```
## do all imports here
import numpy as np
import pandas as pd
import numpy as np
from sklearn.linear_model import LinearRegression

from google.colab import files

## downloaded csv file from url and importing it into notebook
weather_data = files.upload()
energy_data = files.upload()

weather_data = pd.read_csv('weather_data.csv') ## opening weather data
energy_data = pd.read_csv('energy_data.csv') ## opening energy data
```

Choose Files weather_data.csv

- **weather_data.csv**(text/csv) - 670684 bytes, last modified: 3/31/2022 - 100% done

```
Saving weather_data.csv to weather_data.csv
```

Choose Files energy_data.csv

- **energy_data.csv**(text/csv) - 3530451 bytes, last modified: 3/31/2022 - 100% done

```
Saving energy_data.csv to energy_data.csv
```

```
## Task 1

copy_energy = energy_data

## adding a column just for the date in copy_energy
just_time = []

for i in range(365):
  for j in range(48):
    index = i * 48 + j
    time = energy_data.at[index, 'Date & Time']
    time = time[0:10]
    just_time.append(time)

copy_energy["Date"] = just_time


## grouping copy_energy by the date
columns = copy_energy.columns[1:18:1]
daily_energy = copy_energy.groupby(["Date"])[columns].sum() ## adding per day usage

## copying time value in weather data into energy data
energy_every_two = energy_data
energy_every_two = energy_every_two.iloc[::2, :] ## only retreiving every two rows

energy_every_two.head()
```

```
energy_every_two.head()

unix_times = [] ## converting unix times

## adding unix time to energy_every_two
for i in range(365):
  for j in range(24):
    index = i * 24 + j
    time = weather_data.at[index, 'time']
    unix_times.append(time)

energy_every_two["time"] = unix_times


merged_data = pd.merge(weather_data, energy_every_two) ## merging the two altered data

## grouping by day in weather_data

columns_to_average = []

## only getting the necesary columns
grouped_merged_data = merged_data.copy()
grouped_merged_data = grouped_merged_data.groupby("Date")["temperature","humidity", "v

## grouped_merged_data.head()
## daily_energy.head()

daily_merged_data = grouped_merged_data.join(daily_energy)

print(daily_merged_data)


## merged_data2 = pd.merge(grouped_merged_data, daily_energy)

## What we need: merge the grouped_energy data with the weather_data that is averaged
## print(merged_data2)

## Task 2

## split the merged_data into training and testing datasets
merged_data_copy = merged_data.copy()
daily_merged_data_copy = daily_merged_data.copy()

columns = energy_data.columns[2:18:1]

for i in range(len(columns)):
    del merged_data_copy[columns[i]] ## removing each column
    del daily_merged_data_copy[columns[i]]

training_data = daily_merged_data_copy.head(334)
testing_data = daily_merged_data_copy.tail(31)
```

```
testing_data_without_label = testing_data.copy()
y_actual = testing_data["use [kW]"]
del testing_data_without_label["use [kW]"]
```

```
2014-01-04                            0.180056              0.344005
2014-01-05                            0.178556              0.348489
...                                        ...                   ...
2014-12-27                            0.112661              0.255620
2014-12-28                            0.115673              0.257369
2014-12-29                            0.112204              0.274396
2014-12-30                            0.115933              0.238277
2014-12-31                            0.114914              0.273398

            MBed + KBed outlets [kW]  Dryer + egauge [kW]  \
Date
2014-01-01                  0.254839            31.938131
2014-01-02                  0.798316             5.423866
2014-01-03                  0.746972             0.005554
2014-01-04                  0.640721            19.994908
2014-01-05                  0.584570             9.493912
...                              ...                  ...
2014-12-27                  5.422751             0.005953
2014-12-28                 11.602281             0.008270
2014-12-29                  5.951963             0.005461
2014-12-30                 11.100021             0.008893
2014-12-31                  7.741381             0.005618

            Panel GFI (central vac) [kW]  Home Office (R) [kW]  \
Date
2014-01-01                      0.350291              3.272944
2014-01-02                      0.346679              3.475469
2014-01-03                      0.344061              3.615520
2014-01-04                      0.346872              3.700408
2014-01-05                      0.346070              3.699178
...                                  ...                   ...
2014-12-27                      0.015400              0.473471
2014-12-28                      0.018872              0.473571
2014-12-29                      0.015199              0.493595
2014-12-30                      0.020299              0.512197
2014-12-31                      0.017158              0.514595

            Dining room (R) [kW]  Microwave (R) [kW]  Fridge (R) [kW]
Date
2014-01-01              0.200970            4.997037         4.639598
2014-01-02              0.207041            1.534426         3.881399
