In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
```

In [2]:
```
c = pd.read_csv(r"C:\Users\Chinenye Claire\Downloads\energydata_complete.csv")
```

In [3]:
```
c.shape
```

Out[3]:
```
(19735, 29)
```

In [4]:
```
column_names = {'T1':'Temperature in kitchen area', 'T2': 'Temperature in livi
                'T3':  'Temperature in laundry room area', 'T4': 'Temperature i
                'T6': 'Temperature outside the building (north side)', 'T7': '
                'T8': 'Temperature in teenager room 2',
                'T9': 'Temperature in parents room', 'To': 'Temperature outsid
```

In [5]:
```
df = c.rename(columns=column_names)
```

In [6]:
```
#Select a sample of the dataset
simple_linear_reg_df = df[['Temperature in living room area', 'Temperature out
```

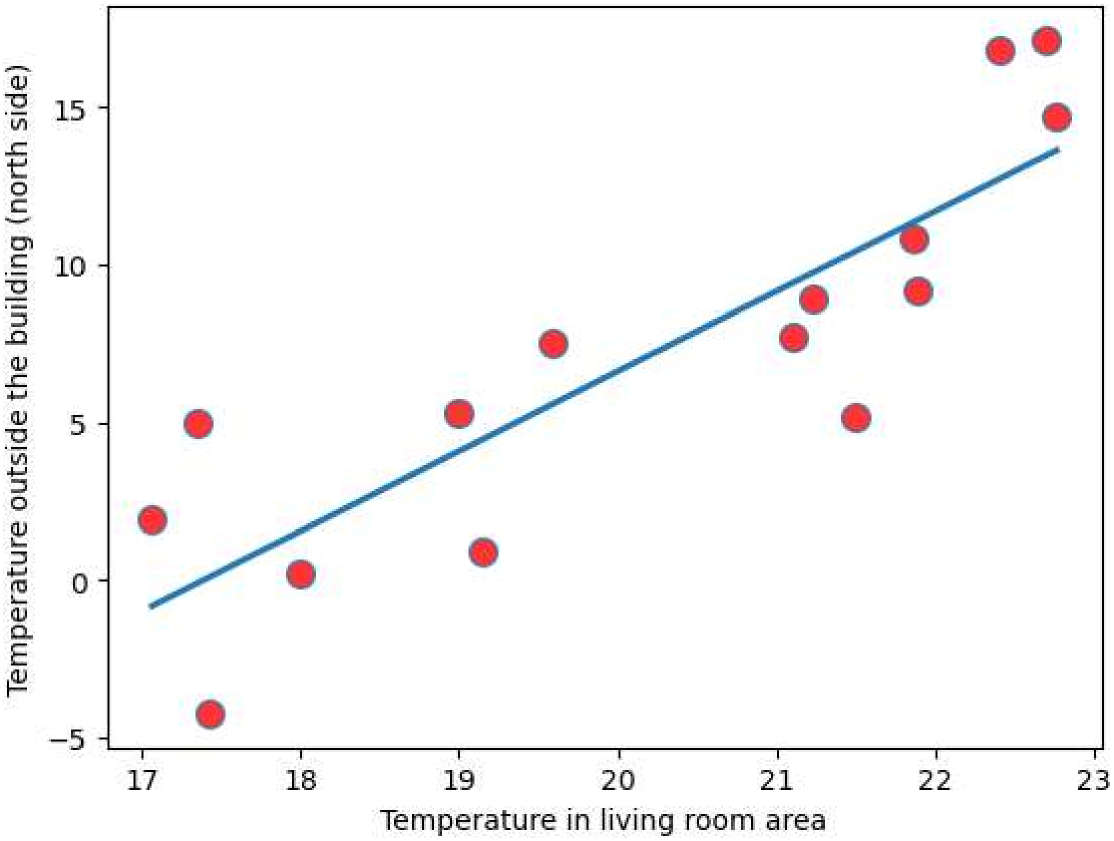
In [7]:
```
simple_linear_reg_df
```

Out[7]:

	Temperature in living room area	Temperature outside the building (north side)
1117	17.426667	-4.238889
16275	22.760000	14.690000
13272	21.230000	8.926667
3160	21.100000	7.690000
19210	21.856667	10.800000
8260	17.356667	5.000000
12299	19.000000	5.300000
13505	22.700000	17.133333
12913	19.593333	7.545000
17788	21.890000	9.190000
17894	21.500000	5.160000
7665	19.142857	0.937500
10165	18.000000	0.200000
18809	22.400000	16.833333
8737	17.066667	1.900000

In [8]:
```
sns.regplot(x="Temperature in living room area", y="Temperature outside the bu
```

Out[8]:
```
<Axes: xlabel='Temperature in living room area', ylabel='Temperature outside
the building (north side)'>
```



In [9]:
```
x= np.array(simple_linear_reg_df['Temperature in living room area'])
y = np.array(simple_linear_reg_df['Temperature outside the building (north sid
```

In [10]:
```
x = x.reshape(-1, 1) #feature matrix
y = y.reshape(-1, 1) #response vector
```

In [11]:
```
#Now, we split our dataset into the training and testing dataset. Recall that 
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.30, rand
print(x_train.shape)
print(x_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(10, 1)
(5, 1)
(10, 1)
(5, 1)
```

In [14]:

```
from sklearn.linear_model import LinearRegression
linear_model = LinearRegression()
#fit the model to the training dataset
linear_model.fit(x_train, y_train)
#obtain predictions
y_pred = linear_model.predict(x_test)
y_pred_train = linear_model.predict(x_train)
```

In [13]:

```
#Q17 What is the ROOT MEAN SQUARED ERROR for the Linear model in three D.P.?
from sklearn.metrics import  mean_squared_error
rmse = np.sqrt(mean_squared_error(y_test, y_pred))
round(rmse, 3)
```

Out[13]:

```
3.737
```

In [16]:

```
df1 = df.drop(columns=['date', 'lights'])
```

In [17]:

```
#Normalise our dataset to a common scale using the min max scaler
from sklearn.preprocessing import MinMaxScaler
scaler = MinMaxScaler()
#Apply scale to data to create normalised DF
normalised_df = pd.DataFrame(scaler.fit_transform(df1), columns=df1.columns)
#select features/Independent variables
X = normalised_df.drop(columns=['Appliances'])
#select target variable (dependent variables)
Y = normalised_df['Appliances']
```

In [23]:

```
#Now, we split our dataset into the training and testing dataset. Recall that w
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train,Y_test = train_test_split(X, Y,test_size=0.3, random_
```

In [19]:

```
#Run a multiple linear regression using the training set
from sklearn.linear_model import LinearRegression
linear_model = LinearRegression()
#fit the model to the training dataset
linear_model.fit(X_train, Y_train)
#obtain predictions
predicted_values_train = linear_model.predict(X_train)
predicted_values_test = linear_model.predict(X_test)
```

In [20]:

```
#Q18 What is the Mean Absolute Error (in three decimal places) for the  trainin
from sklearn.metrics import mean_absolute_error
mae = mean_absolute_error(Y_train, predicted_values_train)
round(mae, 3)
```

Out[20]:

```
0.05
```

In [21]:

```
#Q19 What is the Root Mean Square Error (in three decimal places) for the  tra
from sklearn.metrics import  mean_squared_error
rmse = np.sqrt(mean_squared_error(Y_train, predicted_values_train))
round(rmse, 3)
```

Out[21]:

```
0.089
```

In [24]:

```
#Q20 What is the Mean Absolute Error (in three decimal places) for the testing
from sklearn.metrics import mean_absolute_error
mae = mean_absolute_error(Y_test, predicted_values_test)
round(mae, 3)
```

Out[24]:

```
0.05
```

In [25]:

```
#Q21 What is the Root Mean Square Error (in three decimal places) for the  test
from sklearn.metrics import  mean_squared_error
rmse = np.sqrt(mean_squared_error(Y_test, predicted_values_test))
round(rmse, 3)
```

Out[25]:

```
0.088
```

In [ ]:

```
#Q22 Did the Model above overfit to the training set
Yes, there is overfitting because there is very little difference between trai
```

In [28]:

```
from sklearn.linear_model import Ridge
ridge_reg = Ridge(alpha=0.5)
ridge_reg.fit(X_train, Y_train)   # Fit a ridge regression on the training data
```

Out[28]:

```
Ridge(alpha=0.5)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.

