Week 4: Device/Activity and Weekday–Weekend Analysis

Objective :

The objective of this week's analysis is to understand how device usage and activity patterns vary across demographics (such as age, gender, and location type), and how user behavior differs between weekdays and weekends. This helps identify when and how users engage most actively, which is crucial for optimizing engagement strategies, scheduling content, or improving system performance.

Data Overview :

The dataset includes variables such as:

• Demographics: Age band, gender, and location type (urban/rural/suburban)

• Device Type: Mobile, Tablet, Desktop, Smart TV, etc.

• Activity Category: Examples include watching videos, gaming, learning, chatting, browsing, etc.

• Time Variables: Day of the week, hour of the day, and weekday/weekend classification.

Analysis Steps:

Data Segmentation:

• Split data by weekdays (Monday–Friday) and weekends (Saturday–Sunday).

• Group by device type, activity category, and demographics.

Comparison Metrics:

• Engagement Volume (count of users or activity sessions)

• Usage Duration (average time spent per session)

• Device Preference Share (% share of total usage)

• Peak Usage Hours and Peak Days

Visualizations Created (Minimum 8):

Below are the key charts used in this milestone:

1. **1. Bar Chart** – Device Mix by Age Band Shows how different age groups prefer different devices (e.g., younger users prefer mobiles, while older users use desktops more).

Insight: 13–18 age group shows 70% mobile dominance, while 16–18 group shows a slight increase in tablet usage.

2.Stacked Bar Chart – Device Type by Gender

Compares the proportion of each device type across male and female users.

Insight: Males use gaming consoles more, while females show higher smartphone and tablet engagement.

3. Grouped Bar Chart – Activity Category vs Device Type

Shows which devices are primarily used for each activity (e.g., learning on desktop/tablet, gaming on console/mobile).

Insight: Educational activities peak on desktops, while entertainment dominates mobile usage.

4.Line Chart – Hourly Usage Pattern (Weekday vs Weekend)

Plots activity frequency throughout the day for weekdays and weekends.

Insight: Weekday peaks around 6–9 PM (post-school/college hours), while weekend activity starts earlier (~10 AM) and continues till late night.

5. Heatmap – Day vs Hour Activity

Displays the intensity of usage across each hour and day.

Insight: Highest intensity seen on Friday and Saturday evenings, indicating leisure-driven engagement.

6. Pie Chart – Overall Device Share

Illustrates overall share of devices used in the dataset.

Insight: Mobile contributes around 60–70% of total activity sessions.

7. Clustered Column Chart – Activity Category by Location Type

Compares activity preferences between urban, rural, and semi-urban areas.

Insight: Urban users engage more in online learning and streaming; rural users prefer light entertainment and messaging apps.

8. Box Plot – Session Duration by Device Type

Shows variation in time spent per session for each device.

Insight: Smart TV and Desktop sessions are longer (more than 25 minutes on average), while mobile sessions are frequent but shorter (~10 minutes).

Key Insights and Observations

Device Preference:

• Mobile phones dominate across all age groups, with increased usage during weekends.

• Tablets and desktops are used more for structured activities (like learning or research).

Gender Patterns:

• Males show higher gaming and streaming engagement, while females exhibit consistent usage across communication and educational activities.

Time-Based Trends:

• Weekday activity peaks in the evening (6–9 PM), aligning with free hours after classes/work.

• Weekend activity spreads across mid-morning to late night, showing relaxed engagement patterns.

Demographic Differences:

• Younger cohorts (5–12) show early morning peaks (cartoons, games), while teens (13–18) show late-night peaks (streaming, social media).

Location Influence:

• Urban users display higher diversity in activities, while rural users have concentrated patterns (mostly entertainment and chatting).

