```
##importing everything
import sys
#if the device the code is being ran on doesn't contain any of the
librarys listed underneath
#please use the following command to pip install them
#!{sys.executable} -m pip install {library}
import pandas as pd
import numpy as np
######
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
######
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import f1_score
######
import matplotlib.pyplot as plt
import datetime
####################################
#PART 1
w_df = pd.read_csv('weather_data.csv')
# w_df.info()
e_df = pd.read_csv('energy_data.csv')
# e_df.info()

#convert to datetime object
#first convert the time from int to a readable date
###################
for ind in w_df.index:
    w_df["time"][ind] = datetime.datetime.fromtimestamp(w_df["time"]
[ind])
w_df["time"] = pd.to_datetime(w_df["time"])
# print(w_df)
#only want the time for the year 2014
w_df = w_df.loc[(w_df['time'] >=
datetime.datetime.fromtimestamp(1388549000))]
# temp = w_df.groupby(pd.Grouper(key='time', freq='1D')).sum()

###################
e_df['time'] = pd.to_datetime(e_df['Date & Time'])

#calculate sum per day
sum_of_use = e_df.groupby(pd.Grouper(key = 'time', freq = '1D')).sum()
# sum_use_col = sum_of_use["use [kW]"]
# w_df['use [kW]'] = sum_of_use['use [kW]'].values
#merge the data together
merged_data = pd.merge(w_df, sum_of_use, on = 'time')
print("MERGED:\n")
print(merged_data)
```

MERGED:

```
     temperature                 icon  humidity  visibility
summary  \
0          20.31          clear-night      0.47       10.00
Clear
1          19.92          clear-night      0.76        5.44
Clear
2           4.68                 snow      0.78        1.19     Light
Snow
3          -7.54          clear-night      0.75        9.93
Clear
4          16.20          clear-night      0.61        9.97
Clear
..           ...                  ...       ...         ...
...
360        27.75          clear-night      0.87        7.40
Clear
361        41.70  partly-cloudy-night      0.72        9.89  Partly
Cloudy
362        35.44          clear-night      0.59       10.00
Clear
363        25.77          clear-night      0.53       10.00
Clear
364        14.55          clear-night      0.64       10.00
Clear

     pressure  windSpeed  cloudCover       time  windBearing  ...  \
0     1023.25      12.65        0.00 2014-01-01          283  ...
1     1027.47       5.43        0.00 2014-01-02           31  ...
2     1010.40      12.13         NaN 2014-01-03           22  ...
3     1030.70       2.28        0.00 2014-01-04          296  ...
4     1025.78       4.51        0.00 2014-01-05          185  ...
..        ...        ...         ...        ...          ...  ...
360   1021.48       2.21        0.02 2014-12-27          231  ...
361   1016.34       6.55        0.31 2014-12-28          171  ...
362   1016.88       7.55        0.11 2014-12-29          297  ...
363   1024.06       7.44        0.02 2014-12-30          321  ...
364   1027.38       2.61        0.04 2014-12-31          248  ...

     First Floor lights [kW]  Utility Rm + Basement Bath [kW]  \
0                   0.567603                         0.178529
1                   0.506440                         0.178024
2                   0.507426                         0.176649
3                   0.515988                         0.180056
4                   0.519449                         0.178556
..                       ...                              ...
360                 0.825872                         0.112661
361                 0.874563                         0.115673
362                 0.552812                         0.112204
```

```
363                 0.764434                          0.115933
364                 0.559797                          0.114914

     Garage outlets [kW]  MBed + KBed outlets [kW]  Dryer + egauge
[kW]  \
0               0.261094                  0.254839
31.938131
1               0.282479                  0.798316
5.423866
2               0.279159                  0.746972
0.005554
3               0.344005                  0.640721
19.994908
4               0.348489                  0.584570
9.493912
..                   ...                       ...                   ..
.
360             0.255620                  5.422751
0.005953
361             0.257369                 11.602281
0.008270
362             0.274396                  5.951963
0.005461
363             0.238277                 11.100021
0.008893
364             0.273398                  7.741381
0.005618

     Panel GFI (central vac) [kW]  Home Office (R) [kW]  Dining room
(R) [kW]  \
0                        0.350291              3.272944
0.200970
1                        0.346679              3.475469
0.207041
2                        0.344061              3.615520
0.201975
3                        0.346872              3.700408
0.203913
4                        0.346070              3.699178
0.197897
..                            ...                   ...
