```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

```
df = pd.read_csv("/content/drive/MyDrive/Advertising.csv")
```

```
df.columns
```

```
Index(['Unnamed: 0', 'TV', 'Radio', 'Newspaper', 'Sales'], dtype='object')
```

```
df.head()
```

	Unnamed: 0	TV	Radio	Newspaper	Sales
0	1	230.1	37.8	69.2	22.1
1	2	44.5	39.3	45.1	10.4
2	3	17.2	45.9	69.3	9.3
3	4	151.5	41.3	58.5	18.5
4	5	180.8	10.8	58.4	12.9

```
df.drop('Unnamed: 0',axis = 1)
```

	TV	Radio	Newspaper	Sales
0	230.1	37.8	69.2	22.1
1	44.5	39.3	45.1	10.4
2	17.2	45.9	69.3	9.3
3	151.5	41.3	58.5	18.5
4	180.8	10.8	58.4	12.9
...	...	...	...	...
195	38.2	3.7	13.8	7.6
196	94.2	4.9	8.1	9.7
197	177.0	9.3	6.4	12.8
198	283.6	42.0	66.2	25.5
199	232.1	8.6	8.7	13.4

200 rows × 4 columns

```
df.describe()
```

	Unnamed: 0	TV	Radio	Newspaper	Sales
count	200.000000	200.000000	200.000000	200.000000	200.000000
mean	100.500000	147.042500	23.264000	30.554000	14.022500
std	57.879185	85.854236	14.846809	21.778621	5.217457
min	1.000000	0.700000	0.000000	0.300000	1.600000
25%	50.750000	74.375000	9.975000	12.750000	10.375000
50%	100.500000	149.750000	22.900000	25.750000	12.900000
75%	150.250000	218.825000	36.525000	45.100000	17.400000
max	200.000000	296.400000	49.600000	114.000000	27.000000

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

```
Unnamed: 0    0
TV            0
Radio         0
Newspaper     0
```

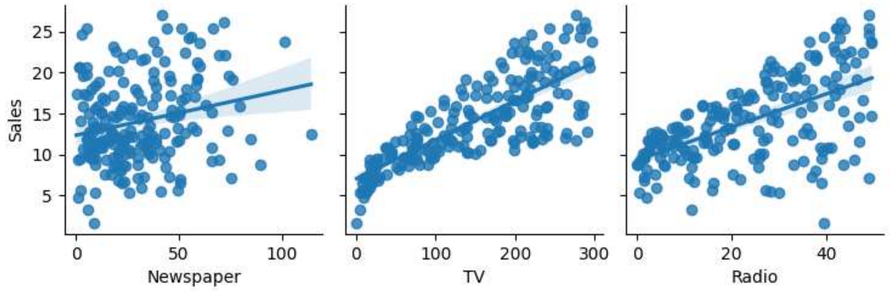
```
Sales        0
dtype: int64
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   Unnamed: 0  200 non-null    int64  
 1   TV          200 non-null    float64
 2   Radio       200 non-null    float64
 3   Newspaper   200 non-null    float64
 4   Sales       200 non-null    float64
dtypes: float64(4), int64(1)
memory usage: 7.9 KB
```

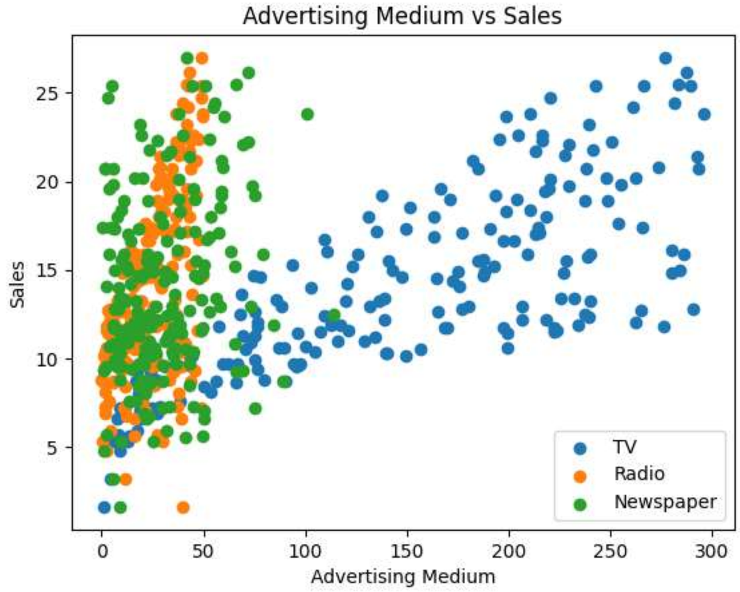
```
sns.pairplot(df, x_vars=["Newspaper", "TV", "Radio"], y_vars="Sales",kind='reg')
```

