EDA And Feature Engineering Of Google Play Store Dataset

1) Problem statement. Today, 1.85 million different apps are available for users to download. Android users have even more from which to choose, with 2.56 million available through the Google Play Store. These apps have come to play a huge role in the way we live our lives today. Our Objective is to find the Most Popular Category, find the App with largest number of installs , the App with largest size etc. 2) Data Collection.

The data consists of 20 column and 10841 rows.

Steps We Are Going to Follow

1. Data Clearning
2. Exploratory Data Analysis
3. Featur eEngineering

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

warnings.filterwarnings("ignore")

%matplotlib inline

df = pd.read_csv(r'C:\Users\RITIK\Desktop\Google Play Store\
googleplaystore.csv')
df.head()
```

```
                                                 App        Category
Rating  \
0     Photo Editor & Candy Camera & Grid & ScrapBook  ART_AND_DESIGN
4.1
1                                Coloring book moana  ART_AND_DESIGN
3.9
2  U Launcher Lite – FREE Live Cool Themes, Hide ...  ART_AND_DESIGN
4.7
3                              Sketch - Draw & Paint  ART_AND_DESIGN
4.5
4              Pixel Draw - Number Art Coloring Book  ART_AND_DESIGN
4.3

  Reviews  Size     Installs  Type Price Content Rating  \
0     159   19M      10,000+  Free     0       Everyone
1     967   14M     500,000+  Free     0       Everyone
2   87510  8.7M   5,000,000+  Free     0       Everyone
3  215644   25M  50,000,000+  Free     0           Teen
```

```
4     967  2.8M     100,000+  Free     0       Everyone

                     Genres      Last Updated         Current Ver  \
0              Art & Design   January 7, 2018               1.0.0
1  Art & Design;Pretend Play  January 15, 2018               2.0.0
2              Art & Design    August 1, 2018               1.2.4
3              Art & Design      June 8, 2018  Varies with device
4    Art & Design;Creativity     June 20, 2018                 1.1

    Android Ver
0  4.0.3 and up
1  4.0.3 and up
2  4.0.3 and up
3    4.2 and up
4    4.4 and up
```

```
df.shape
```

```
(10841, 13)
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10841 entries, 0 to 10840
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   App             10841 non-null  object
 1   Category        10841 non-null  object
 2   Rating          9367 non-null   float64
 3   Reviews         10841 non-null  object
 4   Size            10841 non-null  object
 5   Installs        10841 non-null  object
 6   Type            10840 non-null  object
 7   Price           10841 non-null  object
 8   Content Rating  10840 non-null  object
 9   Genres          10841 non-null  object
 10  Last Updated    10841 non-null  object
 11  Current Ver     10833 non-null  object
 12  Android Ver     10838 non-null  object
dtypes: float64(1), object(12)
memory usage: 1.1+ MB
```

```
#Summary of the data set
```

```
df.describe()
```

```
            Rating
count  9367.000000
mean      4.193338
std       0.537431
```

```
min          1.000000
25%          4.000000
50%          4.300000
75%          4.500000
max         19.000000

#Missing values
df.isnull().sum()

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
```

Insights and observation

The data set has missing values

Data Cleaning

```
df['Reviews'].unique()

array(['159', '967', '87510', ..., '603', '1195', '398307'],
dtype=object)

 df['Reviews'].str.isnumeric().sum()

10840

df[~df['Reviews'].str.isnumeric()]

                                           App Category  Rating
Reviews  \
10472  Life Made WI-Fi Touchscreen Photo Frame      1.9    19.0
3.0M

        Size Installs Type     Price Content Rating
Genres   \
10472  1,000+     Free     0  Everyone            NaN  February 11,
2018
```

```
      Last Updated Current Ver Android Ver
10472       1.0.19  4.0 and up         NaN
```

```
df_copy=df.copy()
```

```
df_copy = df_copy.drop(df_copy.index[10472])
```

```
df_copy[~df_copy['Reviews'].str.isnumeric()]
```

```
Empty DataFrame
Columns: [App, Category, Rating, Reviews, Size, Installs, Type, Price, 
Content Rating, Genres, Last Updated, Current Ver, Android Ver]
Index: []
```

```
# Convert Review Datatype to int
df_copy['Reviews']=df_copy['Reviews'].astype(int)
```

```
df_copy.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 10840 entries, 0 to 10840
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   App             10840 non-null  object 
 1   Category        10840 non-null  object 
 2   Rating          9366 non-null   float64
 3   Reviews         10840 non-null  int32  
 4   Size            10840 non-null  object 
 5   Installs        10840 non-null  object 
 6   Type            10839 non-null  object 
 7   Price           10840 non-null  object 
 8   Content Rating  10840 non-null  object 
 9   Genres          10840 non-null  object 
 10  Last Updated    10840 non-null  object 
 11  Current Ver     10832 non-null  object 
 12  Android Ver     10838 non-null  object 
dtypes: float64(1), int32(1), object(11)
memory usage: 1.1+ MB
```