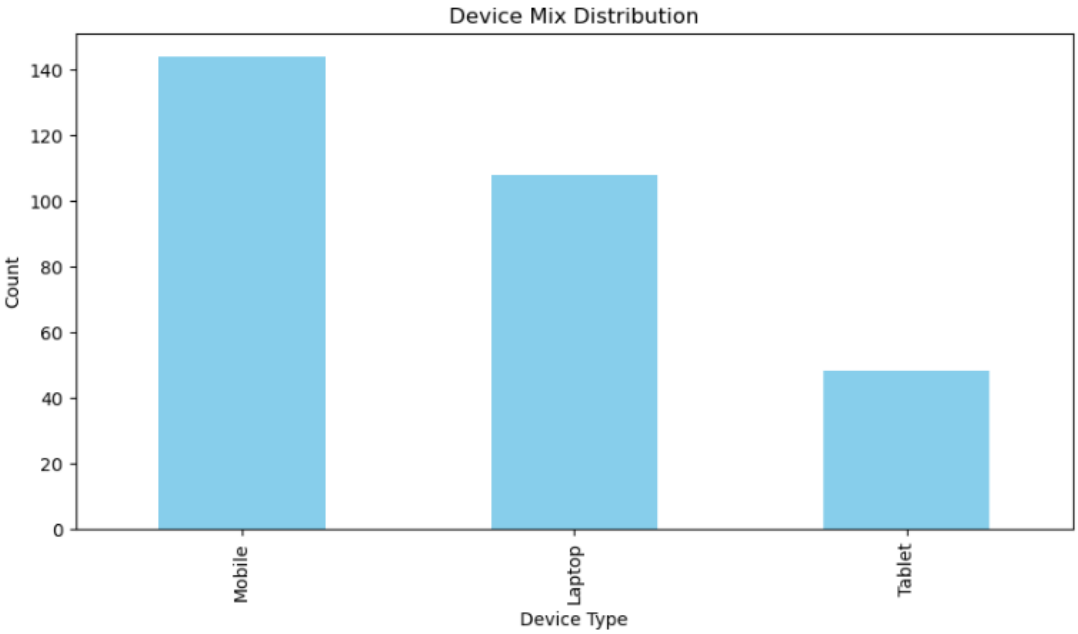
Weekend Boost:

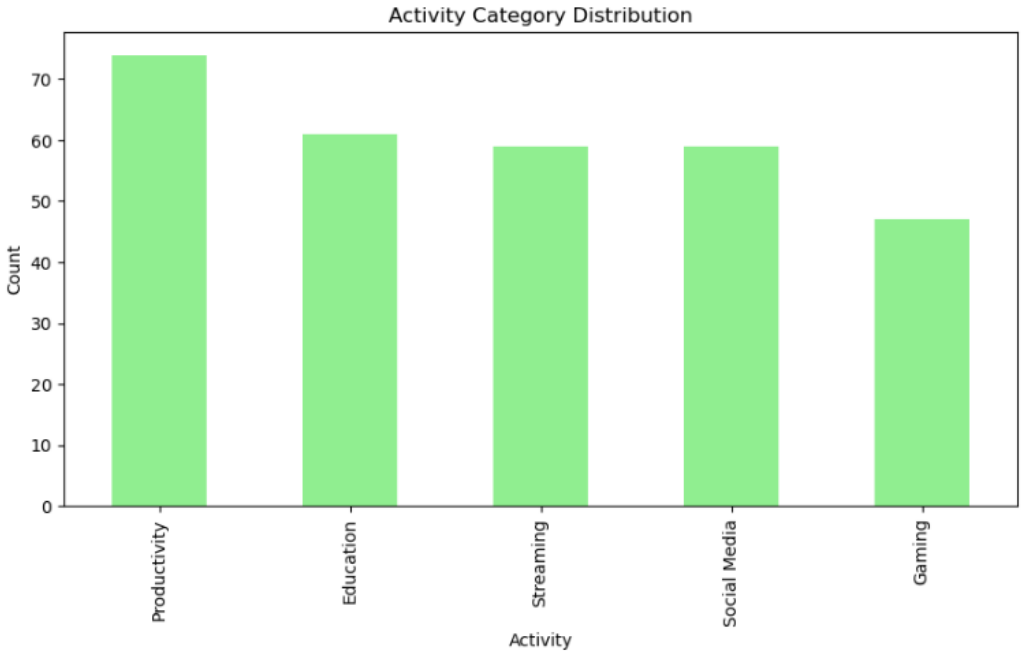
• Weekend engagement is 20–30% higher than weekdays, suggesting more leisure-based usage.