2014-01-03              0.201975            1.667553         3.671391
2014-01-04              0.203913            1.029198         3.357907
2014-01-05              0.197897            1.619991         4.373730
...                          ...                 ...              ...
2014-12-27              0.668127            0.642506         3.839653
2014-12-28              0.657405            0.311556         3.510436
2014-12-29              0.670818            0.279923         3.702587
2014-12-30              0.680587            0.623743         4.555577
2014-12-31              0.597449            0.513711         3.118014

[365 rows x 27 columns]
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:37: SettingWithCopyW
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/stabl
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:48: FutureWarning: I
```

```
## Task 3
from sklearn.linear_model import LinearRegression
import math
from sklearn.metrics import mean_squared_error
from math import sqrt
import csv


columns = testing_data_without_label.columns ## retrieving columns to group

x_train = training_data[columns] ## only getting the necesary columns
y_train = training_data['use [kW]']   ## dependent variables
## print(x_train)
x_train = np.reshape(x_train, (334, 10)) ## shaping the data


testing_data_without_label = np.reshape(testing_data_without_label, (31, 10)) ## shapi

LR = LinearRegression() ## setting up linear regression model
LR = LR.fit(x_train,y_train) ## training the model

prediction =  LR.predict(testing_data_without_label) ## testing the model

## print(prediction)
## print(y_actual)

rms = sqrt(mean_squared_error(y_actual, prediction)) ## rms calculation

print("Root mean square error value : " + str(rms))
## rms value is apx 8.629 || max-value: 44.563400 || min-value: 19.387136
adjusted_rms = rms / (44.563400 - 19.387136)
print("Adjusted rmse value: " + str(adjusted_rms))
## rms value is 0.3423 is which around an average fitting model. Closer to 0 is perfec



## creating csv file
dates = testing_data.index

with open('cse351_hw2_raja_rahul_sbuid_linear_regression.csv', 'w', newline='') as fil
    writer = csv.writer(file)
    writer.writerow(["Date", "Predicted Value"])
    for i in range(len(prediction)):
        writer.writerow([dates[i], prediction[i]]) ## writing the data into the file
```

```
predictor = pd.read_csv('cse351_hw2_raja_rahul_sbuid_linear_regression.csv')
print(predictor)
```

```
Root mean square error value : 8.629044152737501
Adjusted rmse value: 0.3427452203685782
          Date  Predicted Value
0   2014-12-01        30.640995
1   2014-12-02        31.771946
2   2014-12-03        18.535163
3   2014-12-04        31.506958
4   2014-12-05        23.720011
5   2014-12-06        21.470628
6   2014-12-07        22.177421
7   2014-12-08        24.715977
8   2014-12-09        20.536352
9   2014-12-10        18.808375
10  2014-12-11        20.117905
11  2014-12-12        22.047780
12  2014-12-13        25.695860
13  2014-12-14        24.481432
14  2014-12-15        28.048542
15  2014-12-16        16.850926
16  2014-12-17        23.628356
17  2014-12-18        26.174668
18  2014-12-19        25.953018
19  2014-12-20        25.473606
20  2014-12-21        15.427852
21  2014-12-22        13.876996
22  2014-12-23        14.176729
23  2014-12-24        17.301925
24  2014-12-25        30.294769
25  2014-12-26        34.086540
26  2014-12-27        26.694369
27  2014-12-28        27.611849
28  2014-12-29        30.600297
29  2014-12-30        29.890010
30  2014-12-31        25.919144
```

```
## Task 4
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import f1_score

weather_copy = grouped_merged_data.copy()
temperatures = weather_copy["temperature"]
binary_temp = []

## classfying high and low data
for i in range(len(temperatures)):
  if temperatures[i] < 35:
    binary_temp.append(0)
  else:
```

```
  else:
    binary_temp.append(1)

weather_copy["temperature"] = binary_temp ## adding column to the table

weather_copy.head(10)

training_data = weather_copy.head(334)
testing_data = weather_copy.tail(31)

y_actual = testing_data["temperature"]
testing_data_with_label = testing_data.copy()
del testing_data["temperature"]

columns = testing_data.columns
x_train = training_data[columns]   ## independent variables
y_train = training_data['temperature']   ## dependent variables

logreg = LogisticRegression() ## setting up logistic reg. model
logreg.fit(x_train,y_train) ## training log model

prediction = logreg.predict(testing_data) ## testing the model

f1score = f1_score(y_actual, prediction) ## calculating f1 score
print("F1 score: " + str(f1score))

dates = testing_data.index

## received a f1 score of around 0.7027, which is also above average. Closer to 1 is a

## creating csv file
with open('cse351_hw2_rahul_raja_sbuid_logistic_regression.csv', 'w', newline='') as f
    writer = csv.writer(file)
    writer.writerow(["Date", "Temperature Classification"])
    for i in range(len(prediction)):
        writer.writerow([dates[i], prediction[i]]) ## writing data



predictor = pd.read_csv('cse351_hw2_rahul_raja_sbuid_logistic_regression.csv')
print(predictor)
```