```
df_copy['Size'].unique()
```

```
array(['19M', '14M', '8.7M', '25M', '2.8M', '5.6M', '29M', '33M', 
'3.1M',
       '28M', '12M', '20M', '21M', '37M', '2.7M', '5.5M', '17M', 
'39M',
       '31M', '4.2M', '7.0M', '23M', '6.0M', '6.1M', '4.6M', '9.2M',
       '5.2M', '11M', '24M', 'Varies with device', '9.4M', '15M', 
'10M',
       '1.2M', '26M', '8.0M', '7.9M', '56M', '57M', '35M', '54M', 
'201k',
       '3.6M', '5.7M', '8.6M', '2.4M', '27M', '2.5M', '16M', '3.4M',
       '8.9M', '3.9M', '2.9M', '38M', '32M', '5.4M', '18M', '1.1M',
       '2.2M', '4.5M', '9.8M', '52M', '9.0M', '6.7M', '30M', '2.6M',
       '7.1M', '3.7M', '22M', '7.4M', '6.4M', '3.2M', '8.2M', '9.9M',
       '4.9M', '9.5M', '5.0M', '5.9M', '13M', '73M', '6.8M', '3.5M',
       '4.0M', '2.3M', '7.2M', '2.1M', '42M', '7.3M', '9.1M', '55M',
       '23k', '6.5M', '1.5M', '7.5M', '51M', '41M', '48M', '8.5M',
'46M',
       '8.3M', '4.3M', '4.7M', '3.3M', '40M', '7.8M', '8.8M', '6.6M',
       '5.1M', '61M', '66M', '79k', '8.4M', '118k', '44M', '695k',
'1.6M',
       '6.2M', '18k', '53M', '1.4M', '3.0M', '5.8M', '3.8M', '9.6M',
       '45M', '63M', '49M', '77M', '4.4M', '4.8M', '70M', '6.9M',
'9.3M',
       '10.0M', '8.1M', '36M', '84M', '97M', '2.0M', '1.9M', '1.8M',
       '5.3M', '47M', '556k', '526k', '76M', '7.6M', '59M', '9.7M',
'78M',
       '72M', '43M', '7.7M', '6.3M', '334k', '34M', '93M', '65M',
'79M',
       '100M', '58M', '50M', '68M', '64M', '67M', '60M', '94M',
'232k',
       '99M', '624k', '95M', '8.5k', '41k', '292k', '11k', '80M',
'1.7M',
       '74M', '62M', '69M', '75M', '98M', '85M', '82M', '96M', '87M',
       '71M', '86M', '91M', '81M', '92M', '83M', '88M', '704k',
'862k',
       '899k', '378k', '266k', '375k', '1.3M', '975k', '980k', '4.1M',
       '89M', '696k', '544k', '525k', '920k', '779k', '853k', '720k',
       '713k', '772k', '318k', '58k', '241k', '196k', '857k', '51k',
       '953k', '865k', '251k', '930k', '540k', '313k', '746k', '203k',
       '26k', '314k', '239k', '371k', '220k', '730k', '756k', '91k',
       '293k', '17k', '74k', '14k', '317k', '78k', '924k', '902k',
'818k',
       '81k', '939k', '169k', '45k', '475k', '965k', '90M', '545k',
'61k',
       '283k', '655k', '714k', '93k', '872k', '121k', '322k', '1.0M',
       '976k', '172k', '238k', '549k', '206k', '954k', '444k', '717k',
       '210k', '609k', '308k', '705k', '306k', '904k', '473k', '175k',
       '350k', '383k', '454k', '421k', '70k', '812k', '442k', '842k',
       '417k', '412k', '459k', '478k', '335k', '782k', '721k', '430k',
       '429k', '192k', '200k', '460k', '728k', '496k', '816k', '414k',
       '506k', '887k', '613k', '243k', '569k', '778k', '683k', '592k',
       '319k', '186k', '840k', '647k', '191k', '373k', '437k', '598k',
       '716k', '585k', '982k', '222k', '219k', '55k', '948k', '323k',
       '691k', '511k', '951k', '963k', '25k', '554k', '351k', '27k',
       '82k', '208k', '913k', '514k', '551k', '29k', '103k', '898k',
       '743k', '116k', '153k', '209k', '353k', '499k', '173k', '597k',
       '809k', '122k', '411k', '400k', '801k', '787k', '237k', '50k',
       '643k', '986k', '97k', '516k', '837k', '780k', '961k', '269k',
       '20k', '498k', '600k', '749k', '642k', '881k', '72k', '656k',
       '601k', '221k', '228k', '108k', '940k', '176k', '33k', '663k',
       '34k', '942k', '259k', '164k', '458k', '245k', '629k', '28k',
       '288k', '775k', '785k', '636k', '916k', '994k', '309k', '485k',
       '914k', '903k', '608k', '500k', '54k', '562k', '847k', '957k',
       '688k', '811k', '270k', '48k', '329k', '523k', '921k', '874k',
       '981k', '784k', '280k', '24k', '518k', '754k', '892k', '154k',
       '860k', '364k', '387k', '626k', '161k', '879k', '39k', '970k',
       '170k', '141k', '160k', '144k', '143k', '190k', '376k', '193k',
       '246k', '73k', '658k', '992k', '253k', '420k', '404k', '470k',
       '226k', '240k', '89k', '234k', '257k', '861k', '467k', '157k',
       '44k', '676k', '67k', '552k', '885k', '1020k', '582k', '619k'],
      dtype=object)
```