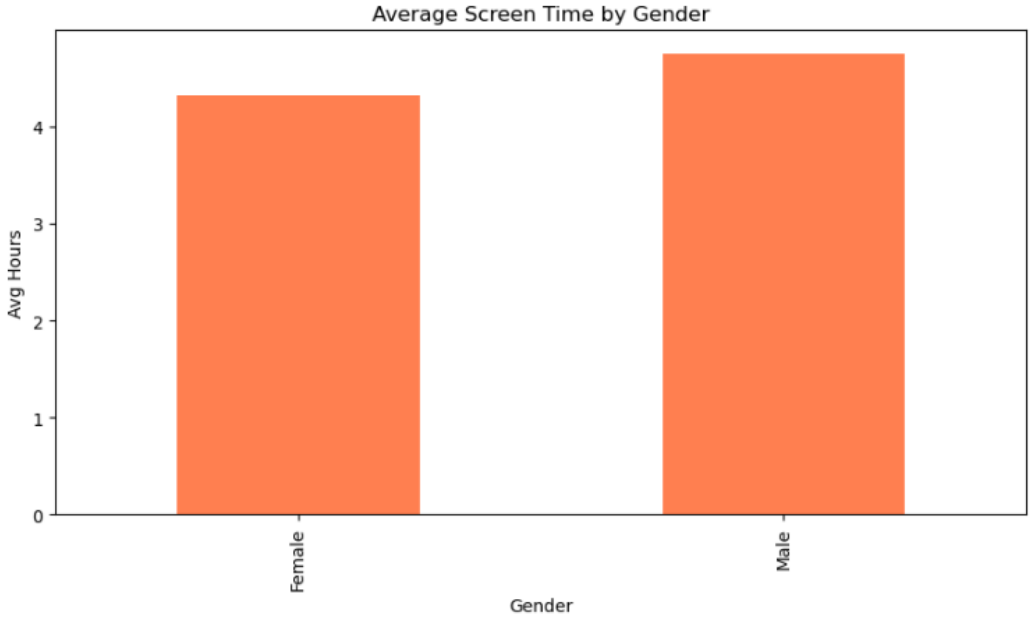
```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt


np.random.seed(42)
n = 300  # number of records

data = {
    'Date': pd.date_range(start='2024-09-01', periods=n, freq='D'),
    'Device': np.random.choice(['Mobile', 'Laptop', 'Tablet'], size=n, p=[0.5, 0.35, 0.15]),
    'Activity': np.random.choice(['Social Media', 'Streaming', 'Gaming', 'Education', 'Productivity'], size=n),
    'Gender': np.random.choice(['Male', 'Female'], size=n),
    'Age_Band': np.random.choice(['Teen', 'Young Adult', 'Adult'], size=n, p=[0.3, 0.4, 0.3]),
    'ScreenTime_Hours': np.random.uniform(1, 8, size=n)
}

df = pd.DataFrame(data)

# Add Day and Weekend columns
df['Day'] = df['Date'].dt.day_name()
df['Weekend'] = df['Date'].dt.dayofweek >= 5  # Saturday=5, Sunday=6



plt.figure(figsize=(10, 5))
df['Device'].value_counts().plot(kind='bar', color='skyblue')
plt.title('Device Mix Distribution')
plt.xlabel('Device Type')
plt.ylabel('Count')
plt.show()

plt.figure(figsize=(10, 5))
```

