ABOUT THE PROJECT

This project revolves around the comprehensive analysis of Google Play Store data, encompassing a diverse range of applications across various categories. The ultimate objective is to formulate predictions for the development of a free app that can optimize public engagement and achieve maximum installations.

The data exploration involves an in-depth examination of app categories, installations. An essential step in the process is the identification and correction of outliers and the removal of duplicate entries. The subsequent focus lies on discerning patterns within the dataset to extract valuable insights.

By visualizing the distribution of app categories, installation frequencies, and average installations per category, the project aims to unravel trends and preferences within the Google Play Store ecosystem. The ultimate goal is to guide the decision-making process for the development of a free app that aligns with user demands, maximizing public traffic and ensuring a successful app launch.

This multifaceted approach, involving data cleaning, exploration, and analysis, lays the groundwork for informed decision-making in the competitive landscape of the Google Play Store.

IMPORTING THE REQUIRED LIBRARIES ¶

In [1]:

```python
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import warnings

warnings.filterwarnings('ignore')
```

READING THE CSV FILE

In [2]:

```python
df = pd.read_csv("googleplaystore.csv")
```

UNDERSTANDING THE DATA

In [3]:

```python
# Checking how the data looks like
df.sample(5)
```

Out[3]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Conte Rati
5900	Cures A-Z	HEALTH_AND_FITNESS	4.0	265	4.1M	100,000+	Free	0	Everyo
7417	Grand Theft Auto: San Andreas	GAME	4.4	348962	26M	1,000,000+	Paid	$6.99	Matu 1
8197	Just Dance Now	GAME	4.2	794058	56M	10,000,000+	Free	0	Everyo
1786	Episode - Choose Your Story	GAME	4.3	1841061	Varies with device	50,000,000+	Free	0	Te
3033	Golfshot: Golf GPS + Tee Times	SPORTS	4.3	7543	25M	500,000+	Free	0	Everyo

In [4]:

```python
# It has 10841 rows and 13 columns
df.shape
```

Out[4]:

```
(10841, 13)
```

In [5]:

```python
# Checking if there are null values or not
df.isnull().sum()
```

Out[5]:

```
App                  0
Category             0
Rating            1474
Reviews              0
Size                 0
Installs             0
Type                 1
Price                0
Content Rating       1
Genres               0
Last Updated         0
Current Ver          8
Android Ver          3
dtype: int64
```

The above output shows that the data contains 1474, 1, 1, 8, 3 null values in the Rating, Type ,Content Rating ,Current Ver, Android Ver respectively

CLEANING THE DATA

Part 1 : Detecting and Handling an outlier

```
In [6]:  df['Category'].value_counts()
```

```
Out[6]: FAMILY                 1972
        GAME                   1144
        TOOLS                   843
        MEDICAL                 463
        BUSINESS                460
        PRODUCTIVITY            424
        PERSONALIZATION         392
        COMMUNICATION           387
        SPORTS                  384
        LIFESTYLE               382
        FINANCE                 366
        HEALTH_AND_FITNESS      341
        PHOTOGRAPHY             335
        SOCIAL                  295
        NEWS_AND_MAGAZINES      283
        SHOPPING                260
        TRAVEL_AND_LOCAL        258
        DATING                  234
        BOOKS_AND_REFERENCE     231
        VIDEO_PLAYERS           175
        EDUCATION               156
        ENTERTAINMENT           149
        MAPS_AND_NAVIGATION     137
        FOOD_AND_DRINK          127
        HOUSE_AND_HOME           88
        LIBRARIES_AND_DEMO       85
        AUTO_AND_VEHICLES        85
        WEATHER                  82
        ART_AND_DESIGN           65
        EVENTS                   64
        PARENTING                60
        COMICS                   60
        BEAUTY                   53
        1.9                       1
        Name: Category, dtype: int64
```

The above output shows the category counts but there is one outlier that is "1.9". "1.9" is not a category so there is some mistake in the dataset

In [7]:

```
df[df['Category'] == '1.9']
```

Out[7]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genre
10472	Life Made WI-Fi Touchscreen Photo Frame	1.9	19.0	3.0M	1,000+	Free	0	Everyone	NaN	Februar 11, 201

The above output shows that category value is "1.9" which is wrong. The mistake is that the category value is not there instead rating value is written in category column. All the values is shifted left from category onwards. So first we need to know that in which category "Life Made WI-Fi Touchscreen Photo Frame" lies.

In [8]:

```
new_lst = ['Life Made WI-Fi Touchscreen Photo Frame', 'LIFESTYLE' , '1.9',
        '1,000+', 'Free', '0', 'Everyone', 'LIFESTYLE', 'February 11, 2018
        '1.0.19', '4.0 and up']
```

Now the category value has been added to the above record

In [9]:

```
df[df['Category'] == '1.9'] = new_lst
```

In [10]:

```python
df['Category'].value_counts()
```

Out[10]:

```
FAMILY                 1972
GAME                   1144
TOOLS                   843
MEDICAL                 463
BUSINESS                460
PRODUCTIVITY            424
PERSONALIZATION         392
COMMUNICATION           387
SPORTS                  384
LIFESTYLE               383
FINANCE                 366
HEALTH_AND_FITNESS      341
PHOTOGRAPHY             335
SOCIAL                  295
NEWS_AND_MAGAZINES      283
SHOPPING                260
TRAVEL_AND_LOCAL        258
DATING                  234
BOOKS_AND_REFERENCE     231
VIDEO_PLAYERS           175
EDUCATION               156
ENTERTAINMENT           149
MAPS_AND_NAVIGATION     137
FOOD_AND_DRINK          127
HOUSE_AND_HOME           88
AUTO_AND_VEHICLES        85
LIBRARIES_AND_DEMO       85
WEATHER                  82
ART_AND_DESIGN           65
EVENTS                   64
PARENTING                60
COMICS                   60
BEAUTY                   53
Name: Category, dtype: int64
```

Outlier has been handled now our data has no outlier

Part 2: Handling Duplicated Values

In [11]:

```
app_count = df['App'].value_counts()
app_count
```

Out[11]:

```
ROBLOX                                                9
CBS Sports App - Scores, News, Stats & Watch Live     8
ESPN                                                  7
Duolingo: Learn Languages Free                        7
Candy Crush Saga                                      7
                                                     ..
Meet U - Get Friends for Snapchat, Kik & Instagram    1
U-Report                                              1
U of I Community Credit Union                         1
Waiting For U Launcher Theme                          1
iHoroscope - 2018 Daily Horoscope & Astrology         1
Name: App, Length: 9660, dtype: int64
```

In [12]:

```
# printing only those apps which are duplicated
num_of_duplicate_apps = app_count[app_count > 1]
num_of_duplicate_apps
```

Out[12]:

```
ROBLOX                                               9
CBS Sports App - Scores, News, Stats & Watch Live    8
ESPN                                                 7
Duolingo: Learn Languages Free                       7
Candy Crush Saga                                     7
                                                    ..
Transenger – Ts Dating and Chat for Free             2
Random Video Chat                                    2
Clover Dating App                                    2
Docs To Go™ Free Office Suite                        2
English Dictionary - Offline                         2
Name: App, Length: 798, dtype: int64
```

The data contains 798 duplicate values i.e some apps have more than one record in the dataset. We will clean them by keeping only the reocrd which has max ratings among the duplicate records

In [13]:

```
# Checking if the instagram record is duplicated or not
"Instagram" in app_count[app_count > 1]
```

Out[13]:

```
True
```

```
In [14]: df[df["App"] == "Instagram"]
```

```
Out[14]:
```

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres
2545	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Socia
2604	Instagram	SOCIAL	4.5	66577446	Varies with device	1,000,000,000+	Free	0	Teen	Socia
2611	Instagram	SOCIAL	4.5	66577313	Varies with device	1,000,000,000+	Free	0	Teen	Socia
3909	Instagram	SOCIAL	4.5	66509917	Varies with device	1,000,000,000+	Free	0	Teen	Socia

The above output shows that the instagram app has four records in the data but we will keep only that record which has max ratings i.e data with index 2604

In [15]:

```python
# Checking the number of duplicated apps and keeping only the one record wh
duplicated_apps = df[df.duplicated(subset= ["App"] , keep='first')]
duplicated_apps
```

Out[15]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Conter Ratin
229	Quick PDF Scanner + OCR FREE	BUSINESS	4.2	80805	Varies with device	5,000,000+	Free	0	Everyon
236	Box	BUSINESS	4.2	159872	Varies with device	10,000,000+	Free	0	Everyon
239	Google My Business	BUSINESS	4.4	70991	Varies with device	5,000,000+	Free	0	Everyon
256	ZOOM Cloud Meetings	BUSINESS	4.4	31614	37M	10,000,000+	Free	0	Everyon
261	join.me - Simple Meetings	BUSINESS	4.0	6989	Varies with device	1,000,000+	Free	0	Everyon
...	...	...	...	...	...	...	...	...	.
10715	FarmersOnly Dating	DATING	3.0	1145	1.4M	100,000+	Free	0	Matur 17
10720	Firefox Focus: The privacy browser	COMMUNICATION	4.4	36981	4.0M	1,000,000+	Free	0	Everyon
10730	FP Notebook	MEDICAL	4.5	410	60M	50,000+	Free	0	Everyon
10753	Slickdeals: Coupons & Shopping	SHOPPING	4.5	33599	12M	1,000,000+	Free	0	Everyon
10768	AAFP	MEDICAL	3.8	63	24M	10,000+	Free	0	Everyon

1181 rows × 13 columns

In [16]:

```python
df.shape
```

Out[16]:

```
(10841, 13)
```

In [17]:

```python
duplicated_apps.shape
```

Out[17]:

```
(1181, 13)
```

In [18]:

```python
10841-1181
```

Out[18]:

```
9660
```

After cleaning the duplicate values only 9660 records will be left.

In [19]:

```
# Grouping app on the basis of reviews and getting the apps with max ratin
max_review = df.groupby('App')["Reviews"].max()
max_review
```

Out[19]:

```
App
"i DT" Fútbol. Todos Somos Técnicos.                    27
+Download 4 Instagram Twitter                        40467
- Free Comics - Comic Apps                             115
.R                                                     259
/u/app                                                 573
                                                     ...
뽕티비 - 개인방송, 인터넷방송, BJ방송                            414
💎 I'm rich                                             718
💘 WhatsLov: Smileys of love, stickers and GIF        22098
📏 Smart Ruler ↔ cm/inch measuring for homework!        19
🔥 Football Wallpapers 4K | Full HD Backgrounds 😍     11661
Name: Reviews, Length: 9660, dtype: object
```

In [20]:

```
# Creating an empty list for to keep clean data
android_clean = []

# Creating an empty list to keep track of already added apps
already_added = []

# Loop through each record and store the app name and reviews in name and 
for index, row in df.iterrows():
    name = row["App"]
    n_reviews = row['Reviews']

# checking if the max_review of the specific app is equal to n_reviews of 
    if (max_review[name] == n_reviews) and (name not in already_added):
        android_clean.append(row)
        already_added.append(name)
```

In [21]:

```
len(android_clean)
```

Out[21]:

```
9660
```

The duplicate values are cleaned and we have got the cleaned list of apps without duplication

In [22]:

```
android_clean = pd.DataFrame(android_clean)
```

Part 3: Removing Non-English Apps

In [23]:

```
# This function checks whether the given app is english or not and it allo
def english_apps(app_name):
    eng_apps = []

    for i in app_name:
        if ord(i) < 127:
            eng_apps.append(True)
        else:
            eng_apps.append(False)


    non_ascii = 0
    for j in eng_apps:
        if j == False:
            non_ascii +=1

    if non_ascii < 3:
        return True
    else:
        return False

```

In [24]:

```
english_apps("Instagram😍😍😍😍")
```

Out[24]:

```
False
```

In [25]:

```
android_clean = android_clean[android_clean['App'].apply(english_apps)]
android_clean
```

Out[25]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0
5	Paper flowers instructions	ART_AND_DESIGN	4.4	167	5.6M	50,000+	Free	0
...	...	...	...	...	...	...	...	...
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53M	5,000+	Free	0
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0
10838	Parkinson Exercices FR	MEDICAL	NaN	3	9.5M	1,000+	Free	0
10839	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	4.5	114	Varies with device	1,000+	Free	0
10840	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	4.5	398307	19M	10,000,000+	Free	0

9598 rows × 13 columns

Part 4: Removing paid apps

In [26]:

```
android_clean['Price'].unique()
```

Out[26]:

```
array(['0', '$4.99', '$3.99', '$6.99', '$1.49', '$2.99', '$7.99', '$5.99',
       '$3.49', '$1.99', '$9.99', '$7.49', '$0.99', '$9.00', '$5.49',
       '$10.00', '$11.99', '$79.99', '$16.99', '$14.99', '$1.00',
       '$29.99', '$12.99', '$2.49', '$24.99', '$10.99', '$1.50', '$19.99',
       '$15.99', '$33.99', '$74.99', '$39.99', '$3.95', '$4.49', '$1.70',
       '$8.99', '$2.00', '$3.88', '$25.99', '$399.99', '$17.99',
       '$400.00', '$3.02', '$1.76', '$4.84', '$4.77', '$1.61', '$2.50',
       '$1.59', '$6.49', '$1.29', '$5.00', '$13.99', '$299.99', '$379.99',
       '$37.99', '$18.99', '$389.99', '$19.90', '$8.49', '$1.75',
       '$14.00', '$4.85', '$46.99', '$109.99', '$154.99', '$3.08',
       '$2.59', '$4.80', '$1.96', '$19.40', '$3.90', '$4.59', '$15.46',
       '$3.04', '$4.29', '$2.60', '$3.28', '$4.60', '$28.99', '$2.95',
       '$2.90', '$1.97', '$200.00', '$89.99', '$2.56', '$30.99', '$3.61',
       '$394.99', '$1.26', '$1.20', '$1.04'], dtype=object)
```

In [27]:

```
android_clean = android_clean[android_clean["Price"] == "0"]
android_clean
```

Out[27]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0
5	Paper flowers instructions	ART_AND_DESIGN	4.4	167	5.6M	50,000+	Free	0
...	...	...	...	...	...	...	...	...
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53M	5,000+	Free	0
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0
10838	Parkinson Exercices FR	MEDICAL	NaN	3	9.5M	1,000+	Free	0
10839	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	4.5	114	Varies with device	1,000+	Free	0
10840	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	4.5	398307	19M	10,000,000+	Free	0

8847 rows × 13 columns

Our cleaning part is done in first part we handled outlier, in second part we handled duplciated values, in third part we removed non-english apps , in fourth part we removed paid apps. Now we have 8847 records in our dataset, we will work on this data to analyze and suggest the product we required

DATA ANALYSIS

1. Most Common Apps By Genre

In [28]:

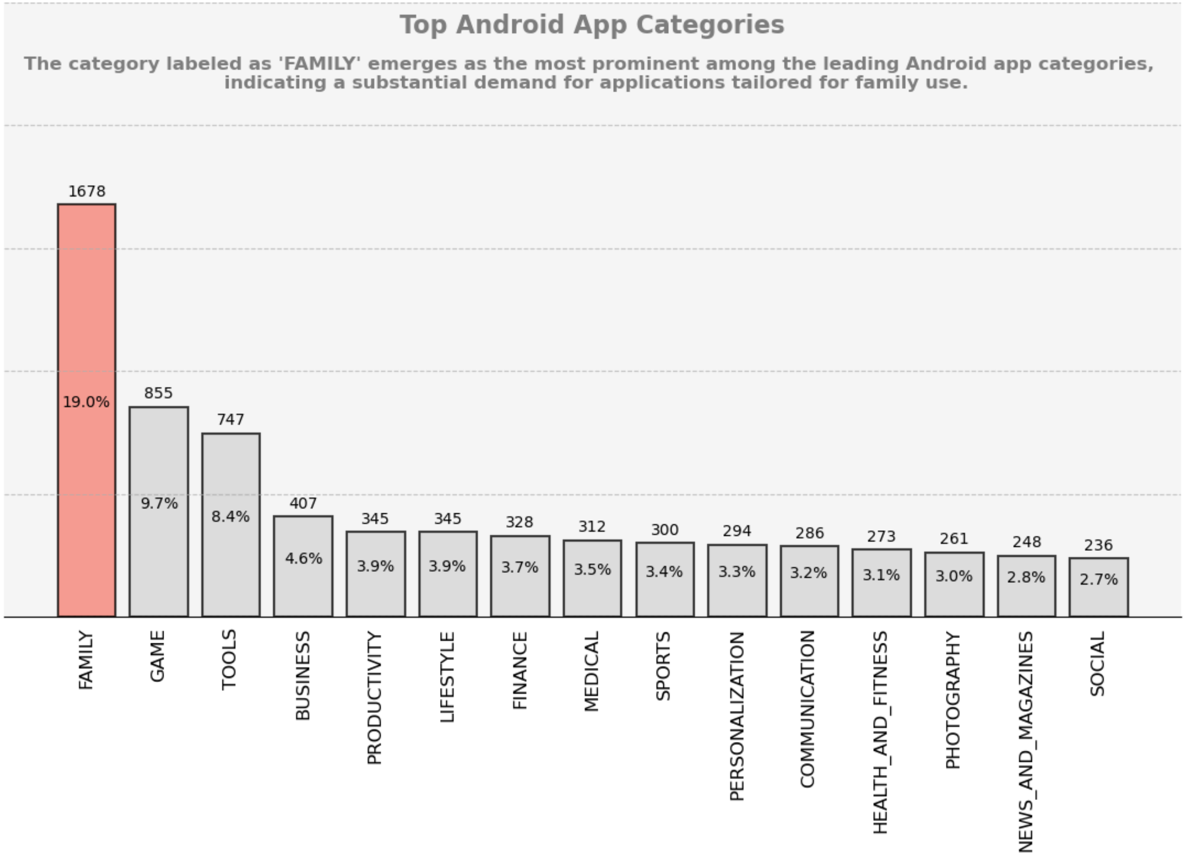
```
android_clean['Category'].value_counts(normalize = True) * 100
```

Out[28]:

```
FAMILY                 18.966881
GAME                    9.664293
TOOLS                   8.443540
BUSINESS                4.600430
PRODUCTIVITY            3.899627
LIFESTYLE               3.899627
FINANCE                 3.707471
MEDICAL                 3.526619
SPORTS                  3.390980
PERSONALIZATION         3.323160
COMMUNICATION           3.232734
HEALTH_AND_FITNESS      3.085792
PHOTOGRAPHY             2.950153
NEWS_AND_MAGAZINES      2.803210
SOCIAL                  2.667571
TRAVEL_AND_LOCAL        2.339776
SHOPPING                2.249350
BOOKS_AND_REFERENCE     2.136317
DATING                  1.865039
VIDEO_PLAYERS           1.797219
MAPS_AND_NAVIGATION     1.390302
FOOD_AND_DRINK          1.243359
EDUCATION               1.175540
ENTERTAINMENT           0.960778
LIBRARIES_AND_DEMO      0.938171
AUTO_AND_VEHICLES       0.926868
HOUSE_AND_HOME          0.802532
WEATHER                 0.791229
EVENTS                  0.712106
PARENTING               0.655589
ART_AND_DESIGN          0.644286
COMICS                  0.610376
BEAUTY                  0.599073
Name: Category, dtype: float64
```

In [29]:

```
categories = android_clean['Category'].value_counts().index[:15]
counts = android_clean['Category'].value_counts().values[:15]
percentage = round(android_clean['Category'].value_counts(normalize = True

# Creating a stylish bar chart
plt.figure(figsize=(12,8))
bars = plt.bar(categories , counts , color='lightgray', alpha=0.75, edgeco
plt.xticks(rotation=90 , fontsize=12)
plt.yticks(range(0,3000,500), [], fontsize=12)
plt.tick_params(bottom=0, left=0)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.grid(axis='x', linestyle='')

# Find the category with highest count
max_count_category = categories[counts.argmax()]

# Highlight the bar for the category with the highest count
max_count_index = list(categories).index(max_count_category)
bars[max_count_index].set_color('salmon')
bars[max_count_index].set_edgecolor('black')

# Adding data labels and percentages inside the bar
for bar,perc in zip(bars,percentage):
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height + 20, '%d' % int(heig
    plt.text(bar.get_x() + bar.get_width()/2, height/2, f'{perc}%', ha='ce

# Adding a background color
ax = plt.gca()
ax.set_facecolor('#f7f7f7')

# Adding chart title
plt.text(0.5,0.95,"Top Android App Categories", ha='center',fontsize=16, t
        color='gray', fontweight='bold')

# Adding conclusion inside the chart
plt.text(0.5, 0.86,
"The category labeled as 'FAMILY' emerges as the most prominent among the

# Remove spines
for i in ['top','right','left']:
    plt.gca().spines[i].set_visible(False)

plt.tight_layout() # Adjust layout top prevent clipping

plt.show()
```



Top Android App Categories

The category labeled as 'FAMILY' emerges as the most prominent among the leading Android app categories, indicating a substantial demand for applications tailored for family use.

2. Most Popular Apps By Genre On Google Play Store

```
In [30]: android_clean['Installs'].value_counts(normalize=True) * 100
```

```
Out[30]: 1,000,000+        15.768057
         100,000+          11.540635
         10,000,000+       10.534645
         10,000+           10.195547
         1,000+             8.409630
         100+               6.928902
         5,000,000+         6.838476
         500,000+           5.572510
         50,000+            4.769979
         5,000+             4.487397
         10+                3.537922
         500+               3.244038
         50,000,000+        2.271957
         100,000,000+       2.125014
         50+                1.921555
         5+                 0.791229
         1+                 0.508647
         500,000,000+       0.271278
         1,000,000,000+     0.226065
```

In [31]:

```
android_clean['Installs'] = android_clean['Installs'].str.replace(',' , ''
```

In [32]:

```
install_freq = android_clean['Installs'].value_counts().sort_index()
install_freq = install_freq[install_freq.index > 500]
install_freq
```

Out[32]:

```
1000           744
5000           397
10000          902
50000          422
100000        1021
500000         493
1000000       1395
5000000        605
10000000       932
50000000       201
100000000      188
500000000       24
1000000000      20
Name: Installs, dtype: int64
```

In [33]:

```
install_freq_perc = round(android_clean['Installs'].value_counts(normalize
install_freq_perc = install_freq_perc[install_freq_perc.index > 500]
install_freq_perc
```

Out[33]:

```
1000           8.41
5000           4.49
10000         10.20
50000          4.77
100000        11.54
500000         5.57
1000000       15.77
5000000        6.84
10000000      10.53
50000000       2.27
100000000      2.13
500000000      0.27
1000000000     0.23
Name: Installs, dtype: float64
```

In [34]:

```
def convert_to_unit(number):
    if number >= 1_000_000_000:
        return f"{number // 1_000_000_000}B"
    elif number >= 1_000_000:
        return f"{number // 1_000_000}M"
    elif number >= 1_000:
        return f"{number // 1_000}K"
    else:
        return str(number)

```

The above function has been made to make install_freq into readable form because the previous output contain too many zeros.

In [35]:

```
install_freq.index = install_freq.index.map(convert_to_unit)
install_freq

```

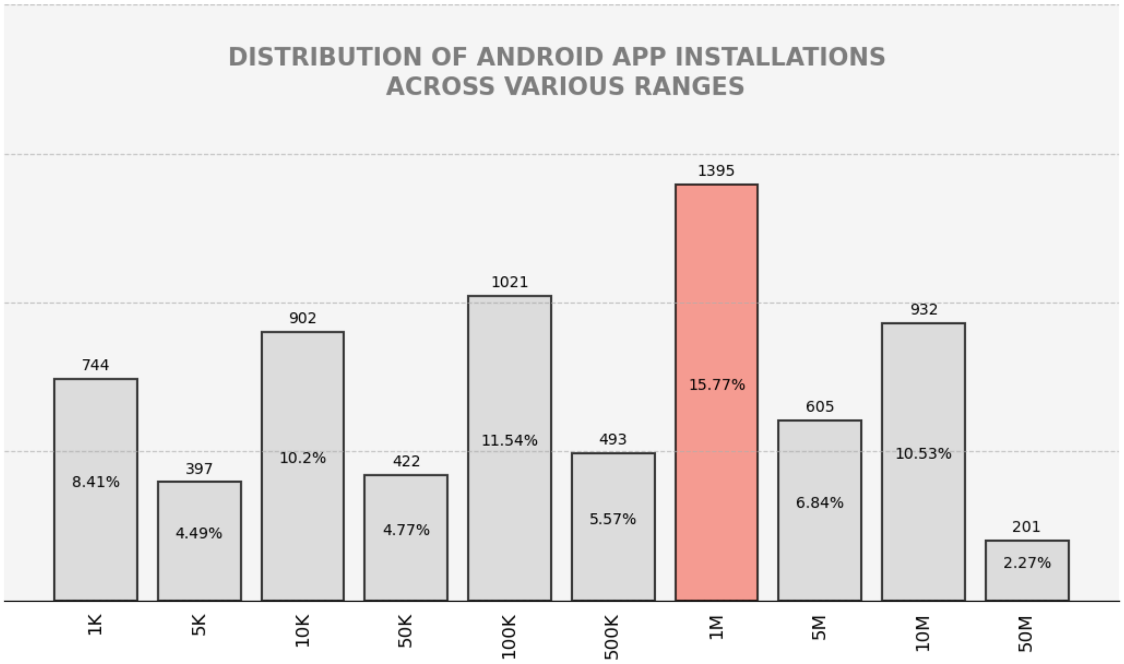
Out[35]:

```
1K        744
5K        397
10K       902
50K       422
100K     1021
500K      493
1M       1395
5M        605
10M       932
50M       201
100M      188
500M       24
1B         20
Name: Installs, dtype: int64
```

Now it is in readable form as the numbers have been converted into units.

In [47]:

```python
categories = install_freq.index[:10]
counts = install_freq.values[:10]
percentage = install_freq_perc.values[:10]

# Creating a stylish bar chart
plt.figure(figsize=(12,8))
bars = plt.bar(categories , counts , color='lightgray', alpha=0.75, edgeco
plt.xticks(rotation=90 , fontsize=12)
plt.yticks(range(0,2500,500), [], fontsize=12)
plt.tick_params(bottom=0, left=0)
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.grid(axis='x', linestyle='')

# Find the category with highest count
max_count_category = categories[counts.argmax()]

# Highlight the bar for the category with the highest count
max_count_index = list(categories).index(max_count_category)
bars[max_count_index].set_color('salmon')
bars[max_count_index].set_edgecolor('black')

# Adding data labels and percentages inside the bar
for bar,perc in zip(bars,percentage):
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2, height + 20, '%d' % int(heig
    plt.text(bar.get_x() + bar.get_width()/2, height/2, f'{perc}%', ha='ce

# Adding a background color
ax = plt.gca()
ax.set_facecolor('#f7f7f7')

# Adding chart title
plt.text(0.5,0.85,"DISTRIBUTION OF ANDROID APP INSTALLATIONS \n ACROSS VARI
        color='gray', fontweight='bold')

# Adding conclusion inside the chart
plt.text(0.5, -0.36,
"Looking at the information given, most Android apps have fewer installati

# Remove spines
for i in ['top','right','left']:
    plt.gca().spines[i].set_visible(False)

plt.tight_layout() # Adjust layout top prevent clipping

plt.show()
```


DISTRIBUTION OF ANDROID APP INSTALLATIONS
ACROSS VARIOUS RANGES

Looking at the information given, most Android apps have fewer installations, mainly falling in the lower range. The largest number of installs happens in the 1,000 to 10 million range. Notably, there are 1,395 apps in the 1 million install range, showing that many apps have this level of popularity. There are only a few apps that have between 500 million and 1 billion installs.

In [48]:

```
# Calculating average number of installations for each category
category_avg_installation = pd.pivot_table(android_clean , values = 'Insta
category_avg_installation
```

Out[48]:

	Installs
Category	
ART_AND_DESIGN	1.986335e+06
AUTO_AND_VEHICLES	6.473178e+05
BEAUTY	5.131519e+05
BOOKS_AND_REFERENCE	8.814200e+06
BUSINESS	1.712290e+06
COMICS	8.326139e+05
COMMUNICATION	3.859058e+07
DATING	8.540288e+05
EDUCATION	1.820673e+06
ENTERTAINMENT	1.164071e+07
EVENTS	2.535422e+05
FAMILY	3.694276e+06
FINANCE	1.387692e+06
FOOD_AND_DRINK	1.924898e+06
GAME	1.551668e+07
HEALTH_AND_FITNESS	4.188822e+06
HOUSE_AND_HOME	1.360598e+06
LIBRARIES_AND_DEMO	6.385037e+05
LIFESTYLE	1.441969e+06
MAPS_AND_NAVIGATION	4.049275e+06
MEDICAL	1.206165e+05
NEWS_AND_MAGAZINES	9.549178e+06
PARENTING	5.426036e+05
PERSONALIZATION	5.201483e+06
PHOTOGRAPHY	1.780563e+07
PRODUCTIVITY	1.678733e+07
SHOPPING	7.036877e+06
SOCIAL	2.325365e+07
SPORTS	3.650602e+06
TOOLS	1.071088e+07
TRAVEL_AND_LOCAL	1.398408e+07
VIDEO_PLAYERS	2.472787e+07
WEATHER	5.145550e+06

In [49]:

```
# Sorting the average installations by descending order, also applying conv
category_avg_installation = category_avg_installation.sort_values(by='Insta
category_avg_installation = category_avg_installation["Installs"].apply(co
category_avg_installation
```

Out[49]:

```
Category
COMMUNICATION           38.0M
VIDEO_PLAYERS           24.0M
SOCIAL                  23.0M
PHOTOGRAPHY             17.0M
PRODUCTIVITY            16.0M
GAME                    15.0M
TRAVEL_AND_LOCAL        13.0M
ENTERTAINMENT           11.0M
TOOLS                   10.0M
NEWS_AND_MAGAZINES       9.0M
BOOKS_AND_REFERENCE      8.0M
SHOPPING                 7.0M
PERSONALIZATION          5.0M
WEATHER                  5.0M
HEALTH_AND_FITNESS       4.0M
MAPS_AND_NAVIGATION      4.0M
FAMILY                   3.0M
SPORTS                   3.0M
ART_AND_DESIGN           1.0M
FOOD_AND_DRINK           1.0M
EDUCATION                1.0M
BUSINESS                 1.0M
LIFESTYLE                1.0M
FINANCE                  1.0M
HOUSE_AND_HOME           1.0M
DATING                 854.0K
COMICS                 832.0K
AUTO_AND_VEHICLES      647.0K
LIBRARIES_AND_DEMO     638.0K
PARENTING              542.0K
BEAUTY                 513.0K
EVENTS                 253.0K
MEDICAL                120.0K
Name: Installs, dtype: object
```

In [39]:

```
category_df = android_clean.groupby("Category")
```

In [40]:

```python
# Printing app,installs of communication category to see which app is lead
COMMUNICATION = category_df.get_group("COMMUNICATION").sort_values(by="Ins
final_df = COMMUNICATION[["App" , "Installs"]]
final_df["Installs"] = final_df["Installs"].apply(convert_to_unit)
final_df.head(10)
```

Out[40]:

	App	Installs
336	WhatsApp Messenger	1B
382	Messenger – Text and Video Chat for Free	1B
464	Hangouts	1B
411	Google Chrome: Fast & Secure	1B
391	Skype - free IM & video calls	1B
451	Gmail	1B
403	LINE: Free Calls & Messages	500M
4676	Viber Messenger	500M
420	UC Browser - Fast Download Private & Secure	500M
371	Google Duo - High Quality Video Calls	500M

In [41]:

```python
# Printing app,installs of video players category to see which app is lead

VIDEO_PLAYERS = category_df.get_group("VIDEO_PLAYERS").sort_values(by="Ins
final_df = VIDEO_PLAYERS[["App" , "Installs"]]
final_df["Installs"] = final_df["Installs"].apply(convert_to_unit)
final_df.head(10)
```

Out[41]:

	App	Installs
3665	YouTube	1B
3687	Google Play Movies & TV	1B
3711	MX Player	500M
3675	VLC for Android	100M
4688	VivaVideo - Video Editor & Photo Movie	100M
4032	Dubsmash	100M
10647	Motorola FM Radio	100M
4696	VideoShow-Video Editor, Video Maker, Beauty Ca...	100M
3672	Motorola Gallery	100M
3691	Samsung Video Library	50M

In [42]:

```
# Printing app,installs of social category to see which app is leading.

SOCIAL = category_df.get_group("SOCIAL").sort_values(by="Installs" , ascen
final_df = SOCIAL[["App" , "Installs"]]
final_df["Installs"] = final_df["Installs"].apply(convert_to_unit)
final_df.head(10)
```

Out[42]:

	App	Installs
2544	Facebook	1B
2554	Google+	1B
2604	Instagram	1B
2610	Snapchat	500M
2546	Facebook Lite	500M
3945	Tik Tok - including musical.ly	100M
2592	Tango - Live Video Broadcast	100M
6373	VK	100M
2552	Pinterest	100M
3951	BIGO LIVE - Live Stream	100M

In [43]:

```
# Printing app,installs of photography category to see which app is leadin

PHOTOGRAPHY = category_df.get_group("PHOTOGRAPHY").sort_values(by="Install
final_df = PHOTOGRAPHY[["App" , "Installs"]]
final_df["Installs"] = final_df["Installs"].apply(convert_to_unit)
final_df.head(10)
```

Out[43]:

	App	Installs
2884	Google Photos	1B
4574	S Photo Editor - Collage Maker , Photo Collage	100M
2949	Camera360: Selfie Photo Editor with Funny Sticker	100M
2908	Retrica	100M
8307	LINE Camera - Photo editor	100M
2921	Photo Editor Pro	100M
2847	Sweet Selfie - selfie camera, beauty cam, phot...	100M
2937	BeautyPlus - Easy Photo Editor & Selfie Camera	100M
2938	PicsArt Photo Studio: Collage Maker & Pic Editor	100M
5057	AR effect	100M

In [44]:

```
# Printing app,installs of productivity category to see which app is leadi

PRODUCTIVITY = category_df.get_group("PRODUCTIVITY").sort_values(by="Insta
final_df = PRODUCTIVITY[["App" , "Installs"]]
final_df["Installs"] = final_df["Installs"].apply(convert_to_unit)
final_df.head(10)
```

Out[44]:

```
                                      App  Installs
3523                         Google Drive        1B
3450                       Microsoft Word      500M
3562                      Google Calendar      500M
3574                          Cloud Print      500M
3473                              Dropbox      500M
3524                  Adobe Acrobat Reader     100M
3489                        Samsung Notes      100M
3477                          Google Docs      100M
3493                     SwiftKey Keyboard     100M
7808   CamScanner - Phone PDF Creator          100M
```

SUMMARY

In analyzing Google Play Store data, we noticed that categories like communication, video players, and social apps are already dominated by big players like Facebook, Instagram, WhatsApp, and YouTube. It's tough for new apps to compete in these crowded spaces.

So, our recommendation is to focus on less crowded categories like productivity and photography. These areas provide a chance for developers to create a unique app and can still attract a decent number of users.

To make the app more effective, consider adding popular features like Artificial Intelligence (AI). This can personalize user experiences, predict user needs, and bring innovation, making your app stand out.

Also, with the growing interest in sustainability, think about adding eco-friendly features or promoting a green initiative in your app. This could resonate well with users who care about the environment.

In summary, targeting less crowded categories like productivity and photography, along with incorporating modern features like AI and considering eco-friendly aspects, can give your app a strategic advantage. Staying updated on market trends and user preferences is key for success in the ever-changing Google Play Store landscape.