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

```
# reading the excel dataset into the Jupyter notebook
df= pd.read_excel(r'C:\Users\user\Downloads\HNG\marketing_campaign_dataset.xlsx')
```

```
# checking out the dataset
# checking out the first 5 rows
df.head()
```

	Campaign_ID	Company	Campaign_Type	Target_Audience	Duration	Channel_Used	Conversion_Rate	Acquisition_Cost	ROI	Location	Date	Clicks	Impr
0	1	Innovate Industries	Email	Men 18-24	30 days	Google Ads	0.04	16174	6.29	Chicago	2021-01-01 00:00:00	506	
1	2	NexGen Systems	Email	Women 35-44	60 days	Google Ads	0.12	11566	5.61	New York	2021-02-01 00:00:00	116	
2	3	Alpha Innovations	Influencer	Men 25-34	30 days	YouTube	0.07	10200	7.18	Los Angeles	2021-03-01 00:00:00	584	
3	4	DataTech Solutions	Display	All Ages	60 days	YouTube	0.11	12724	5.55	Miami	2021-04-01 00:00:00	217	
4	5	NexGen Systems	Email	Men 25-34	15 days	YouTube	0.05	16452	6.50	Los Angeles	2021-05-01 00:00:00	379	

```
# information about the dataset
# total rows = 200005
# total columns = 15
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200005 entries, 0 to 200004
Data columns (total 15 columns):
 #   Column            Non-Null Count   Dtype
---  ------            --------------   -----
 0   Campaign_ID       200005 non-null  int64
 1   Company           200005 non-null  object
```

```
 2   Campaign_Type     200005 non-null  object
 3   Target_Audience   200005 non-null  object
 4   Duration          200005 non-null  object
 5   Channel_Used      200005 non-null  object
 6   Conversion_Rate   200005 non-null  float64
 7   Acquisition_Cost  200005 non-null  int64
 8   ROI               200005 non-null  float64
 9   Location          200005 non-null  object
 10  Date              200005 non-null  object
 11  Clicks            200005 non-null  int64
 12  Impressions       200005 non-null  int64
 13  Engagement_Score  200005 non-null  int64
 14  Customer_Segment  200005 non-null  object
dtypes: float64(2), int64(5), object(8)
memory usage: 22.9+ MB
```

```
# checking the descriptive statisitics of the data frame
df.describe()
```

	Campaign_ID	Conversion_Rate	Acquisition_Cost	ROI	Clicks	Impressions	Engagement_Score
count	200005.000000	200005.000000	200005.000000	200005.000000	200005.000000	200005.000000	200005.000000
mean	100003.000000	0.080069	12504.441794	5.002416	549.774591	5507.307107	5.494673
std	57736.614632	0.040602	4337.663210	1.734485	260.019354	2596.863794	2.872593
min	1.000000	0.010000	5000.000000	2.000000	100.000000	1000.000000	1.000000
25%	50002.000000	0.050000	8740.000000	3.500000	325.000000	3266.000000	3.000000
50%	100003.000000	0.080000	12497.000000	5.010000	550.000000	5518.000000	5.000000
75%	150004.000000	0.120000	16264.000000	6.510000	775.000000	7753.000000	8.000000
max	200005.000000	0.150000	20000.000000	8.000000	1000.000000	10000.000000	10.000000

```
# All the column names
df.columns
```

```
Index(['Campaign_ID', 'Company', 'Campaign_Type', 'Target_Audience',
       'Duration', 'Channel_Used', 'Conversion_Rate', 'Acquisition_Cost',
       'ROI', 'Location', 'Date', 'Clicks', 'Impressions', 'Engagement_Score',
       'Customer_Segment'],
      dtype='object')
```

```
# changing all to column names to lower case
df.columns.str.lower()
```

```
Index(['campaign_id', 'company', 'campaign_type', 'target_audience',
       'duration', 'channel_used', 'conversion_rate', 'acquisition_cost',
```

```
       'roi', 'location', 'date', 'clicks', 'impressions', 'engagement_score',
       'customer_segment'],
      dtype='object')
```

```
# checking for rows with missing values
rows_with_missing_values = df[df.isnull().any(axis=1)]
rows_with_missing_values
```