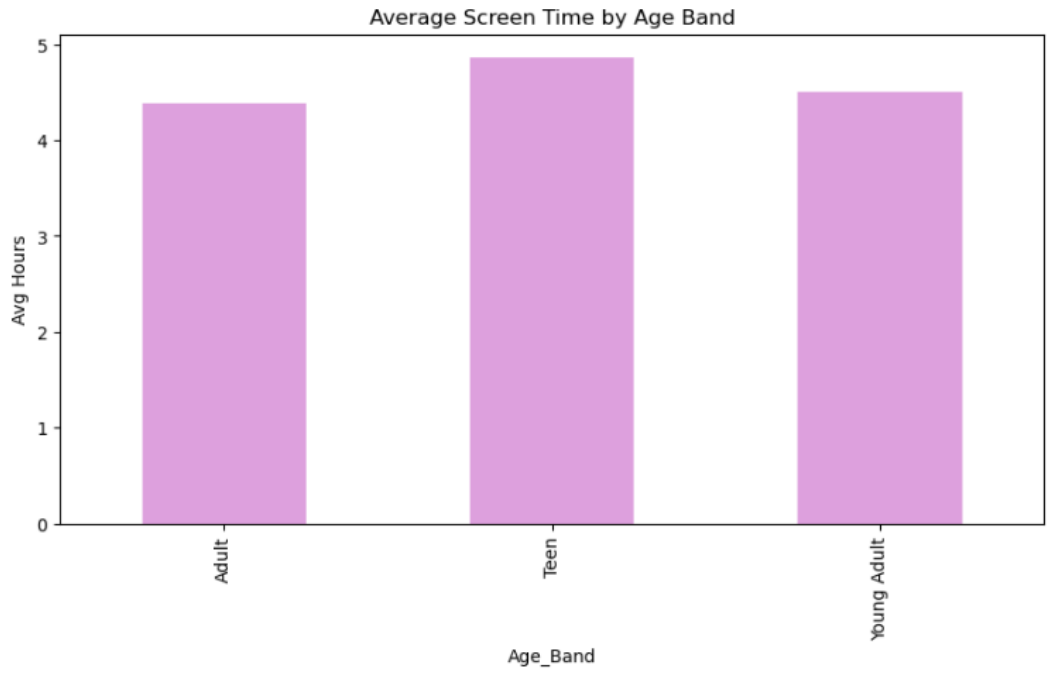
```python
plt.figure(figsize=(10, 5))
df['Device'].value_counts().plot(kind='bar', color='skyblue')
plt.title('Device Mix Distribution')
plt.xlabel('Device Type')
plt.ylabel('Count')
plt.show()

plt.figure(figsize=(10, 5))
df['Activity'].value_counts().plot(kind='bar', color='lightgreen')
plt.title('Activity Category Distribution')
plt.xlabel('Activity')
plt.ylabel('Count')
plt.show()

plt.figure(figsize=(10, 5))
df.groupby('Gender')['ScreenTime_Hours'].mean().plot(kind='bar', color='coral')
plt.title('Average Screen Time by Gender')
plt.ylabel('Avg Hours')
plt.show()

plt.figure(figsize=(10, 5))
df.groupby('Age_Band')['ScreenTime_Hours'].mean().plot(kind='bar', color='plum')
plt.title('Average Screen Time by Age Band')
plt.ylabel('Avg Hours')
plt.show()

plt.figure(figsize=(10, 5))
df.groupby('Weekend')['ScreenTime_Hours'].mean().plot(kind='bar', color='gold')
plt.title('Weekday vs Weekend Screen Time')
plt.xticks([0, 1], ['Weekday', 'Weekend'])
plt.ylabel('Avg Hours')
plt.show()
```

```
plt.figure(figsize=(10, 5))
df.groupby('Day')['ScreenTime_Hours'].mean().plot(kind='line', marker='o')
plt.title('Average Screen Time by Day of Week')
plt.ylabel('Avg Hours')
plt.grid(True)
plt.show()

plt.figure(figsize=(10, 5))
pd.crosstab(df['Device'], df['Gender']).plot(kind='bar', figsize=(10, 5))
plt.title('Device Usage by Gender')
plt.ylabel('Count')
plt.show()

plt.figure(figsize=(10, 5))
pd.crosstab(df['Activity'], df['Age_Band']).plot(kind='bar', figsize=(10, 5))
plt.title('Activity Type by Age Band')
plt.ylabel('Count')
plt.show()
```

