In [52]:

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
from sklearn.model_selection import train_test_split
from xgboost import XGBRegressor
from sklearn import metrics
import warnings
warnings.filterwarnings("ignore", category=FutureWarning)
```

In [4]:

```
# loading data from csv file
sales_data = pd.read_csv(r"D:\study\datasets\advertising.csv")
```

In [5]:

```
# first 5 rows
sales_data.head()
```

Out[5]:

	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	12.0
3	151.5	41.3	58.5	16.5
4	180.8	10.8	58.4	17.9

In [7]:

```
sales_data.shape
```

Out[7]:

```
(200, 4)
```

In [8]:

```
# getting info info about dataset
sales_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 4 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   TV         200 non-null    float64
 1   Radio      200 non-null    float64
 2   Newspaper  200 non-null    float64
 3   Sales      200 non-null    float64
dtypes: float64(4)
memory usage: 6.4 KB
```

In [10]:

```
# checking for null values
sales_data.isnull().sum()
```

Out[10]:

```
TV           0
Radio        0
Newspaper    0
Sales        0
dtype: int64
```

In [12]:

```
# describing data
sales_data.describe()
```

Out[12]:

	TV	Radio	Newspaper	Sales
count	200.000000	200.000000	200.000000	200.000000
mean	147.042500	23.264000	30.554000	15.130500
std	85.854236	14.846809	21.778621	5.283892
min	0.700000	0.000000	0.300000	1.600000
25%	74.375000	9.975000	12.750000	11.000000
50%	149.750000	22.900000	25.750000	16.000000
75%	218.825000	36.525000	45.100000	19.050000
max	296.400000	49.600000	114.000000	27.000000

Average expense spend is lowest on radio

Average expense spend is highest on tv

Max sales is 27 and min is 1.6

In [13]:

```
import plotly.express as px
```

Scatter plot

In [53]:

```
# scatter plot
px.scatter_matrix(sales_data,["TV","Radio","Newspaper","Sales"])
```

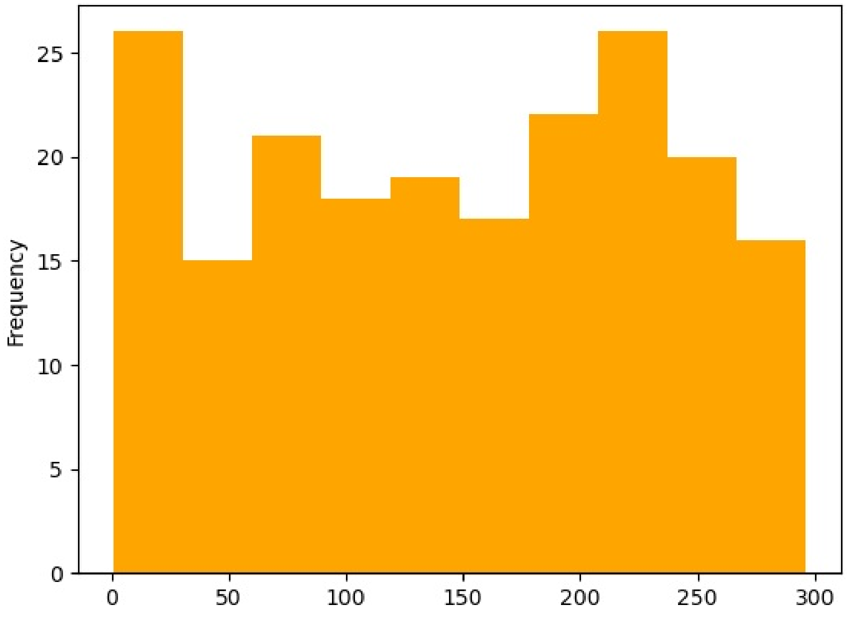
Histrogram plot

In [22]:

```
sales_data['TV'].plot.hist(bins=10, color='orange', xlabel ='TV')
```

Out[22]:

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

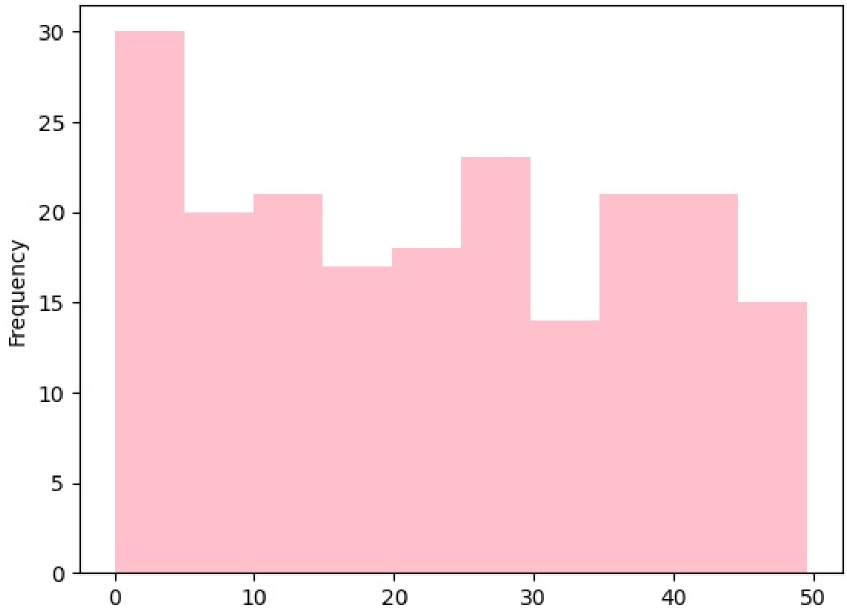


In [26]:

```
sales_data['Radio'].plot.hist(bins=10, color='pink', xlabel ='Radio')
```

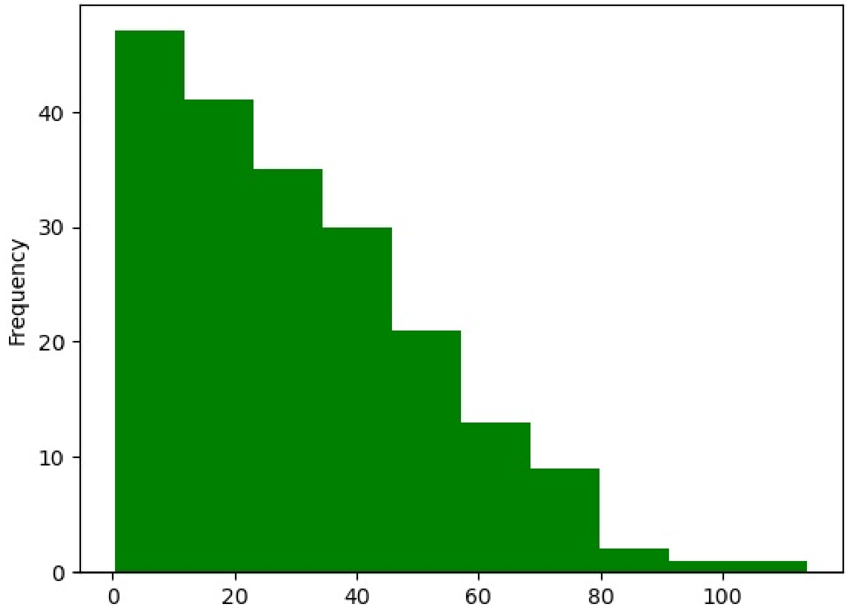
Out[26]:

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



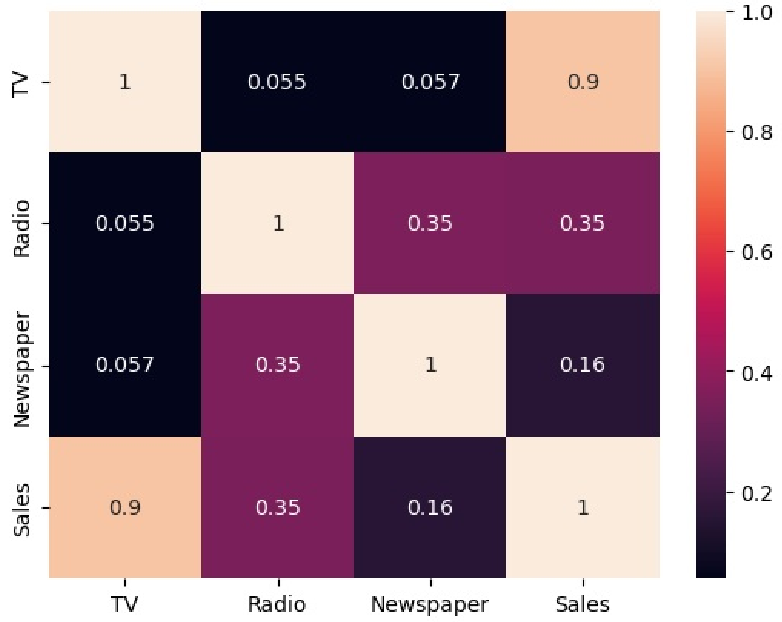
In [24]:
```
sales_data['Newspaper'].plot.hist(bins=10, color='green', xlabel ='Newspaper')
```

Out[24]:
```
<Axes: ylabel='Frequency'>
```



Heatmap of correlation

In [28]:
```
sns.heatmap(sales_data.corr(), annot = True)
plt.show()
```



sales is highly correlated to tv

In [31]:

```
data1 = sales_data.copy()
```

In [34]:

```
from scipy import stats
```

In [35]:

```
# Scaling
for i in data1.columns:
    data1[i]=stats.zscore(data1[i])
```

Train test split

In [37]:

```
x= data1.drop('Sales',axis=1)
y=data1['Sales']
```

In [38]:

```
x_train, x_test, y_train, y_test = train_test_split(x,y, test_size=0.2)
```

Model evaluation

In [43]:

```
# predict target for test data
linear_model = LinearRegression()
linear_model.fit(x_train, y_train)
y_pred = linear_model.predict(x_test)
```

In [49]:

```
# root mean squared error
mean_squared_error(y_test,y_pred)**0.5
```

Out[49]:

```
0.264326208524069
```

In [51]:

```
# r2 value
r2_score(y_test, y_pred)
```

Out[51]:

```
0.9460777438143407
```

Concluding that the above mentioned solution is successfully able to predict sales using advertissement dataset

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