Cohort analysis

Cohort analysis allows businesses to gain a deeper understanding of their customers by tracking their behavior over a period of time. This can help you identify patterns and trends that may not be immediately apparent from looking at vanity metrics.

Load Dataframe

In [31]:

```
import pandas as pd

data=pd.read_csv("cohorts.csv")
```

Explore Dataframe

In [32]:

```
data.head(5)
```

Out[32]:

	Date	New users	Returning users	Duration Day 1	Duration Day 7
0	25/10/2023	3461	1437	202.156977	162.523809
1	26/10/2023	3777	1554	228.631944	258.147059
2	27/10/2023	3100	1288	227.185841	233.550000
3	28/10/2023	2293	978	261.079545	167.357143
4	29/10/2023	2678	1082	182.567568	304.350000

In [33]:

```
data.shape
```

Out[33]:

```
(30, 5)
```

In [34]:

```
data.describe()
```

Out[34]:

	New users	Returning users	Duration Day 1	Duration Day 7
count	30.000000	30.000000	30.000000	30.000000
mean	3418.166667	1352.866667	208.259594	136.037157
std	677.407486	246.793189	64.730830	96.624319
min	1929.000000	784.000000	59.047619	0.000000
25%	3069.000000	1131.500000	182.974287	68.488971
50%	3514.500000	1388.000000	206.356554	146.381667
75%	3829.500000	1543.750000	230.671046	220.021875
max	4790.000000	1766.000000	445.872340	304.350000

In [35]:

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 30 entries, 0 to 29
Data columns (total 5 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   Date              30 non-null     object 
 1   New users         30 non-null     int64  
 2   Returning users   30 non-null     int64  
 3   Duration Day 1    30 non-null     float64
 4   Duration Day 7    30 non-null     float64
dtypes: float64(2), int64(2), object(1)
memory usage: 1.3+ KB
```

Correct the datatype of the column

In [36]:

```
data.Date=pd.to_datetime(data.Date) #datatype of date converted to d
```

```
C:\Users\Banu\AppData\Local\Temp\ipykernel_49172\1844708294.py:1: UserWarning: Parsing da
tes in DD/MM/YYYY format when dayfirst=False (the default) was specified. This may lead t
o inconsistently parsed dates! Specify a format to ensure consistent parsing.
  data.Date=pd.to_datetime(data.Date) #datatype of date converted to d
```

In [37]:

```
data.dtypes
```

Out[37]:

```
Date                 datetime64[ns]
New users                     int64
Returning users               int64
Duration Day 1              float64
Duration Day 7              float64
dtype: object
```

Check for missing data

In [38]:

```
data.isnull().sum() #no missing values
```

Out[38]:

```
Date               0
New users          0
Returning users    0
Duration Day 1     0
Duration Day 7     0
dtype: int64
```

Check for duplicate rows

In [39]:

```
duplicates=data.duplicated()
duplicates
```

Out[39]:

```
0     False
1     False
2     False
3     False
4     False
5     False
```

```
6      False
7      False
8      False
9      False
10     False
11     False
12     False
13     False
14     False
15     False
16     False
17     False
18     False
19     False
20     False
21     False
22     False
23     False
24     False
25     False
26     False
27     False
28     False
29     False
dtype: bool
```

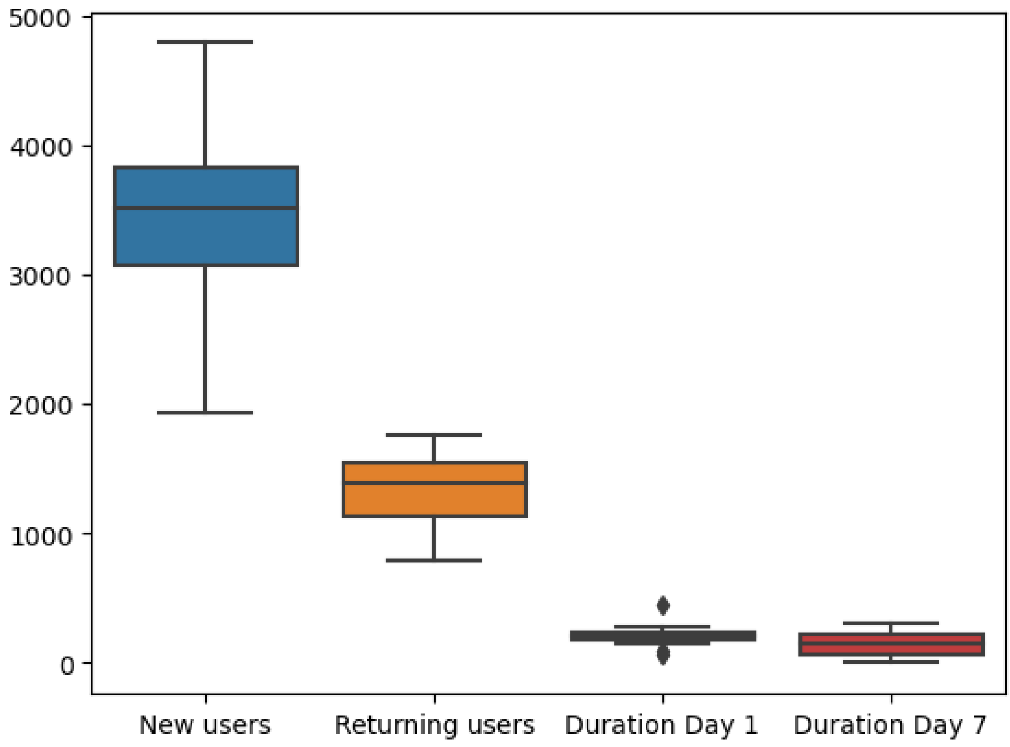
Check for Outliers

In [40]:

```
import seaborn as sns
sns.boxplot(data)
```

Out[40]:

```
<Axes: >
```



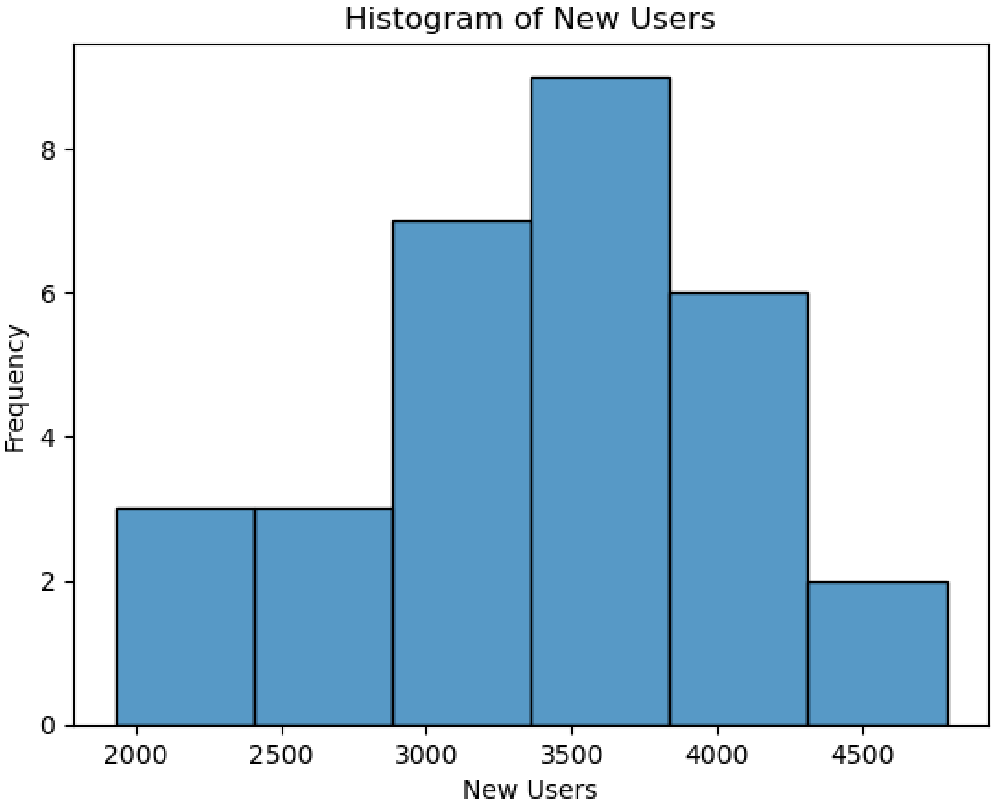
Interpretation of the box plot

Median of 'New users' and 'Returning users' are significantly different from each other

In [41]:

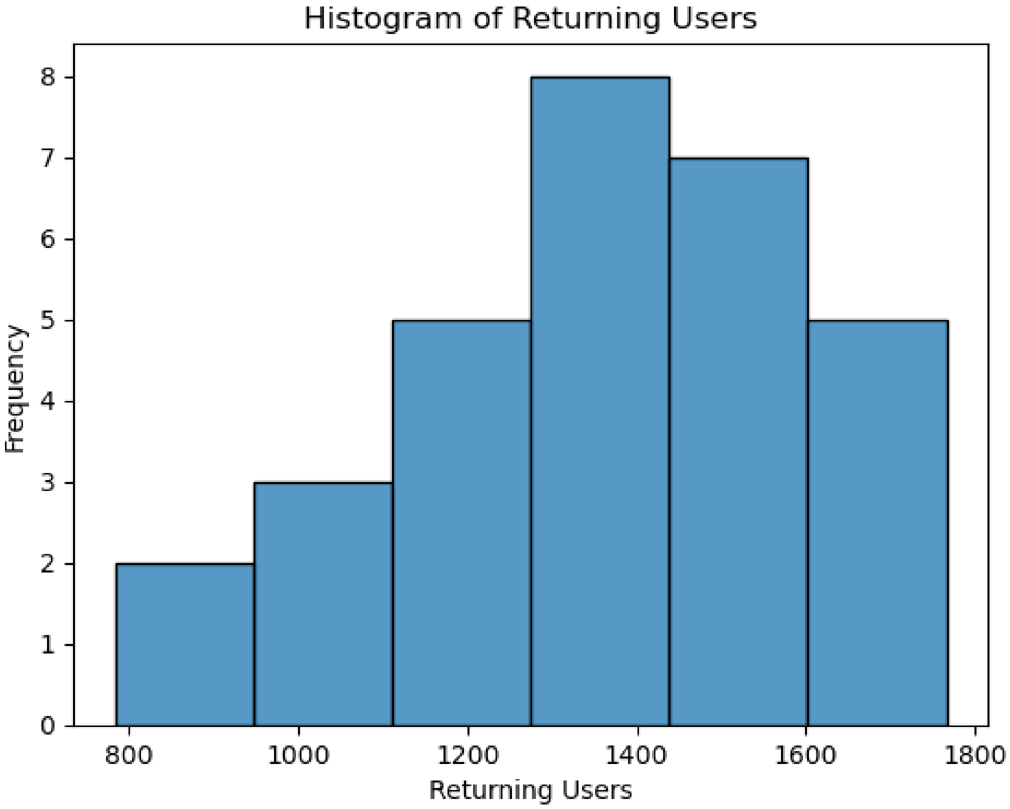
```
import matplotlib.pyplot as plt
```