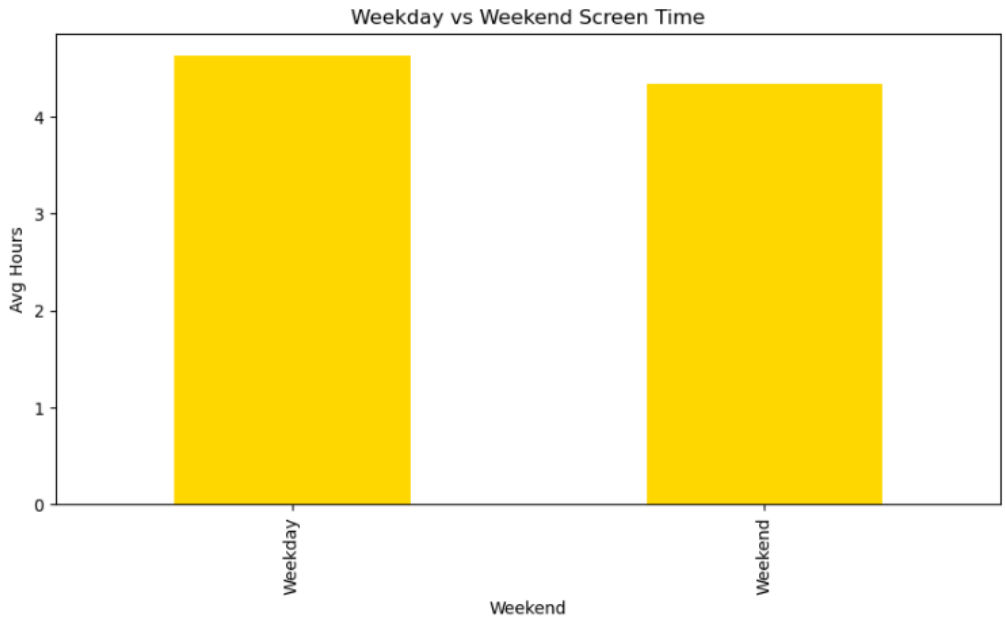


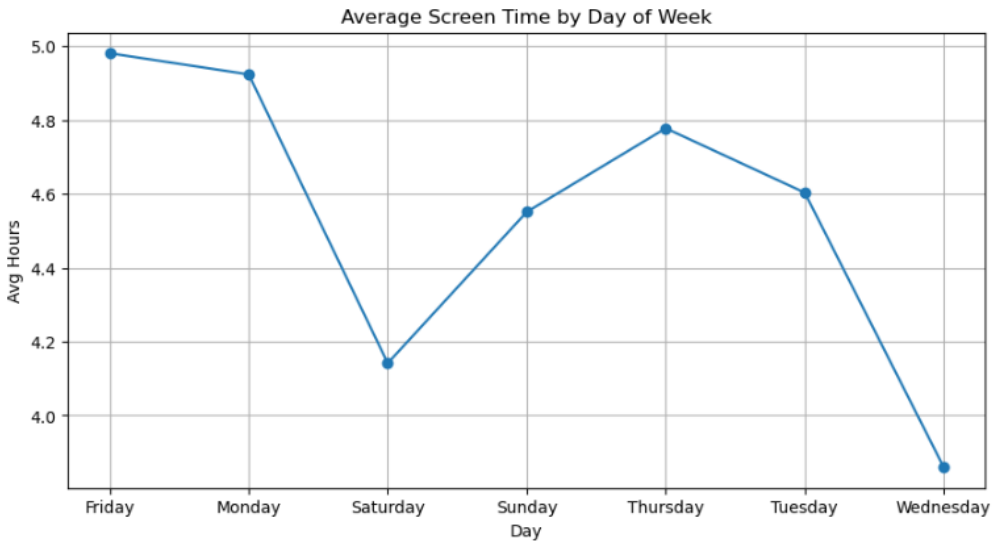

Activity Category Distribution
Count
0
10
20
30
40
50
60
70
Productivity
Education
Streaming
Social Media
Gaming
Activity

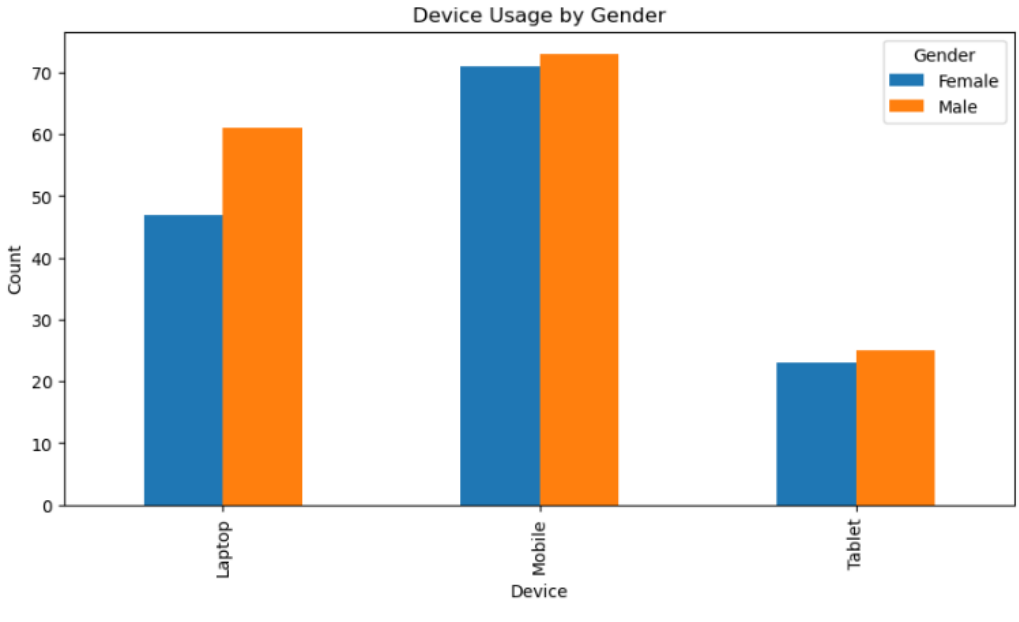

Average Screen Time by Gender
Avg Hours
0
1
2
3
4
Female
Male
Gender


Average Screen Time by Age Band
Avg Hours
0
1
2
3
4
5
Adult
Teen
Young Adult
Age_Band

Age_Band


Weekday vs Weekend Screen Time
Avg Hours
0
1
2
3
4
Weekday
Weekend
Weekend


Average Screen Time by Day of Week
Avg Hours
5.0
4.8
4.6
4.4
4.2
4.0
Friday
Monday
Saturday
Sunday
Thursday
Tuesday
Wednesday
Day


Device Usage by Gender
Gender
Female
Male
Count
70
60
50
40
30
20
10
0
Laptop
Mobile
Tablet
Device