```
import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import seaborn as sns


from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
import matplotlib.pyplot as plt
# import matplotlib.pyplot as plt


data = pd.read_csv("/content/temperatures.csv")
df = data


data.describe()
```

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	
count	117.000000	117.000000	117.000000	117.000000	117.000000	117.000000	117.000000	117.000000	117.000000	117.0
mean	1959.000000	23.687436	25.597863	29.085983	31.975812	33.565299	32.774274	31.035897	30.507692	30.4
std	33.919021	0.834588	1.150757	1.068451	0.889478	0.724905	0.633132	0.468818	0.476312	0.5
min	1901.000000	22.000000	22.830000	26.680000	30.010000	31.930000	31.100000	29.760000	29.310000	29.0
25%	1930.000000	23.100000	24.780000	28.370000	31.460000	33.110000	32.340000	30.740000	30.180000	30.1
50%	1959.000000	23.680000	25.480000	29.040000	31.950000	33.510000	32.730000	31.000000	30.540000	30.5
75%	1988.000000	24.180000	26.310000	29.610000	32.420000	34.030000	33.180000	31.330000	30.760000	30.8
max	2017.000000	26.940000	29.720000	32.620000	35.380000	35.840000	34.480000	32.760000	31.840000	32.2

```
data.head()
```

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	JAN-FEB	MAR-MAY	JUN-SEP
0	1901	22.40	24.14	29.07	31.91	33.41	33.18	31.21	30.39	30.47	29.97	27.31	24.49	28.96	23.27	31.46	31.27
1	1902	24.93	26.58	29.77	31.78	33.73	32.91	30.92	30.73	29.80	29.12	26.31	24.04	29.22	25.75	31.76	31.09
2	1903	23.44	25.03	27.83	31.39	32.91	33.00	31.34	29.98	29.85	29.04	26.08	23.65	28.47	24.24	30.71	30.92
3	1904	22.50	24.73	28.21	32.02	32.64	32.07	30.36	30.09	30.04	29.20	26.36	23.63	28.49	23.62	30.95	30.66
4	1905	22.00	22.83	26.68	30.01	33.32	33.25	31.44	30.68	30.12	30.67	27.52	23.82	28.30	22.25	30.00	31.33

```
data.shape
```

```
(117, 18)
```

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 117 entries, 0 to 116
Data columns (total 18 columns):
 #   Column   Non-Null Count  Dtype
---  ------   --------------  -----
```

```
 0   YEAR     117 non-null    int64  
 1   JAN      117 non-null    float64
 2   FEB      117 non-null    float64
 3   MAR      117 non-null    float64
 4   APR      117 non-null    float64
 5   MAY      117 non-null    float64
 6   JUN      117 non-null    float64
 7   JUL      117 non-null    float64
 8   AUG      117 non-null    float64
 9   SEP      117 non-null    float64
 10  OCT      117 non-null    float64
 11  NOV      117 non-null    float64
 12  DEC      117 non-null    float64
 13  ANNUAL   117 non-null    float64
 14  JAN-FEB  117 non-null    float64
 15  MAR-MAY  117 non-null    float64
 16  JUN-SEP  117 non-null    float64
 17  OCT-DEC  117 non-null    float64
dtypes: float64(17), int64(1)
memory usage: 16.6 KB
```

```
count = (data["JAN"]==22).sum()
print(count)
```

```
1
```

```
column = data
count = column[column == 0].count()
print(count)
```

```
YEAR       0
JAN        0
FEB        0
MAR        0
APR        0
MAY        0
JUN        0
JUL        0
AUG        0
SEP        0
OCT        0
NOV        0
DEC        0
ANNUAL     0
JAN-FEB    0
MAR-MAY    0
JUN-SEP    0
OCT-DEC    0
dtype: int64
```

```
data.isnull().sum()
```

```
YEAR       0
JAN        0
FEB        0
MAR        0
APR        0
MAY        0
JUN        0
JUL        0
AUG        0
SEP        0
OCT        0
NOV        0
DEC        0
ANNUAL     0
JAN-FEB    0
MAR-MAY    0
JUN-SEP    0
```

```
OCT-DEC    0
dtype: int64
```

```
data.isnull().head()
```

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	JAN-FEB	MAR-MAY	JUN-SEP
0	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
1	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
2	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
3	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False
4	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False	False

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 117 entries, 0 to 116
Data columns (total 18 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   YEAR      117 non-null    int64  
 1   JAN       117 non-null    float64
 2   FEB       117 non-null    float64
 3   MAR       117 non-null    float64
 4   APR       117 non-null    float64
 5   MAY       117 non-null    float64
 6   JUN       117 non-null    float64
 7   JUL       117 non-null    float64
 8   AUG       117 non-null    float64
 9   SEP       117 non-null    float64
 10  OCT       117 non-null    float64
 11  NOV       117 non-null    float64
 12  DEC       117 non-null    float64
 13  ANNUAL    117 non-null    float64
 14  JAN-FEB   117 non-null    float64
 15  MAR-MAY   117 non-null    float64
 16  JUN-SEP   117 non-null    float64
 17  OCT-DEC   117 non-null    float64
dtypes: float64(17), int64(1)
memory usage: 16.6 KB
```