```python
sns.histplot(data['New users'])
plt.title('Histogram of New Users')
plt.xlabel('New Users')
plt.ylabel('Frequency')
plt.show()
```



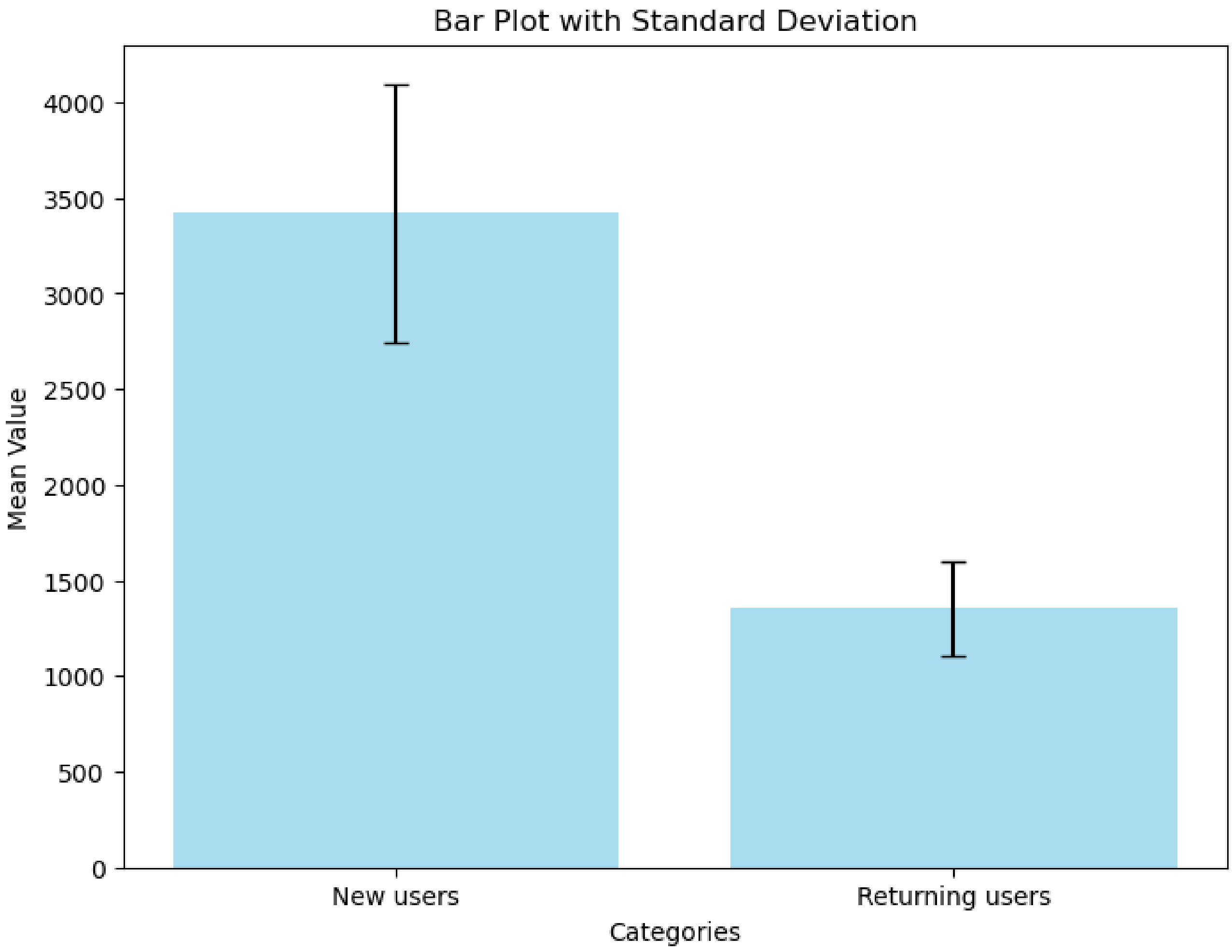
In [42]:

```python
sns.histplot(data['Returning users'])
plt.title('Histogram of Returning Users')
plt.xlabel('Returning Users')
plt.ylabel('Frequency')
plt.show()
```



In [43]:

```
import matplotlib.pyplot as plt

# Sample DataFrame
bar_data = {'Category': ['New users', 'Returning users'],
            'Mean_Value': [3418.166667, 1352.866667],
            'Std_Dev': [677.407486, 246.793189]}

df = pd.DataFrame(bar_data)

# Plotting the bar plot with standard deviation using plt.bar
plt.figure(figsize=(8, 6))
plt.bar(df['Category'], df['Mean_Value'], yerr=df['Std_Dev'], capsize=5, color='skyblue'
, alpha=0.7)

# Adding labels and title
plt.title('Bar Plot with Standard Deviation')
plt.xlabel('Categories')
plt.ylabel('Mean Value')