Campaign_ID	Company	Campaign_Type	Target_Audience	Duration	Channel_Used	Conversion_Rate	Acquisition_Cost	ROI	Location	Date	Clicks	Impressions

```
# finding the total number of with missing values
# This means there are no missing values in the data set
num_rows_with_missing_values = df[df.isnull().any(axis=1)].sum()
num_rows_with_missing_values
```

```
Campaign_ID           0
Company               0
Campaign_Type         0
Target_Audience       0
Duration              0
Channel_Used          0
Conversion_Rate     0.0
Acquisition_Cost      0
ROI                 0.0
Location              0
Date                  0
Clicks                0
Impressions           0
Engagement_Score      0
Customer_Segment      0
dtype: object
```

```
# checking for basic statistics (mean, median, standard deviation).
# in these columns:  ROI, Click-Through Rate (CTR), Cost Per Click (CPC), and Conversion Rate
df[['Conversion_Rate', 'Clicks','ROI','Acquisition_Cost']].agg(['mean', 'median', 'std'])
```

	Conversion_Rate	Clicks	ROI	Acquisition_Cost
mean	0.080069	549.774591	5.002416	12504.441794
median	0.080000	550.000000	5.010000	12497.000000
std	0.040602	260.019354	1.734485	4337.663210

```
# checking if all the IDS are unique
df['Campaign_ID'].unique()
```

```
array([     1,      2,      3, ..., 200003, 200004, 200005], dtype=int64)
```

```
# checking for the unique target audience
df['Target_Audience'].unique()
```

```
array(['Men 18-24', 'Women 35-44', 'Men 25-34', 'All Ages', 'Women 25-34'],
      dtype=object)
```

```
# checking for the unique marketing channels
df['Channel_Used'].unique()
```

```
array(['Google Ads', 'YouTube', 'Instagram', 'Website', 'Facebook',
       'Email'], dtype=object)
```

```
# checking for outliers

# calculating Q1 and Q3
Q1= df[['Conversion_Rate', 'Clicks','ROI','Acquisition_Cost']]. quantile(0.25)
Q3=df[['Conversion_Rate', 'Clicks','ROI','Acquisition_Cost']]. quantile (0.75)

# calculating IQR
IQR= Q3 - Q1

# calculating lower and upper bounds
lower_bound= Q1- 1.5 * IQR
upper_bound= Q3 + 1.5 *IQR


# Create a DataFrame to hold outlier information
outliers = pd.DataFrame()

# Check for outliers in each column
for column in ['Conversion_Rate', 'Clicks', 'ROI', 'Acquisition_Cost']:
    outlier_condition = (df[column] < lower_bound[column]) | (df[column] > upper_bound[column])
    outliers[column] = df[outlier_condition][column]

# Display the outliers
print("Outliers detected in the dataset:")
print(outliers)
```

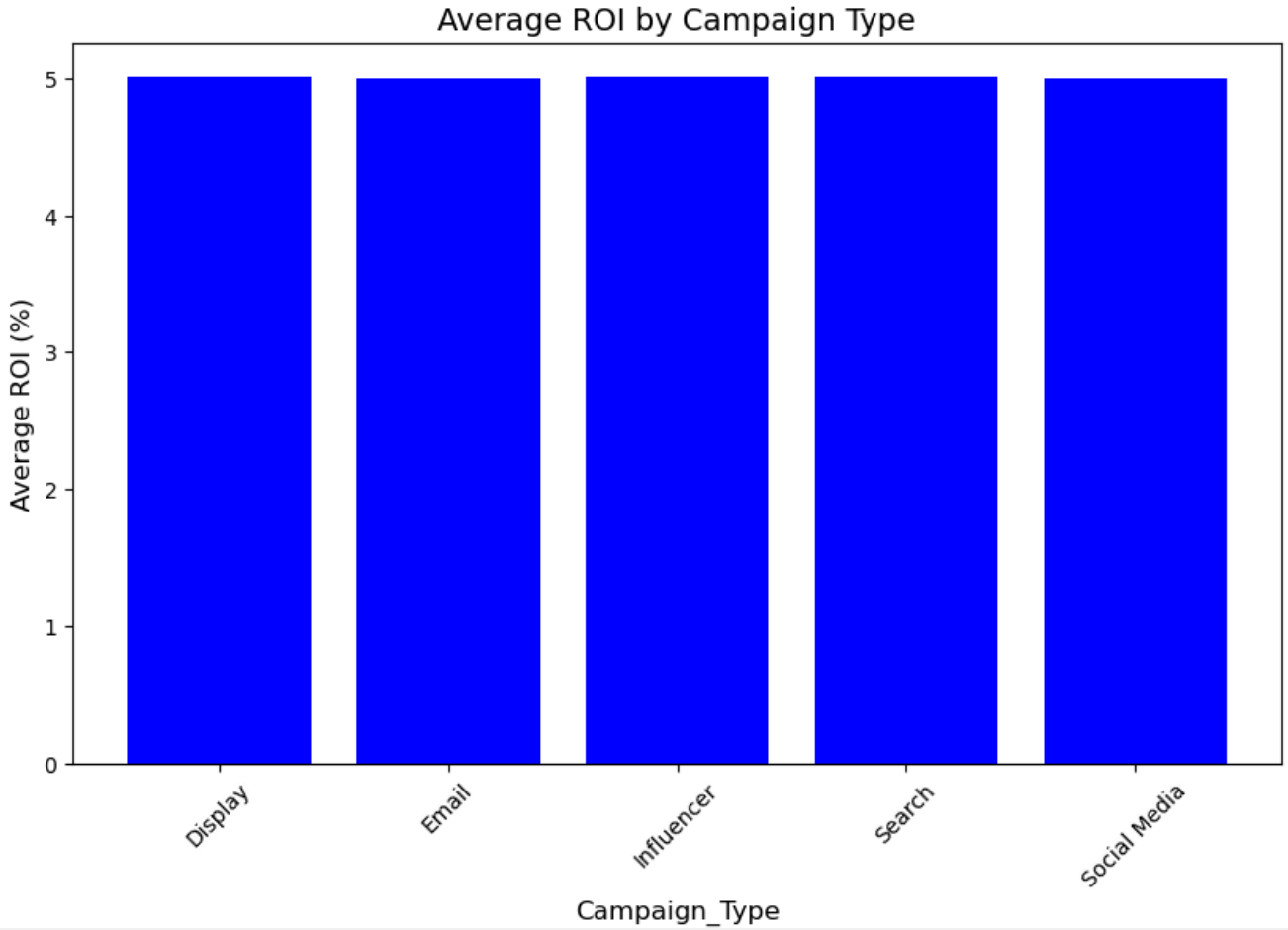
```
Outliers detected in the dataset:
Empty DataFrame
Columns: [Conversion_Rate, Clicks, ROI, Acquisition_Cost]
Index: []
```

```
# Comparing campaign success among different channels
Avg_roi_per_campaign_type=df.groupby('Campaign_Type')['ROI'].mean().reset_index()
```

```
Avg_roi_per_campaign_type
```