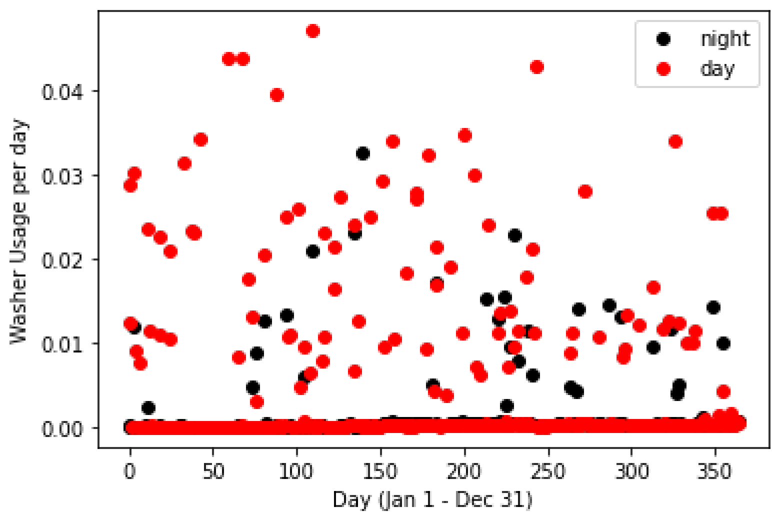
```
F1 score: 0.7027027027027027
         Date  Temperature Classification
0   2014-12-01                           1
1   2014-12-02                           1
2   2014-12-03                           1
3   2014-12-04                           1
4   2014-12-05                           0
5   2014-12-06                           0
6   2014-12-07                           1
7   2014-12-08                           0
```

```
8   2014-12-09                    1
9   2014-12-10                    1
10  2014-12-11                    0
11  2014-12-12                    1
12  2014-12-13                    1
13  2014-12-14                    1
14  2014-12-15                    1
15  2014-12-16                    1
16  2014-12-17                    1
17  2014-12-18                    1
18  2014-12-19                    1
19  2014-12-20                    0
20  2014-12-21                    1
21  2014-12-22                    1
22  2014-12-23                    1
23  2014-12-24                    1
24  2014-12-25                    1
25  2014-12-26                    1
26  2014-12-27                    1
27  2014-12-28                    1
28  2014-12-29                    1
29  2014-12-30                    0
30  2014-12-31                    0
/usr/local/lib/python3.7/dist-packages/sklearn/linear_model/_logistic.py:818: Co
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-regressio
  extra_warning_msg=_LOGISTIC_SOLVER_CONVERGENCE_MSG,
```

```
## Task 5
import matplotlib.pyplot as plt

energy_data2 = energy_data.copy()
date_and_time = energy_data2["Date & Time"]

just_time = []

## 6AM - 7PM is considered daytime, rest is night time

for i in range(len(date_and_time)):
  digit = int(date_and_time[i][11:13])
  if digit >= 6 and digit < 19:
    just_time.append(1) ## 1 is daytime
  else:
    just_time.append(0) ## 0 is nighttime

energy_data2["daytime"] = just_time

grouped_data_with_washer = energy_data2.groupby(["Date","daytime"])["Washer [kW]"].mea
grouped_data_with_ac = energy_data2.groupby(["Date","daytime"])["AC [kW]"].mean()
```

```
y1_data = []
y2_data = []
x_data = []


for i in range(len(grouped_data_with_washer)):
  if i % 2 == 0:
    y1_data.append(grouped_data_with_washer[i]) ## y1 data contains nighttime data
    x_data.append(i / 2)
  else:
    y2_data.append(grouped_data_with_washer[i]) ##y2 data contains daytime data

## First graph is washer
plt.plot(x_data, y1_data, 'o', color='black', label="night"); ## black is nighttime
plt.plot(x_data, y2_data, 'o', color='red', label="day"); ## red is daytime

plt.xlabel("Day (Jan 1 - Dec 31)")
plt.ylabel("Washer Usage per day")

plt.gca().legend(('night','day'))

## people generally use the washer more during the daytime rather than the night time
```