# Show the plot
plt.show()
```



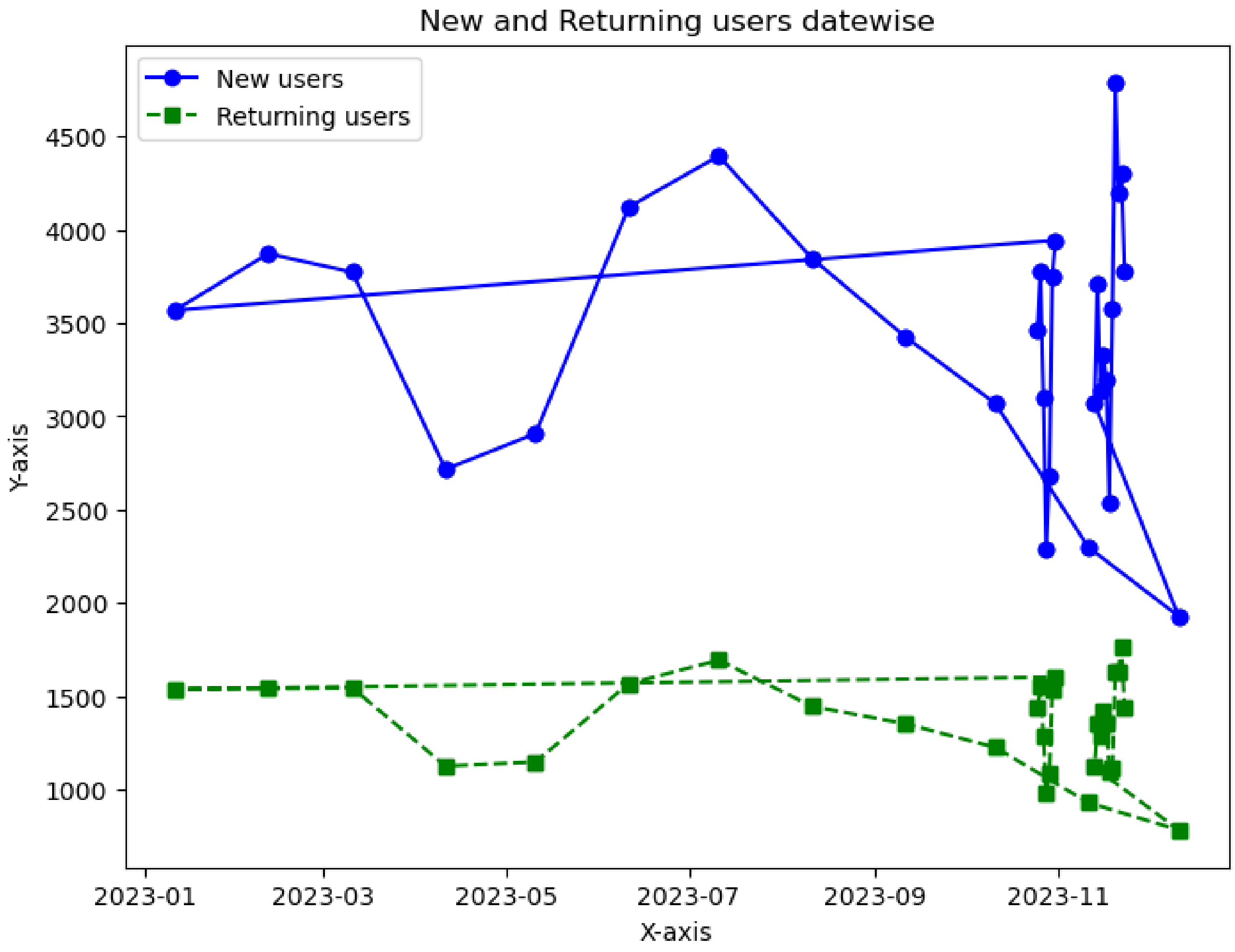
Interpretation of the bar plot

Also, Mean of 'New users' and 'Returning users' are significantly different from each other as their mean and standard deviation are not overlapping each other.

In [44]:

```
df1 = data[['Date','New users']]
df2 = data[['Date','Returning users']]

# Plotting two line plots with data points as markers
plt.figure(figsize=(8, 6))
```

```
# First line plot
plt.plot(df1['Date'], df1['New users'], marker='o', linestyle='-', color='blue', label='New users')

# Second line plot
plt.plot(df2['Date'], df2['Returning users'], marker='s', linestyle='--', color='green', label='Returning users')

# Adding labels and title
plt.title('New and Returning users datewise')
plt.xlabel('Date')
plt.ylabel('No. of users')

# Show data points with markers for both lines
plt.scatter(df1['Date'], df1['New users'], color='blue', marker='o')
plt.scatter(df2['Date'], df2['Returning users'], color='green', marker='s')