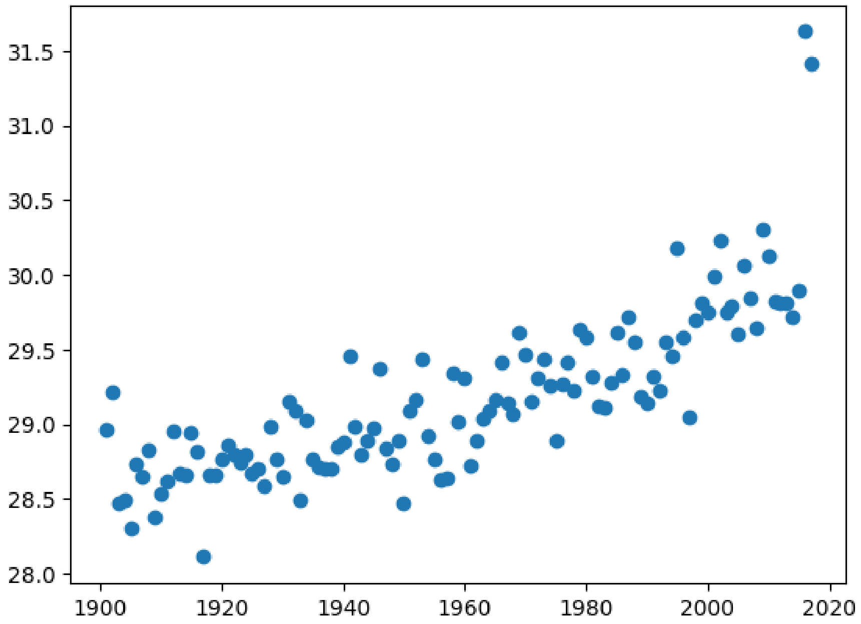
```
data.head()
```

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	AI
0	1901	22.40	24.14	29.07	31.91	33.41	33.18	31.21	30.39	30.47	29.97	27.31	24.49	
1	1902	24.93	26.58	29.77	31.78	33.73	32.91	30.92	30.73	29.80	29.12	26.31	24.04	
2	1903	23.44	25.03	27.83	31.39	32.91	33.00	31.34	29.98	29.85	29.04	26.08	23.65	
3	1904	22.50	24.73	28.21	32.02	32.64	32.07	30.36	30.09	30.04	29.20	26.36	23.63	
4	1905	22.00	22.83	26.68	30.01	33.32	33.25	31.44	30.68	30.12	30.67	27.52	23.82	

```
# x = data.iloc[:,1:6]
# y = data.iloc[:,-1:]
```

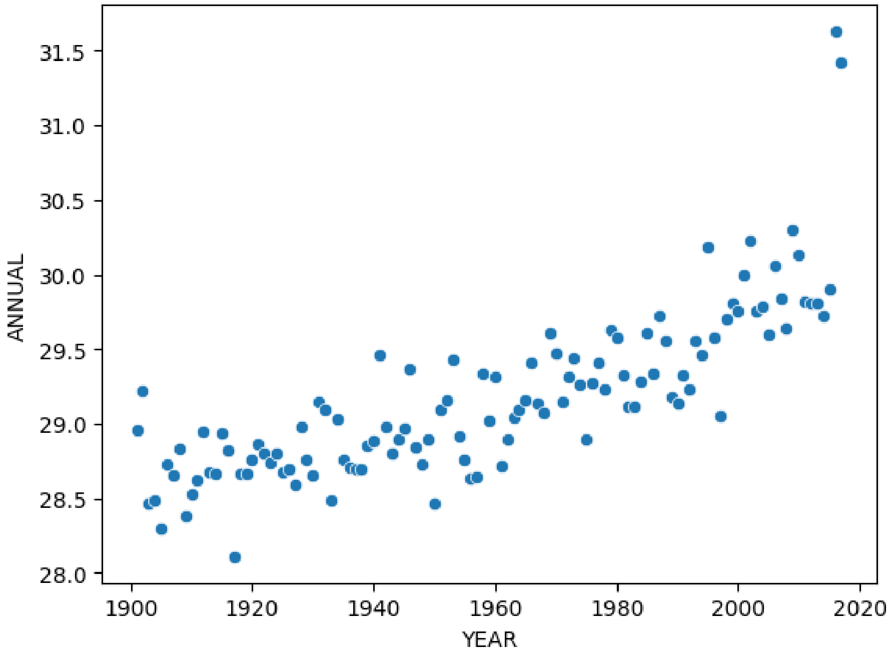
```
x = data["YEAR"]
y = data["ANNUAL"]


plt.plot(x,y,'o')
```

```
[<matplotlib.lines.Line2D at 0x7e54838b09d0>]
```



```
sns.scatterplot(x=x,y=y,data=df)
```

```
<Axes: xlabel='YEAR', ylabel='ANNUAL'>
```



```
type(x)
```

```
pandas.core.series.Series
```

```
x.shape
```

```
(117,)
```

```
x = x.reshape(117,1)
```

```
x.shape
```

```
    (117,)
```

```
x_train, x_test, y_train, y_test = train_test_split(x, y,test_size=0.25)

print(f"x Training dataset: {x_train.shape}")
print(f"y Training dataset: {y_train.shape}")
print(f"x test dataset: {x_test.shape}")
print(f"y test dataset: {y_test.shape}")
```

```
    x Training dataset: (87, 1)
    y Training dataset: (87,)
    x test dataset: (30, 1)
    y test dataset: (30,)
```

```
model = LinearRegression()
```

```
model.fit(x_train,y_train)
```

```
    ▾ LinearRegression
    LinearRegression()
```

```
model.coef_ #w
```

```
    array([0.01456826])
```

```
model.intercept_ #b
```