On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [30]:
```
pred2 = ridge_reg.predict(X_test)
print(pd.Series(ridge_reg.coef_, index = X.columns)) # Print coefficients
```

```
Temperature in kitchen area                                -0.021549
Humidity in kitchen area                                    0.511932
Temperature in living room area                            -0.193880
Humidity in living room area                               -0.401134
Temperature in laundry room area                            0.287408
Humidity in laundry room area                               0.094976
Temperature in office room                                  0.027006
Humidity in office room                                     0.024168
Temperature in bathroom                                    -0.020727
 Humidity in bathroom                                       0.016176
Temperature outside the building (north side)               0.213316
Humidity outside the building (north side)                  0.035023
Temperature in ironing room                                 0.010021
Humidity in ironing room                                   -0.046291
Temperature in teenager room 2                              0.100754
Humidity in teenager room 2                                -0.156596
Temperature in parents room                                -0.188584
Humidity in parents room                                   -0.041701
T_out                                                      -0.250765
Press_mm_hg                                                 0.006516
Humidity outside (from Chievres weather station)           -0.050541
Windspeed                                                   0.030463
Visibility                                                  0.012032
Tdewpoint                                                   0.076668
rv1                                                         0.000743
rv2                                                         0.000743
dtype: float64
```

In [32]:
```
print(np.sqrt(mean_squared_error(Y_test, pred2)))        #Calculate the test
```

```
0.08754118590838059
```

In [ ]:
```
#Q23 Train a ridge regression model with default parameters. Is there any chang
There is no significant change in RMSE.
```

In [55]:
```
from sklearn.linear_model import Lasso
lasso_reg = Lasso(alpha=0.001)
lasso_reg.fit(X_train, Y_train)
```

Out[55]:
```
Lasso(alpha=0.001)
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [37]:

```
#this function returns the weight of every feature
def get_weights_df(model, feat, col_name):
    weights = pd.Series(model.coef_, feat.columns).sort_values()
    weights_df = pd.DataFrame(weights).reset_index()
    weights_df.columns = ['Features', col_name]
    weights_df[col_name].round(3)
    return weights_df
```

In [56]:

```
lasso_weights_df = get_weights_df(lasso_reg, X_train, 'Lasso_weight')
lasso_weights_df
```

Out[56]:

	Features	Lasso_weight
0	Humidity outside (from Chievres weather station)	-0.049557
1	Humidity in teenager room 2	-0.000110
2	Temperature in kitchen area	0.000000
3	Tdewpoint	0.000000
4	Visibility	0.000000
5	Press_mm_hg	-0.000000
6	T_out	0.000000
7	Humidity in parents room	-0.000000
8	Temperature in parents room	-0.000000
9	Temperature in teenager room 2	0.000000
10	Humidity in ironing room	-0.000000
11	rv1	-0.000000
12	Temperature in ironing room	-0.000000
13	Temperature outside the building (north side)	0.000000
14	Humidity in bathroom	0.000000
15	Temperature in bathroom	-0.000000
16	Humidity in office room	0.000000
17	Temperature in office room	-0.000000
18	Humidity in laundry room area	0.000000
19	Temperature in laundry room area	0.000000
20	Humidity in living room area	-0.000000
21	Temperature in living room area	0.000000
22	Humidity outside the building (north side)	-0.000000
23	rv2	-0.000000
24	Windspeed	0.002912
25	Humidity in kitchen area	0.017880

```
In [ ]:  #Q24 Train a lasso regression model with default value and obtain the new featu
         Answer: 3
```

```
In [48]: from sklearn.linear_model import Ridge, RidgeCV, Lasso, LassoCV
         lassocv = LassoCV(alphas = None, cv = 10, max_iter = 100000)
         lassocv.fit(X_train, Y_train)

         lasso.set_params(alpha=lassocv.alpha_)
         lasso.fit(X_train, Y_train)
         np.sqrt(mean_squared_error(Y_test, lasso.predict(X_test)))  # Calculate the te

Out[48]: 0.08751635779581003
```

```
In [ ]:  #Q25 What is the new RMSE with the Lasso Regression on the test set?
         Answer: 0.088
```