# Adding legend
plt.legend()

# Show the plot
plt.show()
```

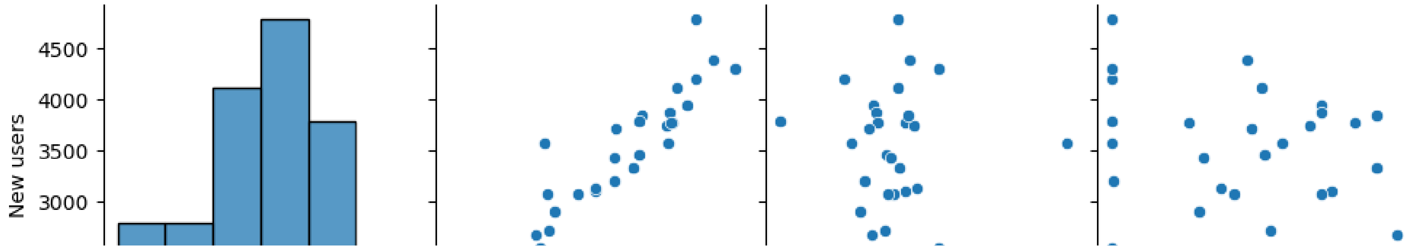


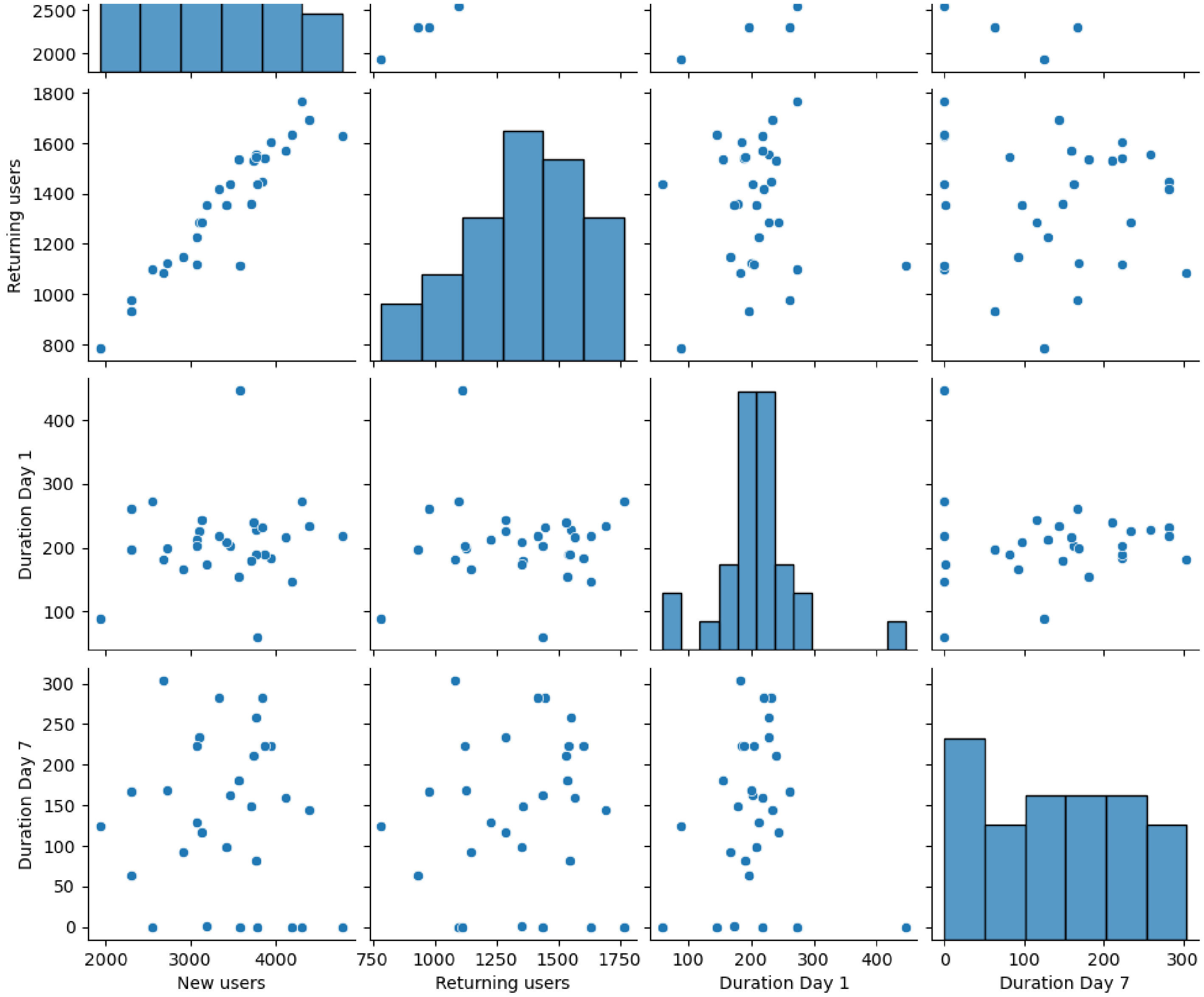
In [45]:

```
sns.pairplot(data)
```

Out[45]:

```
<seaborn.axisgrid.PairGrid at 0x1f90352d5d0>
```





In [46]:

```
data.corr()
```

```
C:\Users\Banu\AppData\Local\Temp\ipykernel_49172\2627137660.py:1: FutureWarning: The defa
ult value of numeric_only in DataFrame.corr is deprecated. In a future version, it will d
efault to False. Select only valid columns or specify the value of numeric_only to silenc
e this warning.
  data.corr()
```

Out[46]:

	New users	Returning users	Duration Day 1	Duration Day 7
New users	1.000000	0.931525	0.104128	-0.122078
Returning users	0.931525	1.000000	-0.014642	-0.018320
Duration Day 1	0.104128	-0.014642	1.000000	-0.063820
Duration Day 7	-0.122078	-0.018320	-0.063820	1.000000

Interpretation from pairplot and Correlation matrix

Positive correlation exists between New users and Returning users. This indicates a potential trend of new users converting to returning users.

Cohort analysis

Grouping the data by week and calculating the necessary averages:

In [47]:

```
data['Week'] = data['Date'].dt.isocalendar().week
```

In [48]:

```
data.head()
```

Out[48]:

	Date	New users	Returning users	Duration Day 1	Duration Day 7	Week
0	2023-10-25	3461	1437	202.156977	162.523809	43
1	2023-10-26	3777	1554	228.631944	258.147059	43
2	2023-10-27	3100	1288	227.185841	233.550000	43
3	2023-10-28	2293	978	261.079545	167.357143	43
4	2023-10-29	2678	1082	182.567568	304.350000	43

In [49]:

```
weekly_averages = data.groupby('Week').agg({'New users':'mean','Returning users': 'mean'
,
    'Duration Day 1': 'mean',
    'Duration Day 7': 'mean'
}).reset_index()
print(weekly_averages)
```