...
360                      0.015400              0.473471
0.668127
361                      0.018872              0.473571
0.657405
362                      0.015199              0.493595
0.670818
363                      0.020299              0.512197
0.680587
```

```
364                     0.017158             0.514595
0.597449

     Microwave (R) [kW]  Fridge (R) [kW]
0              4.997037         4.639598
1              1.534426         3.881399
2              1.667553         3.671391
3              1.029198         3.357907
4              1.619991         4.373730
..                  ...              ...
360            0.642506         3.839653
361            0.311556         3.510436
362            0.279923         3.702587
363            0.623743         4.555577
364            0.513711         3.118014

[365 rows x 30 columns]

C:\Users\jhxia\AppData\Local\Temp\ipykernel_24168\1901021199.py:29:
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
  w_df["time"][ind] = datetime.datetime.fromtimestamp(w_df["time"]
[ind])
```

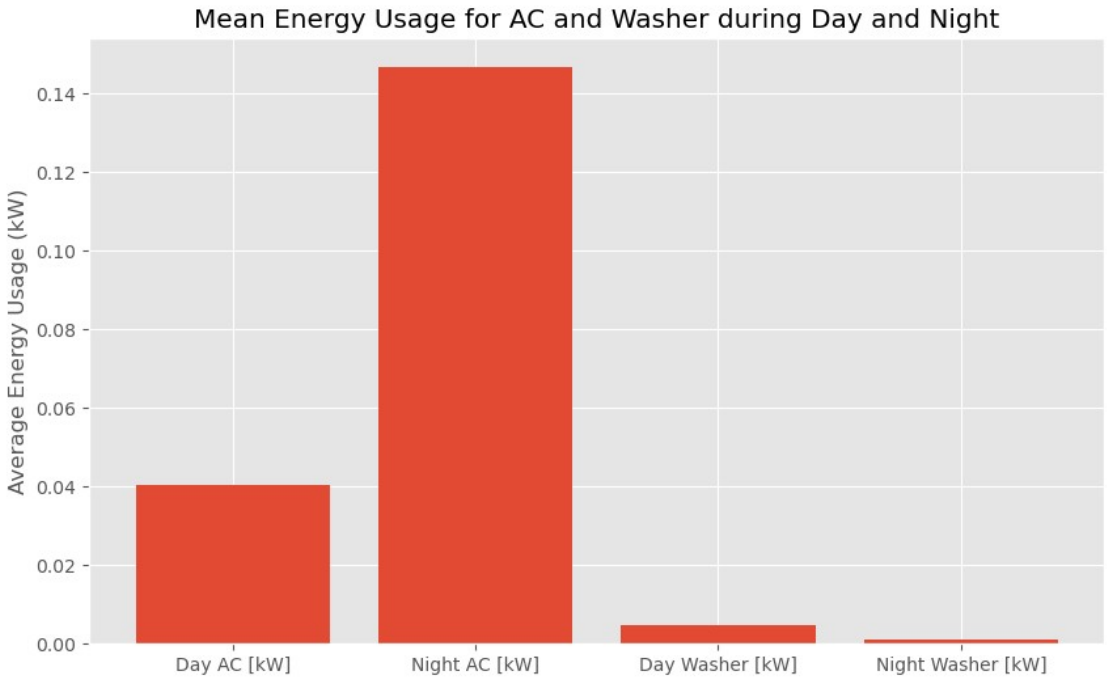
```python
###################################
#PART 2
#training using all the days in the year 2014 apart from december
train_data = merged_data[merged_data["time"].dt.month != 12]
#testing data is using the month of december in 2014
test_data = merged_data[merged_data["time"].dt.month == 12]

###################################
#PART 3
#drop the 'use [kW]', 'icon', and 'summary' columns from test data
test_data_drop = test_data.drop(['use [kW]', 'icon', 'summary'], axis
= 1)
#do similar with train data
train_data_drop = train_data.drop(['icon', 'summary'], axis = 1)
#train the linear regression model
x_train = train_data_drop.drop(['time', 'use [kW]'], axis =
1).fillna(0)
y_train = train_data_drop['use [kW]'].fillna(0)
reg = LinearRegression().fit(x_train, y_train)

#predict energy usage for december using weather data
x_test = test_data_drop.drop('time', axis = 1).fillna(0)
```

```
y_pred = reg.predict(x_test)
#How well/badly does the model work?