```
<seaborn.axisgrid.PairGrid at 0x786944e42170>
```



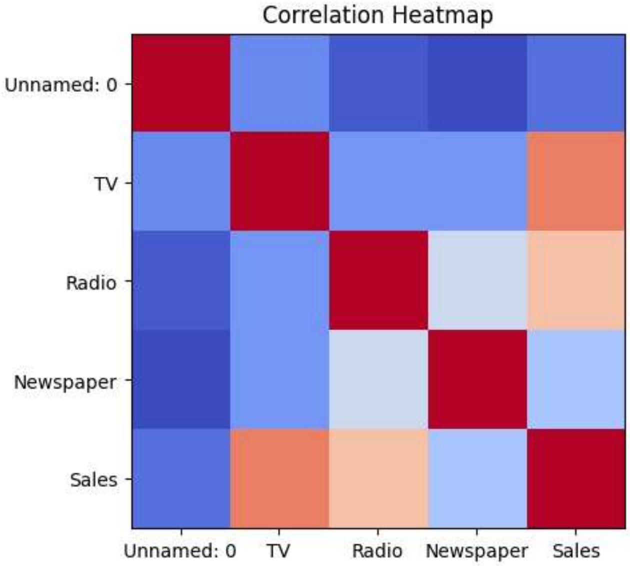
```
fig, ax = plt.subplots()
ax.scatter(df['TV'], df['Sales'], label='TV')
ax.scatter(df['Radio'], df['Sales'], label='Radio')
ax.scatter(df['Newspaper'], df['Sales'], label='Newspaper')
ax.set_xlabel('Advertising Medium')
ax.set_ylabel('Sales')
ax.set_title('Advertising Medium vs Sales')
ax.legend()
```

```
<matplotlib.legend.Legend at 0x786942ac7be0>
```

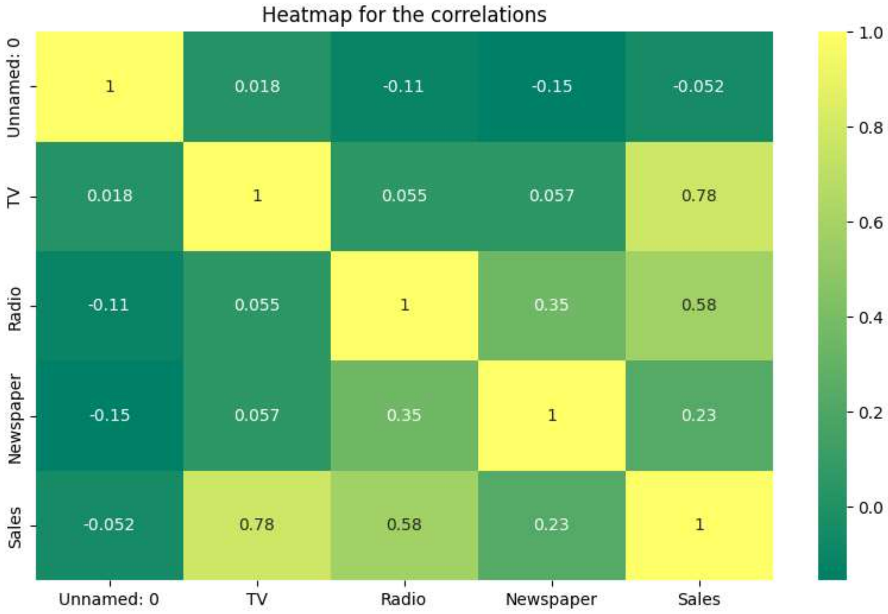


```
fig, ax = plt.subplots()
corr = df.corr()
ax.imshow(corr, cmap='coolwarm')
ax.set_xticks(range(len(corr.columns)))
ax.set_xticklabels(corr.columns)
ax.set_yticks(range(len(corr.columns)))
ax.set_yticklabels(corr.columns)
ax.set_title('Correlation Heatmap')
```

```
Text(0.5, 1.0, 'Correlation Heatmap')
```

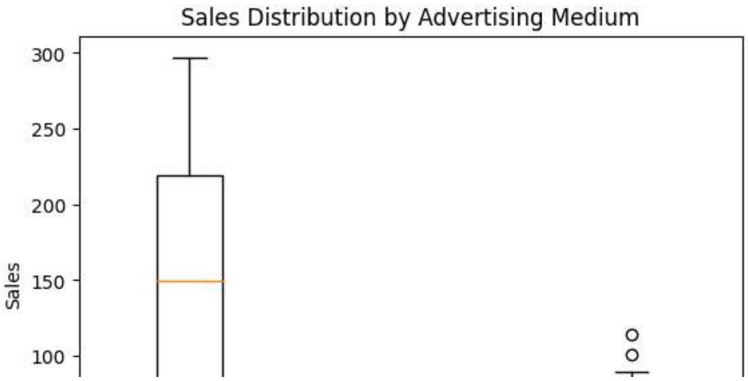