```
    Week    New users  Returning users  Duration Day 1  Duration Day 7
0      2  3568.000000          1538.00      154.312925      180.655172
1      6  3871.000000          1540.00      188.531250      223.137931
2     10  3772.000000          1545.00      189.689394       81.705882
3     15  2716.000000          1126.00      200.044643      169.000000
4     19  2907.000000          1148.00      166.305556       92.200000
5     23  4121.000000          1568.00      217.125604      159.545455
6     28  4394.000000          1693.00      233.579235      144.083333
7     32  3846.000000          1446.00      231.350746      282.500000
8     37  3426.000000          1353.00      209.083969       98.097561
9     41  3069.000000          1226.00      211.943182      129.476191
10    43  3061.800000          1267.80      220.324375      225.185602
11    44  3845.500000          1567.50      212.369200      217.181707
12    45  2298.000000           930.00      197.261905       64.083333
13    46  3222.428571          1250.00      248.123542      110.199609
14    47  4267.750000          1616.25      174.173330        0.000000
15    50  1929.000000           784.00       88.641026      124.941176
```

In [50]:

```
data= pd.DataFrame(weekly_averages)
data
```

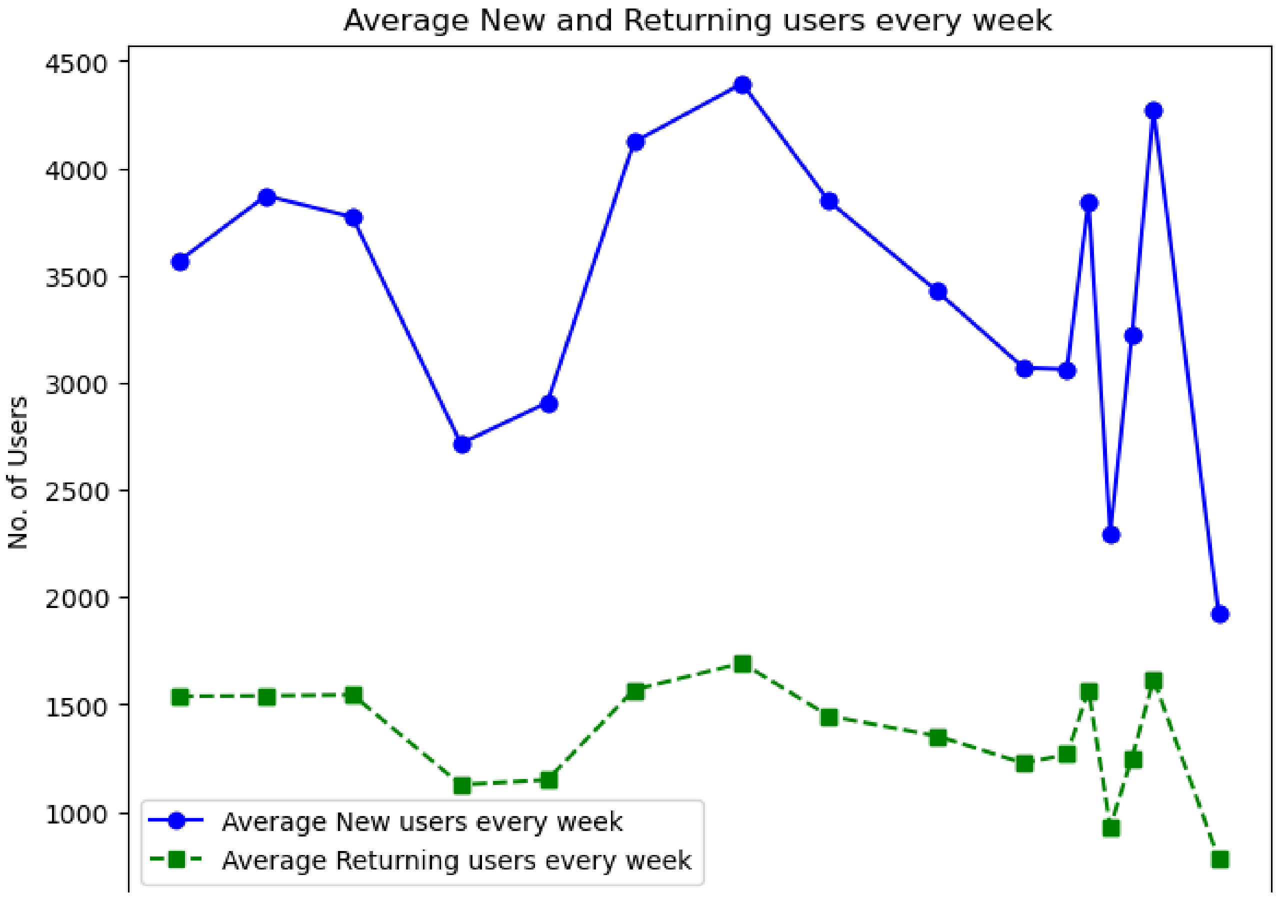
Out[50]:

	Week	New users	Returning users	Duration Day 1	Duration Day 7
0	2	3568.000000	1538.00	154.312925	180.655172
1	6	3871.000000	1540.00	188.531250	223.137931
2	10	3772.000000	1545.00	189.689394	81.705882