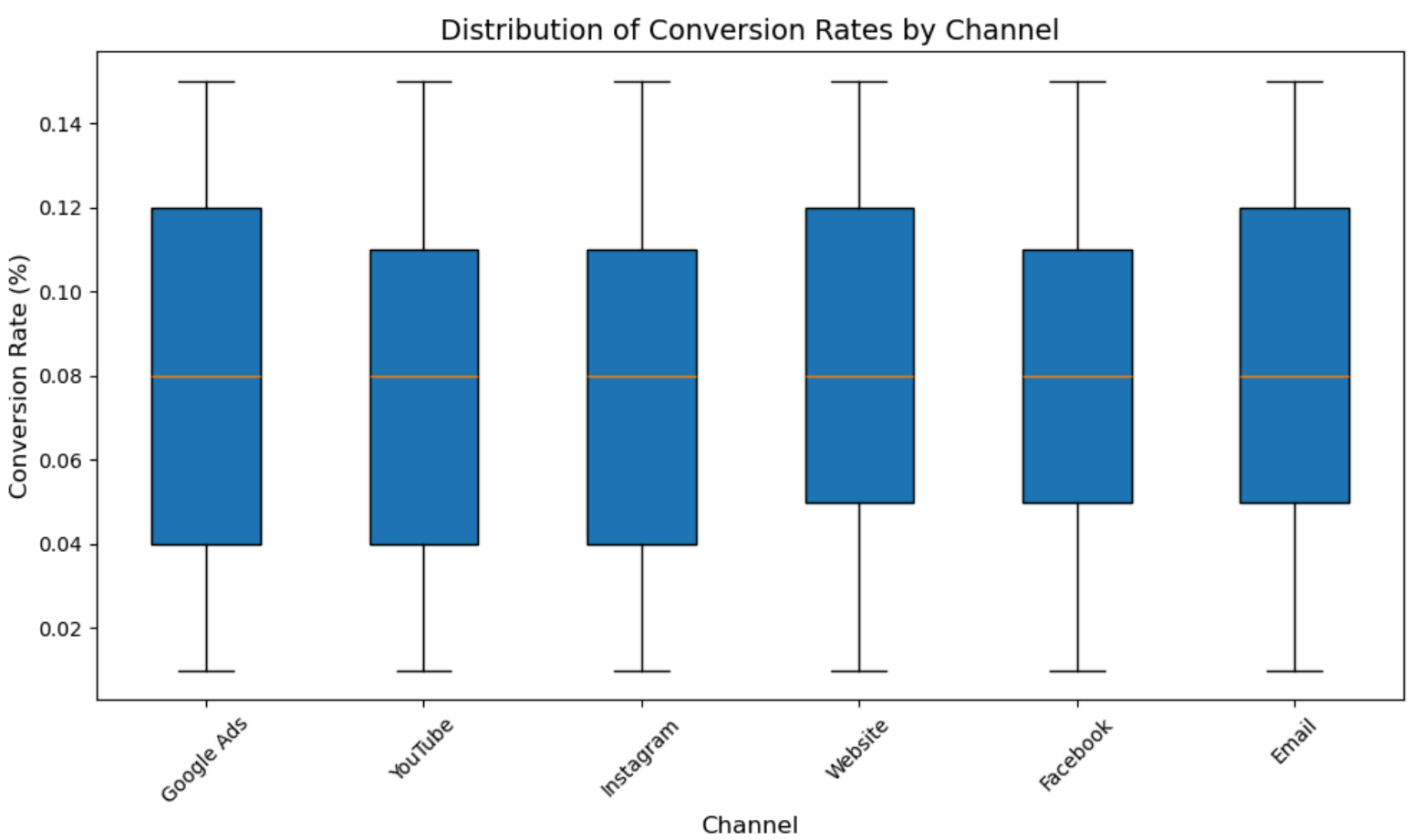
	Campaign_Type	ROI
0	Display	5.006497
1	Email	4.994274
2	Influencer	5.011040
3	Search	5.008357
4	Social Media	4.991781

```
# Creating a bar chart
plt.figure(figsize=(10, 6))
plt.bar(Avg_roi_per_campaign_type['Campaign_Type'], Avg_roi_per_campaign_type['ROI'], color='blue')

plt.title('Average ROI by Campaign Type', fontsize=14)
plt.xlabel('Campaign_Type', fontsize=12)
plt.ylabel('Average ROI (%)', fontsize=12)
plt.xticks(rotation=45)  # Rotate x-axis labels for readability

plt.show()
```




```
# Comparing campaign success among different channels
# Boxplot (distribution of conversion rates)
plt.figure(figsize=(10, 6))

# Group data by channel
channels = df['Channel_Used'].unique()
data_to_plot = [df[df['Channel_Used'] == channel]['Conversion_Rate'] for channel in channels]

# Create the boxplot
plt.boxplot(data_to_plot, labels=channels, patch_artist=True)

# Customize
plt.title('Distribution of Conversion Rates by Channel', fontsize=14)
plt.xlabel('Channel', fontsize=12)
plt.ylabel('Conversion Rate (%)', fontsize=12)
```

```
plt.xticks(rotation=45)  # Rotate x-axis labels

plt.tight_layout()
plt.show()
```