```
plt.figure(figsize=(10,6))
sns.heatmap(df.corr(),annot=True,cmap="summer")
plt.title("Heatmap for the correlations")
plt.show()
```

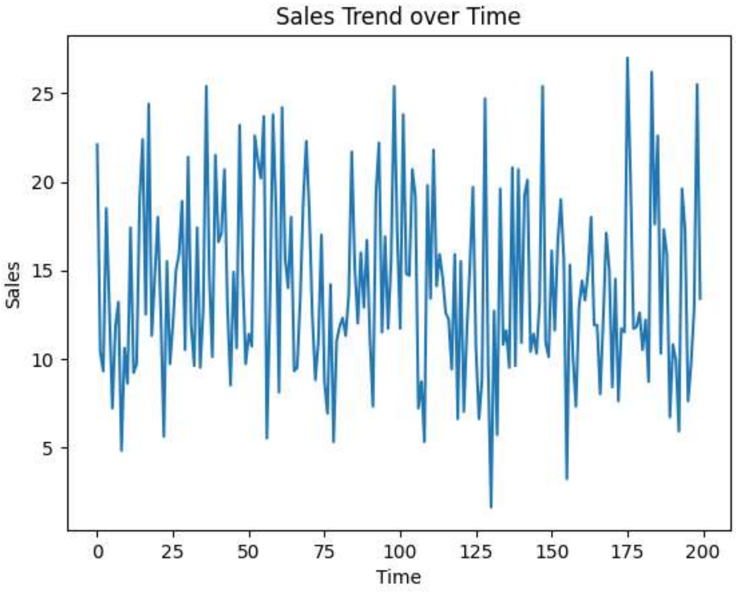


```
fig, ax = plt.subplots()
ax.boxplot([df['TV'], df['Radio'], df['Newspaper']])
ax.set_xticklabels(['TV', 'Radio', 'Newspaper'])
ax.set_ylabel('Sales')
ax.set_title('Sales Distribution by Advertising Medium')
```

```
Text(0.5, 1.0, 'Sales Distribution by Advertising Medium')
```



```
fig, ax = plt.subplots()
ax.plot(df['Sales'])
ax.set_xlabel('Time')
ax.set_ylabel('Sales')
ax.set_title('Sales Trend over Time')

plt.show()
```



```
X = df[['TV', 'Radio', 'Newspaper']]
y = df['Sales']
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

```
from sklearn.svm import SVR
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import SGDRegressor
from sklearn.neighbors import KNeighborsRegressor
from sklearn.gaussian_process import GaussianProcessRegressor
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import GradientBoostingRegressor
from sklearn.ensemble import RandomForestRegressor
from sklearn.isotonic import IsotonicRegression
from sklearn.neural_network import MLPRegressor
```

```
from xgboost import XGBRegressor
```

```
svr = SVR()
lr = LinearRegression()
sgdr = SGDRegressor()
knr = KNeighborsRegressor()
gpr = GaussianProcessRegressor()
```

```
dtr = DecisionTreeRegressor()
gbr = GradientBoostingRegressor()
rfr = RandomForestRegressor()
xgbr = XGBRegressor()
mlpr = MLPRegressor()
ir = IsotonicRegression()


models = {"a" :["LinearRegression",lr],
 "b": ["SVR", svr],
 "c": ["SGDRegressor", sgdr],
 "d": ["KNeighborsRegressor",knr],
 "e": ["GaussianProcessRegressor" , gpr],
 "f": ["DecisionTreeRegressor", dtr],
 "g": ["GradientBoostingRegressor",gbr],
 "h": ["RandomForestRegressor" , rfr],
 "i": ["XGBRegressor", xgbr],
 "j": ["MLPRegressor", mlpr],
          "k": ["IsotonicRegression", ir]
}


from sklearn.model_selection import KFold, cross_val_score
from sklearn.metrics import make_scorer , r2_score

def test_model(model, X_train = X_train, y_train = y_train):
  cv = KFold(n_splits= 7, shuffle = True, random_state = 45)
  r2 = make_scorer(r2_score)
  r2_val_score = cross_val_score(model, X_train, y_train, cv=cv, scoring = r2)
  score = [r2_val_score.mean()]
  return score


models_score = []
for model in models:
  print("Training model: ", models[model][0])
  score = test_model(models[model][1],X_train , y_train)
  print("Score of model :", score)
  models_score.append([models[model][0], score[0]])
```

```
    Training model:  SGDRegressor
    Score of model : [-3.8062498636580333e+25]
    Training model:  KNeighborsRegressor
    Score of model : [0.8963620589500793]
    Training model:  GaussianProcessRegressor
    Score of model : [-8.206668655974893]
    Training model:  DecisionTreeRegressor
    Score of model : [0.921524062168431]
    Training model:  GradientBoostingRegressor
    Score of model : [0.9705662509220236]
    Training model:  RandomForestRegressor
    Score of model : [0.9726076920910414]
    Training model:  XGBRegressor
    Score of model : [0.9657054128131645]
    Training model:  MLPRegressor
    /usr/local/lib/python3.10/dist-packages/sklearn/neural_network/_multilayer_perceptron.py:686: ConvergenceWarning: Stochastic Optimize
      warnings.warn(
    Score of model : [-0.2550884048482209]
```

```
models_score
```

```
    [['LinearRegression', 0.8817172226918385],
     ['SVR', 0.7781668672049022],
     ['SGDRegressor', -3.8062498636580333e+25],
     ['KNeighborsRegressor', 0.8963620589500793],
     ['GaussianProcessRegressor', -8.206668655974893],
     ['DecisionTreeRegressor', 0.921524062168431],
     ['GradientBoostingRegressor', 0.9705662509220236],
     ['RandomForestRegressor', 0.9726076920910414],
     ['XGBRegressor', 0.9657054128131645],
     ['MLPRegressor', -0.2550884048482209]]
    error_score)
```