3	15	2716.000000	1126.00	200.044643	169.000000
4	19	2907.000000	1148.00	166.305556	92.200000
5	23	4121.000000	1568.00	217.125604	159.545455
6	28	4394.000000	1693.00	233.579235	144.083333
7	32	3846.000000	1446.00	231.350746	282.500000
8	37	3426.000000	1353.00	209.083969	98.097561

	Week	New users	Returning users	Duration Day 1	Duration Day 7
9	41	3069.000000	1226.00	211.943182	129.476191
10	43	3061.800000	1267.80	220.324375	225.185602
11	44	3845.500000	1567.50	212.369200	217.181707
12	45	2298.000000	930.00	197.261905	64.083333
13	46	3222.428571	1250.00	248.123542	110.199609
14	47	4267.750000	1616.25	174.173330	0.000000
15	50	1929.000000	784.00	88.641026	124.941176

In [53]:

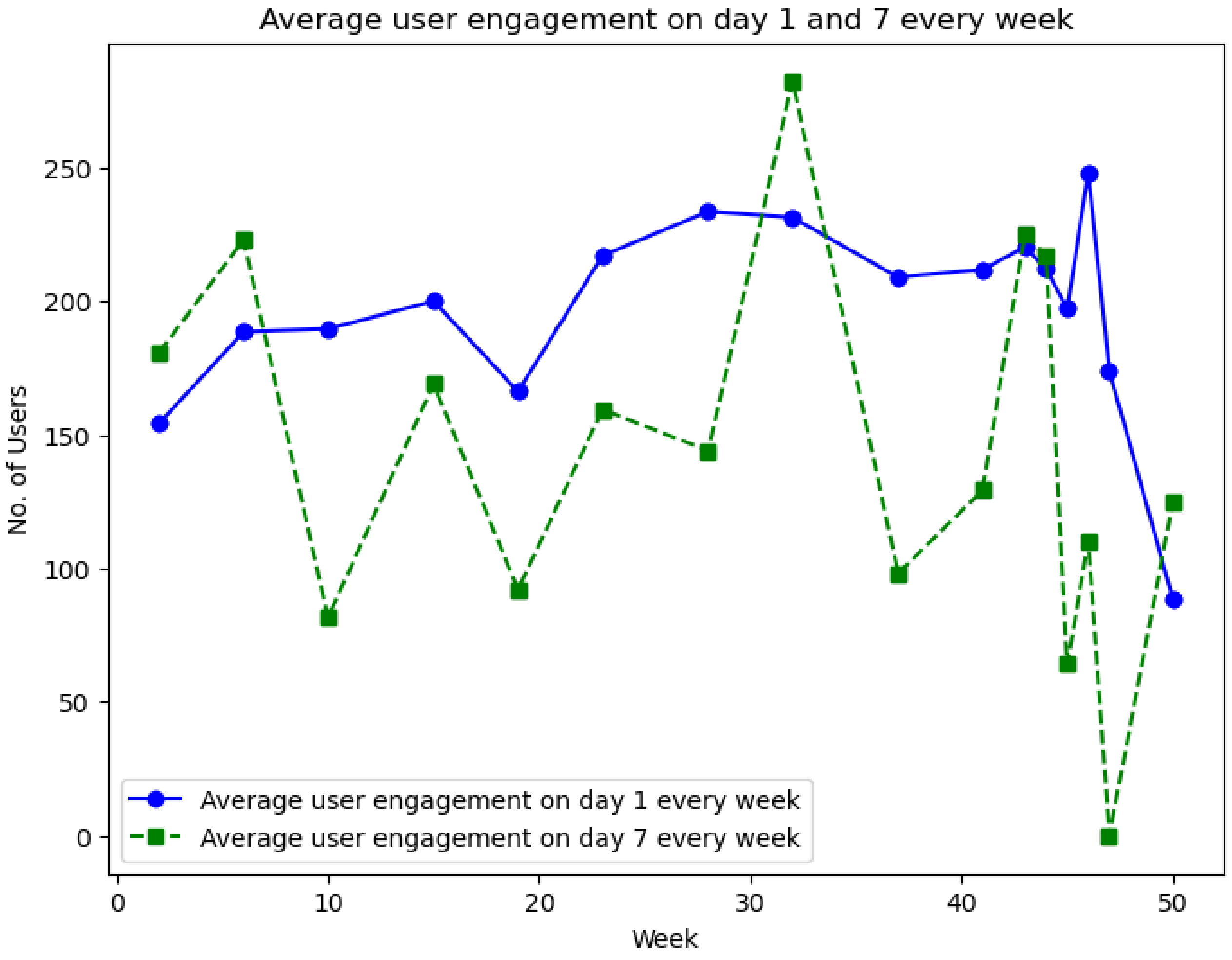
```
df3 = data[['Week','New users']]
df4 = data[['Week','Returning users']]

# Plotting two line plots with data points as markers
plt.figure(figsize=(8, 6))

# First line plot
plt.plot(df3['Week'], df3['New users'], marker='o', linestyle='-', color='blue', label='
Average New users every week')

# Second line plot
plt.plot(df4['Week'], df4['Returning users'], marker='s', linestyle='--', color='green',
label='Average Returning users every week')

# Adding labels and title
plt.title('Average New and Returning users every week')
plt.xlabel('Week')
plt.ylabel('No. of Users')

# Show data points with markers for both lines
plt.scatter(df3['Week'], df3['New users'], color='blue', marker='o')
plt.scatter(df4['Week'], df4['Returning users'], color='green', marker='s')