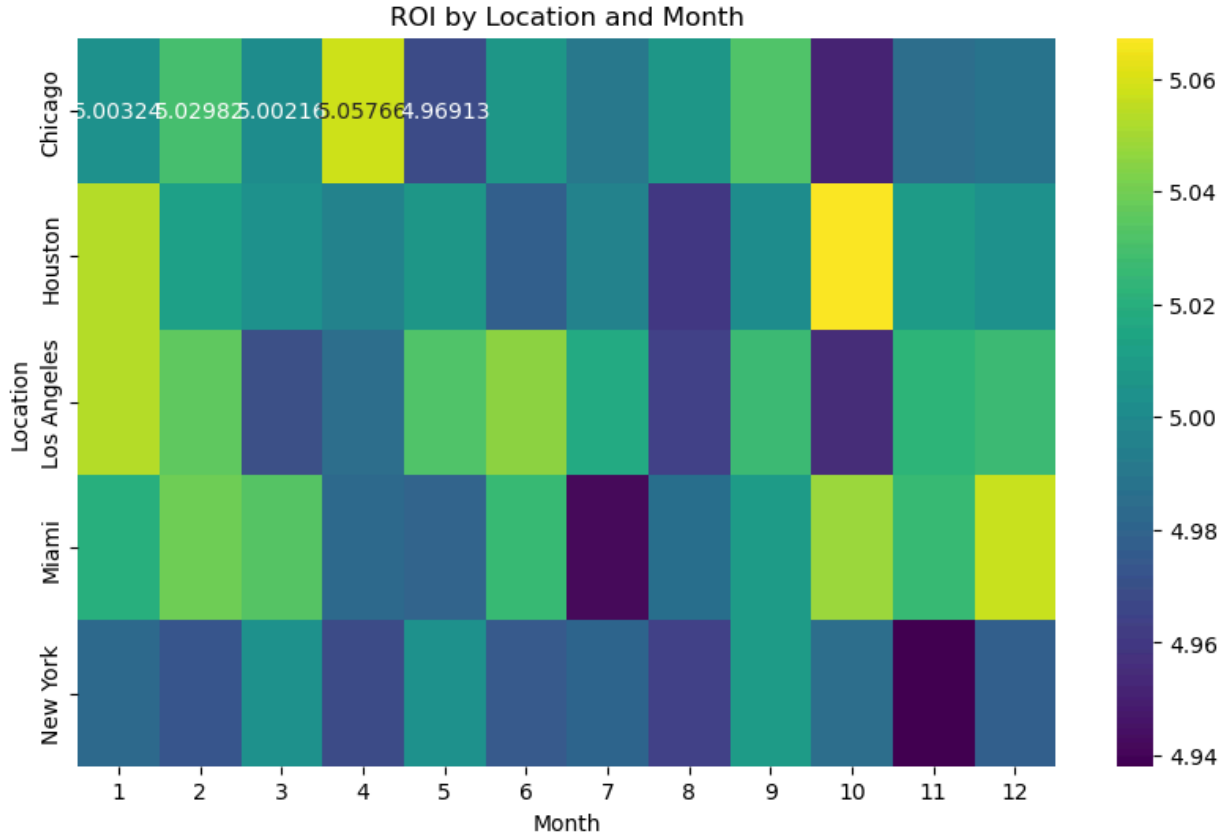

```
#converting the date column
df['Date'] = pd.to_datetime(df['Date'])
#creating a new column extracting month from the date columnn
df['Month'] = df['Date'].dt.month
```

```
# Define month order
#month_order = ['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun', 'Jul', 'Aug', 'Sep', 'Oct', 'Nov', 'Dec']
#df['Month'] = pd.Categorical(df['Month'], categories=month_order, ordered=True)
#df = df.sort_values('Month')  # Sort by month
```