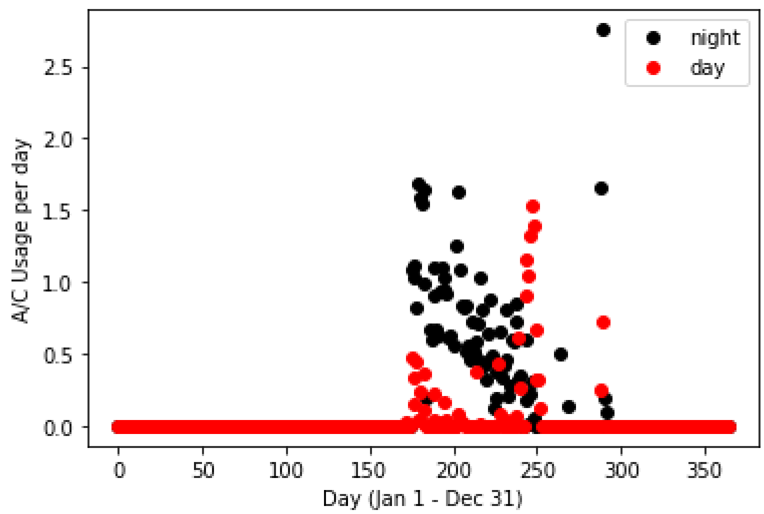
```
<matplotlib.legend.Legend at 0x7f41d878eed0>
```




```
## Task 5 Continued

y1_data = []
y2_data = []
x_data = []

for i in range(len(grouped_data_with_ac)):
  if i % 2 == 0:
    y1_data.append(grouped_data_with_ac[i])
    x_data.append(i / 2)
```

```
    else:
      y2_data.append(grouped_data_with_ac[i])


  ## First graph is washer
  plt.plot(x_data, y1_data, 'o',color='black')
  plt.plot(x_data, y2_data, 'o',color='red')

  plt.xlabel("Day (Jan 1 - Dec 31)")
  plt.ylabel("A/C Usage per day")

  plt.gca().legend(('night','day'))



  ## results show people use the ac more during the night time compared to the daytime a
```

```
<matplotlib.legend.Legend at 0x7f41d8722910>
```



0s completed at 11:28 PM