#the model works very well as after comparing the predicted and
expected results
#the values are extremely similar and that can be seen with the RMSE
value below
#calculate RMSE of the model
y_true = test_data['use [kW]']
rmse = np.sqrt(mean_squared_error(y_true, y_pred))
print("RMSE: ", rmse)

#generate csv dump of predicted values
pred_df = pd.DataFrame({'time': test_data['time'], 'predicted_value':
y_pred})
pred_df.to_csv('cse351_hw2_xia_junhao_113196003_linear_regression.csv'
, index = False)
```

```
RMSE:  1.0739390951000383e-13
```

```
###################################
#PART 4
#create avg_temp dataframe and find average temperature for each day
avg_temp = w_df.groupby(pd.Grouper(key = 'time', freq = '1D')).mean()
avg_temp['temperature_category'] =
avg_temp['temperature'].apply(lambda x: 1 if x >= 35 else 0)
#training using all the days in the year 2014 apart from december
train_data = avg_temp[avg_temp.index.month != 12]
#testing data is using the month of december in 2014
test_data = avg_temp[avg_temp.index.month == 12]
# print(avg_temp)
#split the data
x_train, x_test, y_train, y_test =
train_test_split(avg_temp.drop(['temperature_category'], axis=1),

avg_temp['temperature_category'], test_size=0.2, random_state=42)

#train the logistic regression model
lr_model = LogisticRegression()
lr_model.fit(x_train, y_train)

#evaluate the model
y_pred = lr_model.predict(x_test)
f1 = f1_score(y_test, y_pred)
print("F1 Score of:", f1)

#generate csv dump of temperature_category
pred_df = pd.DataFrame({'time': avg_temp.index,
'temperature_category': avg_temp['temperature_category']})
pred_df.to_csv('cse351_hw2_xia_junhao_113196003_logistic_regression.cs
v', index = False)
```

```
F1 Score of: 0.9772727272727273

#######################################
#PART 5
e_df['Date & Time'] = pd.to_datetime(e_df['Date & Time'])
#set time as index for dataframe
e_df.set_index('Date & Time', inplace=True)
#select the 2 devices
device1 = 'AC [kW]'
device2 = 'Washer [kW]'
devices_df = e_df[[device1, device2]]
# print(devices_df)
#split the devices dataframe into two parts - day and night
day_devices_df = devices_df.between_time('06:00:00', '18:59:59')
night_devices_df = devices_df.between_time('19:00:00', '05:59:59')
#calculate the mean energy usage for each device during the day and
night
mean_day_energy_usage = day_devices_df.mean()
mean_night_energy_usage = night_devices_df.mean()
# print(mean_day_energy_usage)
# print(mean_night_energy_usage)
#set the style of the plot
plt.style.use('ggplot')

#plot the mean energy usage for the two devices during the day and
night
fig, ax = plt.subplots(figsize=(10,6))
ax.bar(['Day ' + device1, 'Night ' + device1, 'Day ' + device2, 'Night
' + device2],
       [mean_day_energy_usage[0], mean_night_energy_usage[0],
mean_day_energy_usage[1], mean_night_energy_usage[1]])
ax.set_title('Mean Energy Usage for AC and Washer during Day and
Night')
ax.set_ylabel('Average Energy Usage (kW)')
plt.show()
#The graph plotted shows that, on average, AC usage tends to spike
during the night
#compared to the day. Another relationship shown would be how the
dishwasher uses
#more kw during the day on average. This also shows the comparision of
energy
#usage between the AC and Washer.
```


Mean Energy Usage for AC and Washer during Day and Night
Average Energy Usage (kW)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
Day AC [kW]
Night AC [kW]
Day Washer [kW]
Night Washer [kW]