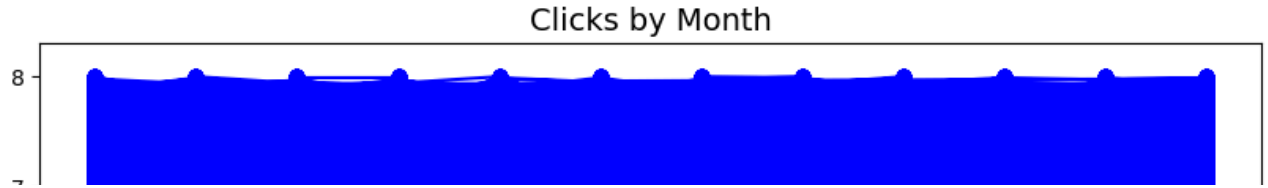
```
# Pivot the data to create a matrix (Location vs. Month)
pivot_table = df.pivot_table(
    index='Location',
    columns='Month',
    values='ROI',
    aggfunc='mean'  # Use mean, sum, etc., depending on your goal
)

print(pivot_table)
```

```
Month              1         2         3         4         5         6   \
Location
Chicago      5.003244  5.029822  5.002158  5.057663  4.969126  5.006608
Houston      5.053001  5.011477  5.003168  4.995567  5.007462  4.976992
Los Angeles  5.053562  5.035795  4.969784  4.985654  5.032001  5.045538
Miami        5.020341  5.038994  5.032944  4.983225  4.979425  5.026264
New York     4.981786  4.972897  5.004085  4.968962  5.004004  4.974811

Month              7         8         9         10        11        12
Location
Chicago      4.989621  5.007647  5.032198  4.951770  4.984379  4.987855
Houston      4.995830  4.959693  5.001248  5.067230  5.008882  5.003913
Los Angeles  5.017449  4.964291  5.027129  4.955186  5.022694  5.027091
Miami        4.941698  4.986892  5.010234  5.047765  5.025957  5.057136
New York     4.980123  4.964144  5.008548  4.985949  4.938112  4.978738
```

```
import matplotlib.pyplot as plt
import seaborn as sns
plt.figure(figsize=(10, 6))
sns.heatmap(pivot_table, annot=True, cmap='viridis', fmt='g')
plt.title('ROI by Location and Month')
plt.show()
```




```
plt.figure(figsize=(10, 6))  # Set figure size
plt.plot(df['Month'], df['ROI'], marker='o', linestyle='-', color='b')

# Customize the plot
plt.title('Clicks by Month', fontsize=14)
plt.xlabel('Month', fontsize=12)
plt.ylabel('Clicks', fontsize=12)

plt.xticks(rotation=45)  # Rotate x-axis labels for readability

# Show the plot

plt.show()
```


Clicks by Month
8