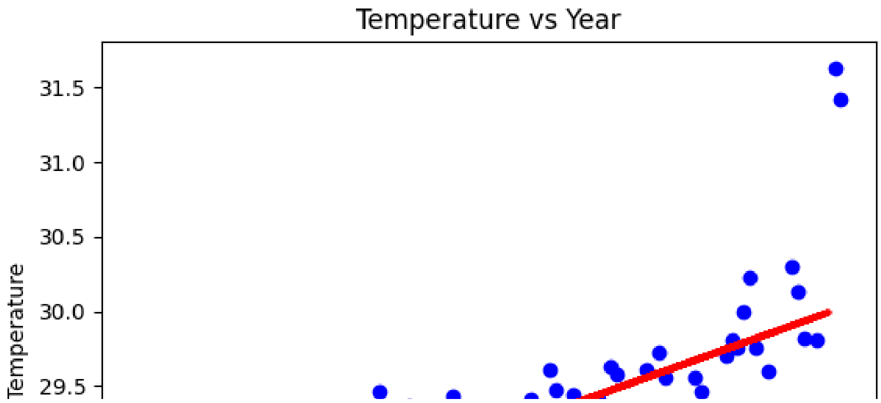
```
    0.6362443556159292
```

```
y_pred = model.predict(x_test)
```

```
y_pred.shape
```

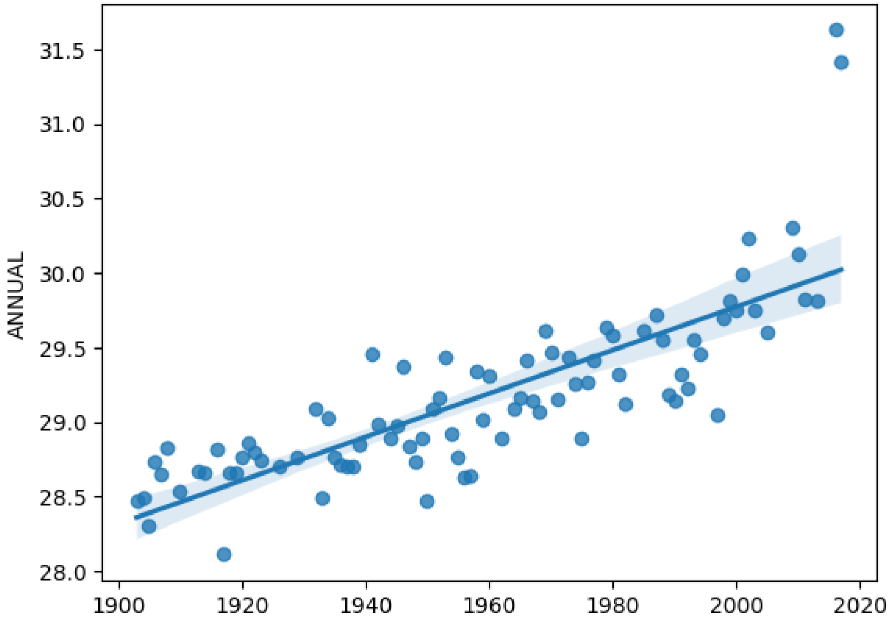
```
    (30,)
```

```
plt.scatter(x_train, y_train, color='blue')
plt.plot(x_test, y_pred, color='red', linewidth=3)
plt.title("Temperature vs Year")
plt.xlabel("Year")
plt.ylabel("Temperature")
plt.show()
```



```
sns.regplot(data=df,x=x_train,y=y_train,)
```

```
    <Axes: ylabel='ANNUAL'>
```



```
from sklearn.metrics import mean_absolute_error,mean_squared_error,r2_score
print(f"MSE:  {mean_squared_error(y_test,y_pred)}")
print(f"MAE:  {mean_absolute_error(y_test,y_pred)}")
print(f"R-Sqaure :  {r2_score(y_test,y_pred)}")
```

```
    MSE:  0.0968690570629762
    MAE:  0.24135238699702838
    R-Sqaure :  0.5759872529064257
```

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