# Adding legend
plt.legend()

# Show the plot
plt.show()
```



Average New users was found to be significantly greater than the average returning users every week

In [56]:

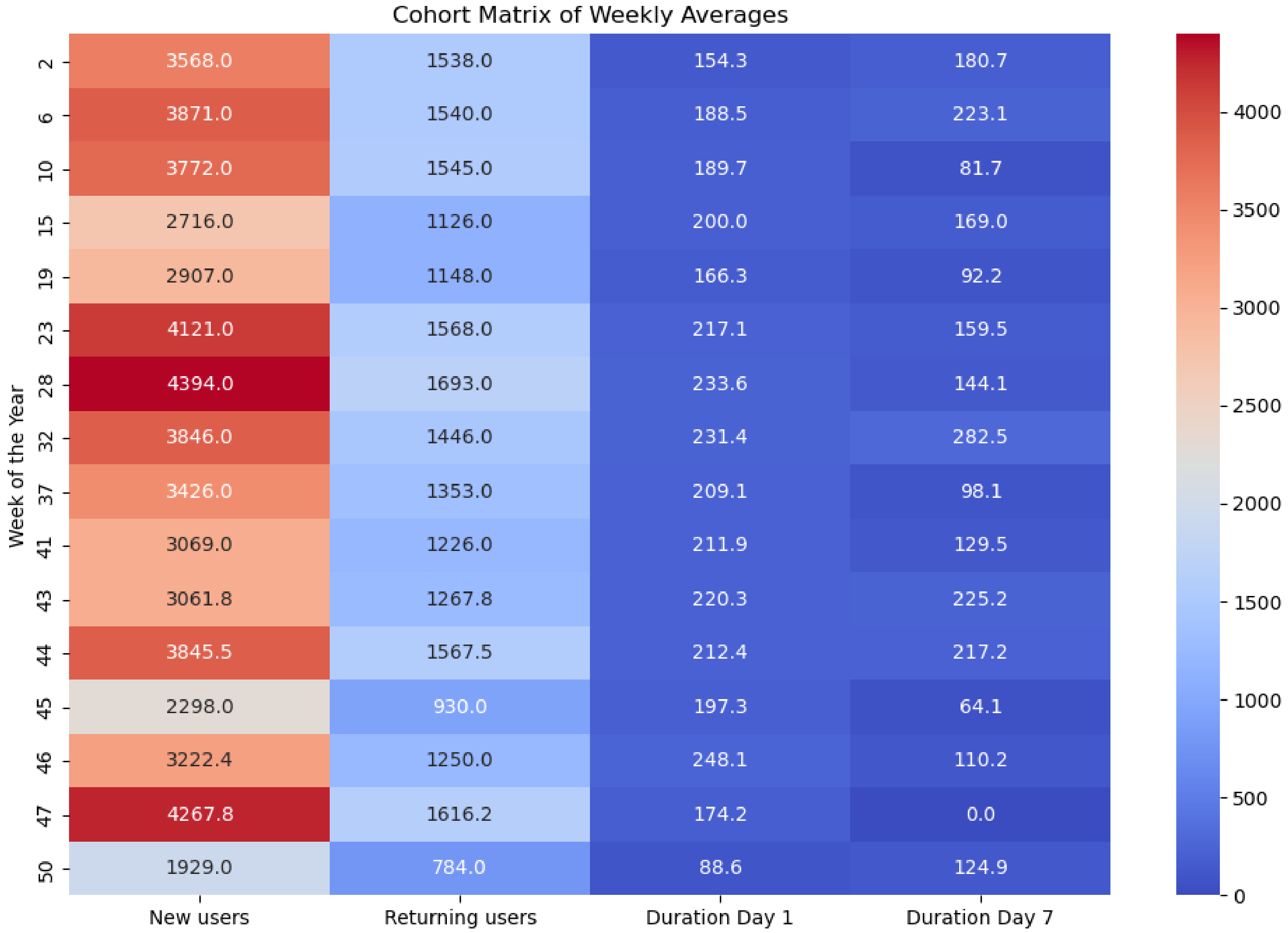
```
df5 = data[['Week','Duration Day 1']]
df6 = data[['Week','Duration Day 7']]

# Plotting two line plots with data points as markers
plt.figure(figsize=(8, 6))

# First line plot
plt.plot(df5['Week'], df5['Duration Day 1'], marker='o', linestyle='-', color='blue', lab
el='Average user engagement on day 1 every week')

# Second line plot
plt.plot(df6['Week'], df6['Duration Day 7'], marker='s', linestyle='--', color='green',
label='Average user engagement on day 7 every week')

# Adding labels and title
plt.title('Average user engagement on day 1 and 7 every week')
plt.xlabel('Week')
plt.ylabel('No. of Users')

# Show data points with markers for both lines
plt.scatter(df5['Week'], df5['Duration Day 1'], color='blue', marker='o')
plt.scatter(df6['Week'], df6['Duration Day 7'], color='green', marker='s')

# Adding legend
plt.legend()

# Show the plot
plt.show()
```



There seem to be no significant difference between the average user engagement on day 1 and day 7 when investigated across every week

In [59]:

```
cohort_matrix = weekly_averages.set_index('Week')

# Plotting the cohort matrix
plt.figure(figsize=(12, 8))

sns.heatmap(cohort_matrix, annot=True, cmap='coolwarm', fmt=".1f")
plt.title('Cohort Matrix of Weekly Averages')
plt.ylabel('Week of the Year')
plt.show()
```



Insights:

1.Average 'New users' and 'Returning users' across each day are significantly different from each other as their mean and standard deviation are not overlapping each other.
2.Positive correlation exists between New users and Returning users. This indicates a potential trend of new users converting to returning users.
3.Average New users was found to be significantly greater than the average returning users every week.
4.There seem to be no significant difference between the average user engagement on day 1 and day 7 when investigated across every week

In [ ]: