_dtypes(exclude=['object']):
    plt.figure()
    sns.boxplot(data=df, x=col)
```

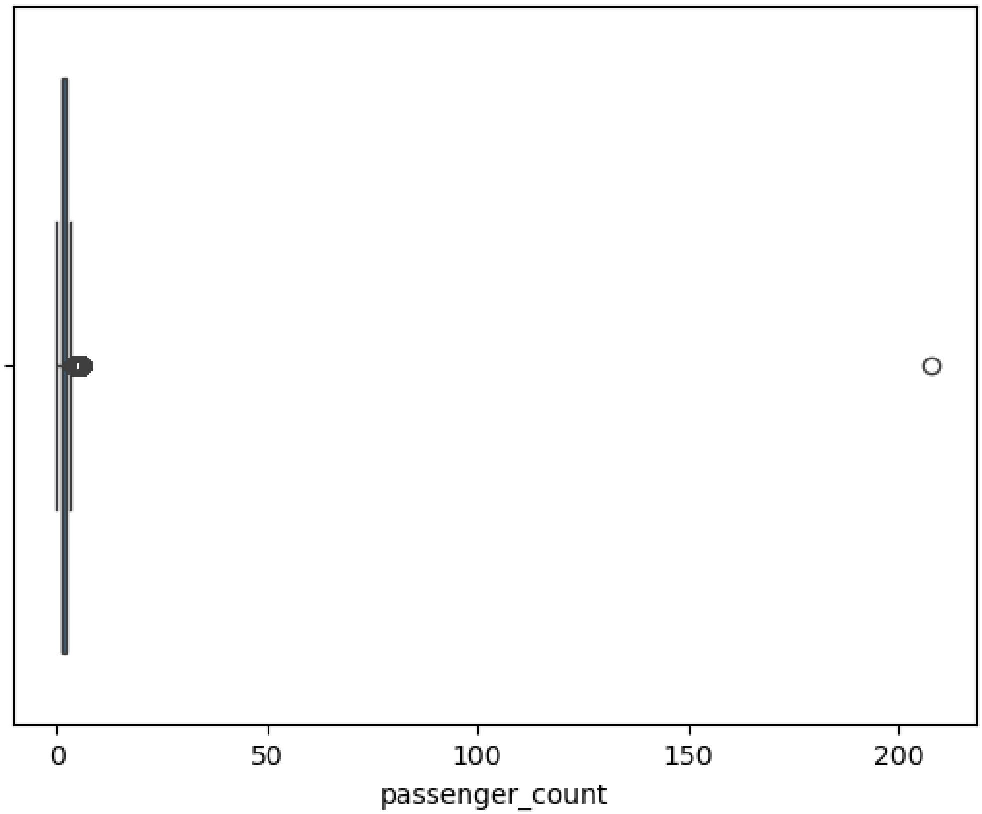



−1400
−1200
−1000
−800
−600
−400
−200
0
pickup_longitude


0
250
500
750
1000
1250
1500
pickup_latitude


−3000
−2000
−1000
0
1000
dropoff_longitude


−750
−500
−250
0
250
500
750
dropoff_latitude



```
df = df[
    (df.pickup_latitude > -90) & (df.pickup_latitude < 90) &
    (df.dropoff_latitude > -90) & (df.dropoff_latitude < 90) &
    (df.pickup_longitude > -180) & (df.pickup_longitude < 180) &
    (df.dropoff_longitude > -180) & (df.dropoff_longitude < 180) &
    (df.fare_amount > 0) & (df.passenger_count > 0) &
(df.passenger_count < 50)
]

from haversine import haversine, Unit

def haversine_distances(coord_list1, coord_list2):
    distances = [haversine(coord1, coord2, unit=Unit.KILOMETERS) for
coord1, coord2 in zip(coord_list1, coord_list2)]

    return distances

coords1 = list(zip(df['pickup_latitude'], df['pickup_longitude']))
coords2 = list(zip(df['dropoff_latitude'], df['dropoff_longitude']))

distances = haversine_distances(coords1, coords2)

distances
```

```
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3.2279354198279515,
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1.4010391366175086,
...]
```

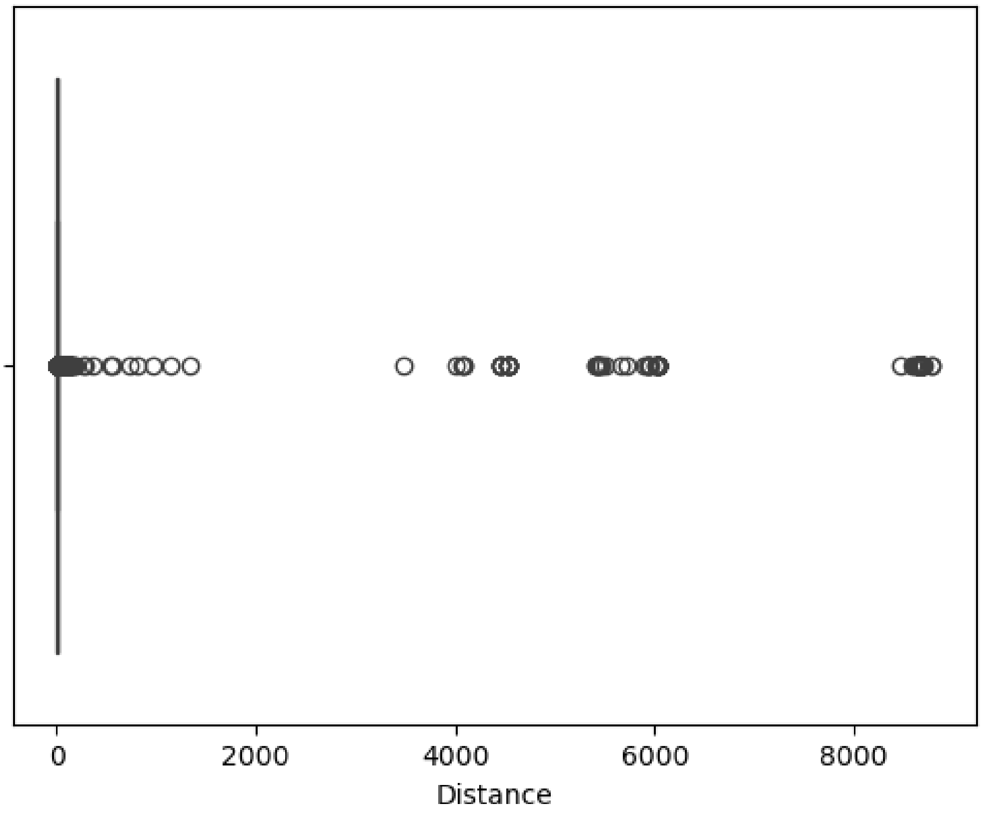
```python
df_new = df.copy()
df_new['Distance'] = distances
df = df_new
df.head()
```

```
   fare_amount          pickup_datetime  pickup_longitude
pickup_latitude  \
0          7.5  2015-05-07 19:52:06 UTC        -73.999817
40.738354
1          7.7  2009-07-17 20:04:56 UTC        -73.994355
40.728225
2         12.9  2009-08-24 21:45:00 UTC        -74.005043
40.740770
3          5.3  2009-06-26 08:22:21 UTC        -73.976124
40.790844
4         16.0  2014-08-28 17:47:00 UTC        -73.925023
40.744085

   dropoff_longitude  dropoff_latitude  passenger_count  Distance
0         -73.999512         40.723217                1  1.683325
1         -73.994710         40.750325                1  2.457593
2         -73.962565         40.772647                1  5.036384
3         -73.965316         40.803349                3  1.661686
4         -73.973082         40.761247                5  4.475456
```

```python
sns.boxplot(data=df,x='Distance')
```

```
<Axes: xlabel='Distance'>
```



```
df = df[(df['Distance'] < 200) & (df['Distance'] > 0)]
```

```
df['pickup_datetime'] = pd.to_datetime(df['pickup_datetime'])
```

```
C:\Users\Shubham\AppData\Local\Temp\ipykernel_28496\1295461447.py:1:
SettingWithCopyWarning:
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-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df['pickup_datetime'] = pd.to_datetime(df['pickup_datetime'])
```

```
df['week_day'] = df['pickup_datetime'].dt.day_name()
df['Year'] = df['pickup_datetime'].dt.year
df['Month'] = df['pickup_datetime'].dt.month
df['Hour'] = df['pickup_datetime'].dt.hour
```

```
C:\Users\Shubham\AppData\Local\Temp\ipykernel_28496\2592915223.py:1:
SettingWithCopyWarning:
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-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df['week_day'] = df['pickup_datetime'].dt.day_name()
C:\Users\Shubham\AppData\Local\Temp\ipykernel_28496\2592915223.py:2:
SettingWithCopyWarning:
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-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df['Year'] = df['pickup_datetime'].dt.year
C:\Users\Shubham\AppData\Local\Temp\ipykernel_28496\2592915223.py:3:
SettingWithCopyWarning:
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-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df['Month'] = df['pickup_datetime'].dt.month
C:\Users\Shubham\AppData\Local\Temp\ipykernel_28496\2592915223.py:4:
SettingWithCopyWarning:
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-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df['Hour'] = df['pickup_datetime'].dt.hour
```

```python
df.drop(columns=['pickup_datetime','pickup_latitude','pickup_longitude
','dropoff_latitude','dropoff_longitude'],inplace=True)
```

```
C:\Users\Shubham\AppData\Local\Temp\ipykernel_28496\3782303944.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation:
https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy

df.drop(columns=['pickup_datetime','pickup_latitude','pickup_longitude
','dropoff_latitude','dropoff_longitude'],inplace=True)
```

```python
df.head()
```

```
   fare_amount  passenger_count  Distance  week_day  Year  Month  Hour
0          7.5                1  1.683325  Thursday  2015      5    19
1          7.7                1  2.457593    Friday  2009      7    20
2         12.9                1  5.036384    Monday  2009      8    21
```

```
3          5.3                3  1.661686    Friday  2009      6     8
4         16.0                5  4.475456  Thursday  2014      8    17
```

```python
distances = df.copy()

def convert_week_day(day):
    if day in ['Monday','Tuesday','Wednesday','Thursday','Friday']:
        return 0 # Weekday
    return 1 # Weekend

def convert_hour(hour):
    if 5 <= hour <= 12:
        return 1
    elif 12 < hour <= 17:
        return 2
    elif 17 < hour < 24:
        return 3
    return 0

df['week_day'] = distances['week_day'].apply(convert_week_day)
df['Hour'] = distances['Hour'].apply(convert_hour)
df.head()
```

```
C:\Users\Shubham\AppData\Local\Temp\ipykernel_28496\3609834711.py:17:
SettingWithCopyWarning:
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-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df['week_day'] = distances['week_day'].apply(convert_week_day)
C:\Users\Shubham\AppData\Local\Temp\ipykernel_28496\3609834711.py:18:
SettingWithCopyWarning:
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-docs/stable/user_guide/indexing.html#
returning-a-view-versus-a-copy
  df['Hour'] = distances['Hour'].apply(convert_hour)
```

```
   fare_amount  passenger_count  Distance  week_day  Year  Month  Hour
0          7.5                1  1.683325         0  2015      5     3
1          7.7                1  2.457593         0  2009      7     3
2         12.9                1  5.036384         0  2009      8     3
3          5.3                3  1.661686         0  2009      6     1
4         16.0                5  4.475456         0  2014      8     2
```

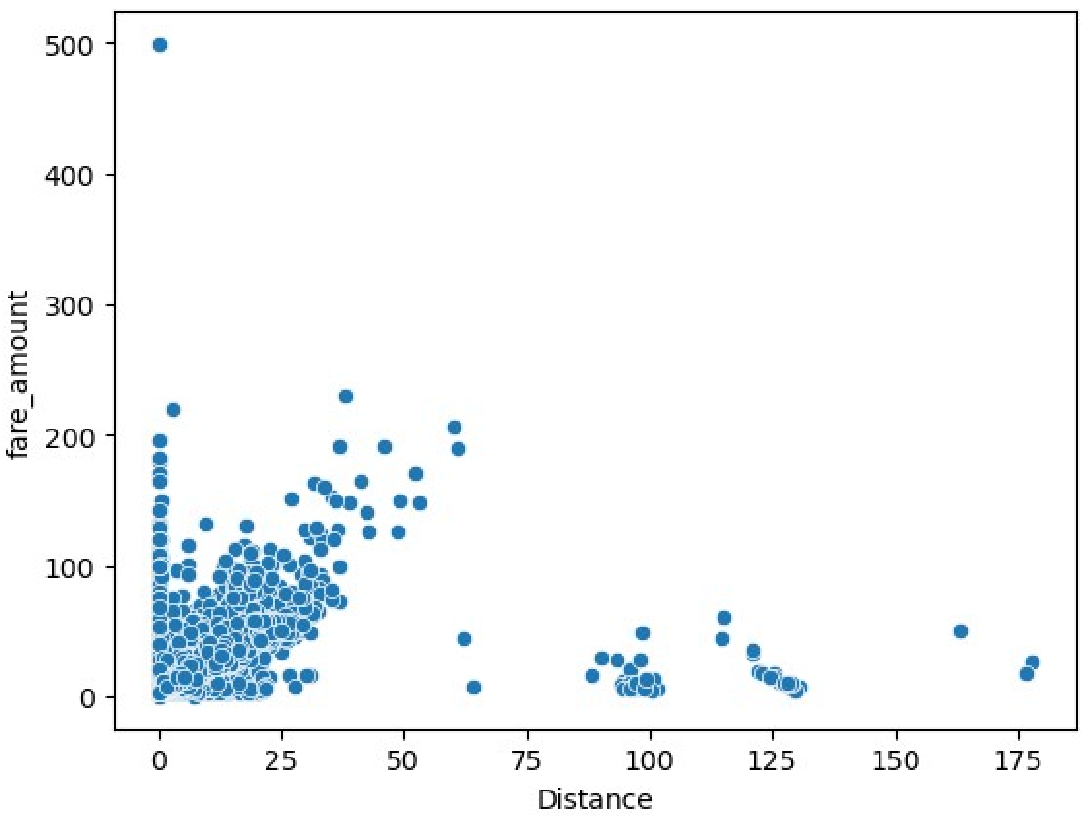
```python
df.corr()
```

```
                 fare_amount  passenger_count  Distance  week_day
Year  \
fare_amount         1.000000         0.011884  0.778667 -0.000165
0.120430
passenger_count     0.011884         1.000000  0.005112  0.042504
0.005339
Distance            0.778667         0.005112  1.000000  0.020587
0.018617
week_day           -0.000165         0.042504  0.020587  1.000000
0.010318
Year                0.120430         0.005339  0.018617  0.010318
1.000000
Month               0.024120         0.008818  0.007373 -0.006138 -
0.115182
Hour               -0.021078         0.013572 -0.022691 -0.092835
0.001131

                    Month      Hour
fare_amount      0.024120 -0.021078
passenger_count  0.008818  0.013572
Distance         0.007373 -0.022691
week_day        -0.006138 -0.092835
Year            -0.115182  0.001131
Month            1.000000 -0.005410
Hour            -0.005410  1.000000
```

```
sns.scatterplot(y=df['fare_amount'],x=df['Distance'])
```

```
<Axes: xlabel='Distance', ylabel='fare_amount'>
```



```
from sklearn.preprocessing import StandardScaler
x = df[['Distance']].values
y = df['fare_amount'].values.reshape(-1,1)

from sklearn.model_selection import train_test_split
x_train, x_test, y_train,y_test =
train_test_split(x,y,random_state=10)

std_x = StandardScaler()
x_train = std_x.fit_transform(x_train)

x_test = std_x.transform(x_test)

std_y = StandardScaler()
y_train = std_y.fit_transform(y_train)

y_test = std_y.transform(y_test)

from sklearn.metrics import mean_squared_error,r2_score,
mean_absolute_error
def fit_predict(model):
    model.fit(x_train,y_train.ravel())
    y_pred = model.predict(x_test)
    r_squared = r2_score(y_test,y_pred)
    RMSE = mean_squared_error(y_test, y_pred,squared=False)
    MAE = mean_absolute_error(y_test,y_pred)
    print('R-squared: ', r_squared)
    print('RMSE: ', RMSE)
    print("MAE:  ",MAE)
```

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

```
fit_predict(LinearRegression())
```

```
R-squared:  0.604116792084117
RMSE:  0.6290054895695945
MAE:   0.2755232959095983
```

```
C:\Users\Shubham\anaconda3\Lib\site-packages\sklearn\metrics\
_regression.py:483: FutureWarning: 'squared' is deprecated in version
1.4 and will be removed in 1.6. To calculate the root mean squared
error, use the function'root_mean_squared_error'.
  warnings.warn(
```

```
from sklearn.ensemble import RandomForestRegressor
fit_predict(RandomForestRegressor())
```

```
----------------------------------------------------------------------
-----
KeyboardInterrupt                         Traceback (most recent call
last)
Cell In[68], line 2
      1 from sklearn.ensemble import RandomForestRegressor
----> 2 fit_predict(RandomForestRegressor())

Cell In[62], line 3, in fit_predict(model)
      2 def fit_predict(model):
----> 3     model.fit(x_train,y_train.ravel())
      4     y_pred = model.predict(x_test)
      5     r_squared = r2_score(y_test,y_pred)

File ~\anaconda3\Lib\site-packages\sklearn\base.py:1474, in
_fit_context.<locals>.decorator.<locals>.wrapper(estimator, *args,
**kwargs)
   1467     estimator._validate_params()
   1469 with config_context(
   1470     skip_parameter_validation=(
   1471         prefer_skip_nested_validation or
global_skip_validation
   1472     )
   1473 ):
-> 1474     return fit_method(estimator, *args, **kwargs)

File ~\anaconda3\Lib\site-packages\sklearn\ensemble\_forest.py:489, in
BaseForest.fit(self, X, y, sample_weight)
    478 trees = [
    479     self._make_estimator(append=False,
random_state=random_state)
    480     for i in range(n_more_estimators)
    481 ]
    483 # Parallel loop: we prefer the threading backend as the Cython
code
    484 # for fitting the trees is internally releasing the Python GIL
    485 # making threading more efficient than multiprocessing in
    486 # that case. However, for joblib 0.12+ we respect any
    487 # parallel_backend contexts set at a higher level,
    488 # since correctness does not rely on using threads.
--> 489 trees = Parallel(
    490     n_jobs=self.n_jobs,
    491     verbose=self.verbose,
    492     prefer="threads",
    493 )(
    494     delayed(_parallel_build_trees)(
    495         t,
    496         self.bootstrap,
    497         X,
    498         y,
    499         sample_weight,
    500         i,
    501         len(trees),
    502         verbose=self.verbose,
    503         class_weight=self.class_weight,
    504         n_samples_bootstrap=n_samples_bootstrap,
    505
missing_values_in_feature_mask=missing_values_in_feature_mask,
    506     )
    507     for i, t in enumerate(trees)
    508 )
    510 # Collect newly grown trees
    511 self.estimators_.extend(trees)

File ~\anaconda3\Lib\site-packages\sklearn\utils\parallel.py:67, in
Parallel.__call__(self, iterable)
     62 config = get_config()
     63 iterable_with_config = (
     64     (_with_config(delayed_func, config), args, kwargs)
     65     for delayed_func, args, kwargs in iterable
     66 )
---> 67 return super().__call__(iterable_with_config)

File ~\anaconda3\Lib\site-packages\joblib\parallel.py:1918, in
Parallel.__call__(self, iterable)
   1916     output = self._get_sequential_output(iterable)
   1917     next(output)
-> 1918     return output if self.return_generator else list(output)
```

```
   1920 # Let's create an ID that uniquely identifies the current
call. If the
   1921 # call is interrupted early and that the same instance is
immediately
   1922 # re-used, this id will be used to prevent workers that were
   1923 # concurrently finalizing a task from the previous call to run
the
   1924 # callback.
   1925 with self._lock:

File ~\anaconda3\Lib\site-packages\joblib\parallel.py:1847, in
Parallel._get_sequential_output(self, iterable)
   1845 self.n_dispatched_batches += 1
   1846 self.n_dispatched_tasks += 1
-> 1847 res = func(*args, **kwargs)
   1848 self.n_completed_tasks += 1
   1849 self.print_progress()

File ~\anaconda3\Lib\site-packages\sklearn\utils\parallel.py:129, in
_FuncWrapper.__call__(self, *args, **kwargs)
    127     config = {}
    128 with config_context(**config):
--> 129     return self.function(*args, **kwargs)

File ~\anaconda3\Lib\site-packages\sklearn\ensemble\_forest.py:192, in
_parallel_build_trees(tree, bootstrap, X, y, sample_weight, tree_idx,
n_trees, verbose, class_weight, n_samples_bootstrap,
missing_values_in_feature_mask)
    189     elif class_weight == "balanced_subsample":
    190         curr_sample_weight *=
compute_sample_weight("balanced", y, indices=indices)
--> 192     tree._fit(
    193         X,
    194         y,
    195         sample_weight=curr_sample_weight,
    196         check_input=False,
    197
missing_values_in_feature_mask=missing_values_in_feature_mask,
    198     )
    199 else:
    200     tree._fit(
    201         X,
    202         y,
   (...)
    205
missing_values_in_feature_mask=missing_values_in_feature_mask,
    206     )

File ~\anaconda3\Lib\site-packages\sklearn\tree\_classes.py:472, in
BaseDecisionTree._fit(self, X, y, sample_weight, check_input,
missing_values_in_feature_mask)
    461 else:
    462     builder = BestFirstTreeBuilder(
    463         splitter,
    464         min_samples_split,
   (...)
    469         self.min_impurity_decrease,
    470     )
--> 472 builder.build(self.tree_, X, y, sample_weight,
missing_values_in_feature_mask)
    474 if self.n_outputs_ == 1 and is_classifier(self):
    475     self.n_classes_ = self.n_classes_[0]

KeyboardInterrupt:
```