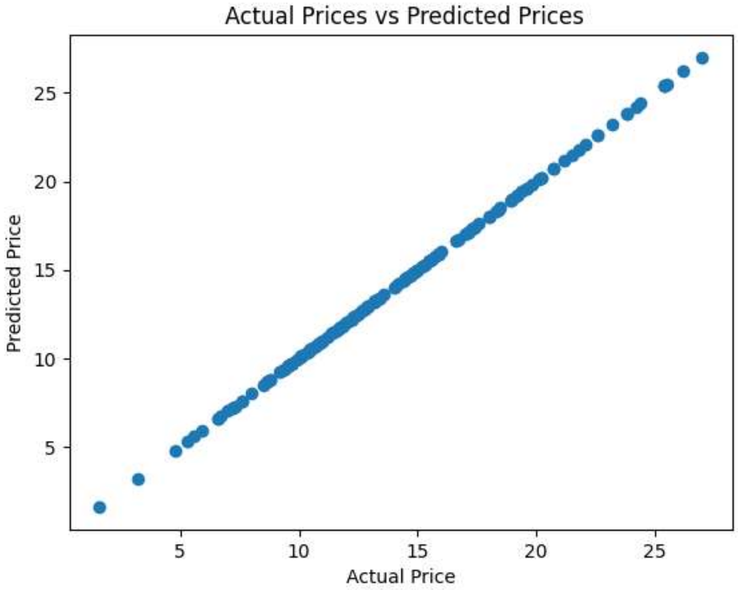
```
max_score = max(models_score, key=lambda x: x[1])

print("Model with the highest score:", max_score[0])
print("Highest score:", max_score[1])
```

```
    Model with the highest score: RandomForestRegressor
    Highest score: 0.9726076920910414
    It is very likely that your model is misconfigured.
```

```
xgbr.fit(X_train,y_train)
training_data_prediction = xgbr.predict(X_train)
```

```
    Traceback (most recent call last):
```

```
plt.scatter(y_train, training_data_prediction)
plt.xlabel("Actual Price")
plt.ylabel("Predicted Price")
plt.title(" Actual Prices vs Predicted Prices")
plt.show()
```



```
import random
```

```
df['Total'] = df['Newspaper']+ df['TV'] + df['Radio']
```

```
df
```

	Unnamed: 0	TV	Radio	Newspaper	Sales	Total
0	1	230.1	37.8	69.2	22.1	337.1
1	2	44.5	39.3	45.1	10.4	128.9
2	3	17.2	45.9	69.3	9.3	132.4
3	4	151.5	41.3	58.5	18.5	251.3
4	5	180.8	10.8	58.4	12.9	250.0
...	...	...	...	...	...	...
195	196	38.2	3.7	13.8	7.6	55.7
196	197	94.2	4.9	8.1	9.7	107.2
197	198	177.0	9.3	6.4	12.8	192.7
198	199	283.6	42.0	66.2	25.5	391.8
199	200	232.1	8.6	8.7	13.4	249.4

200 rows × 6 columns

```
random.seed(42)  # Setting a seed for reproducibility
sample_data = df[['TV', 'Radio', 'Newspaper']].sample(5)
```

```
rfr.fit(X_train,y_train)
training_data_prediction = rfr.predict(sample_data)
```

```
training_data_prediction
```

```
array([12.202, 16.33 , 14.797,  9.691,  9.312])
```