```
df_copy['size']=df_copy['Size'].str.replace('M','000')
df_copy['size']=df_copy['Size'].str.replace('k','')
df_copy['size']=df_copy['Size'].replace('Varies with device',np.nan)
# df_copy['size']=df_copy['Size'].astype(float)
```

```
df_copy['Size']
```

```
0                       19M
1                       14M
2                      8.7M
3                       25M
4                      2.8M
                ...
10836                   53M
10837                  3.6M
10838                  9.5M
10839    Varies with device
10840                   19M
Name: Size, Length: 10840, dtype: object
```

```
df['Installs'].unique()
```

```
array(['10,000+', '500,000+', '5,000,000+', '50,000,000+', '100,000+',
       '50,000+', '1,000,000+', '10,000,000+', '5,000+',
'100,000,000+',
       '1,000,000,000+', '1,000+', '500,000,000+', '50+', '100+',
'500+',
       '10+', '1+', '5+', '0+', '0', 'Free'], dtype=object)
```

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

```
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', '$24.99', '$11.99', '$79.99', '$16.99', '$14.99',
       '$1.00', '$29.99', '$12.99', '$2.49', '$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', 'Everyone', '$1.20', '$1.04'],
dtype=object)
```

```
chars_to_remove=['+',',','$']
cols_to_clean=['Installs','Price']
for item in chars_to_remove:
    for cols in cols_to_clean:
        df_copy[cols]=df_copy[cols].str.replace(item,'')
```

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

```
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',
       '24.99', '11.99', '79.99', '16.99', '14.99', '1.00', '29.99',
       '12.99', '2.49', '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)
```

```
df_copy['Installs']=df_copy['Installs'].astype('int')
```

```
df_copy['Price']=df_copy['Price'].astype('float')
```

```
df_copy.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 10840 entries, 0 to 10840
Data columns (total 14 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   App             10840 non-null  object 
 1   Category        10840 non-null  object 
 2   Rating          9366 non-null   float64
 3   Reviews         10840 non-null  int32  
 4   Size            10840 non-null  object 
 5   Installs        10840 non-null  int32  
 6   Type            10839 non-null  object 
 7   Price           10840 non-null  float64
 8   Content Rating  10840 non-null  object 
 9   Genres          10840 non-null  object 
 10  Last Updated    10840 non-null  object 
 11  Current Ver     10832 non-null  object 
 12  Android Ver     10838 non-null  object 
 13  size            9145 non-null   object 
dtypes: float64(2), int32(2), object(10)
memory usage: 1.2+ MB
```

```
## Handling the last update feature
```

```
df_copy['Last Updated'].unique()
```

```
array(['January 7, 2018', 'January 15, 2018', 'August 1, 2018', ...,
       'January 20, 2014', 'February 16, 2014', 'March 23, 2014'],
      dtype=object)
```

```
df_copy['Last Updated']=pd.to_datetime(df_copy['Last Updated'])
df_copy['Day']=df_copy['Last Updated'].dt.day
df_copy['Month']=df_copy['Last Updated'].dt.month
df_copy['Year']=df_copy['Last Updated'].dt.year
```

```
df_copy.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 10840 entries, 0 to 10840
Data columns (total 17 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   App             10840 non-null  object 
 1   Category        10840 non-null  object 
 2   Rating          9366 non-null   float64
 3   Reviews         10840 non-null  int32  
 4   Size            10840 non-null  object 
 5   Installs        10840 non-null  int32  
 6   Type            10839 non-null  object 
 7   Price           10840 non-null  float64
 8   Content Rating  10840 non-null  object        
 9   Genres          10840 non-null  object        
 10  Last Updated    10840 non-null  datetime64[ns]
 11  Current Ver     10832 non-null  object        
 12  Android Ver     10838 non-null  object        
 13  size            9145 non-null   object        
 14  Day             10840 non-null  int32         
 15  Month           10840 non-null  int32         
 16  Year            10840 non-null  int32         
dtypes: datetime64[ns](1), float64(2), int32(5), object(9)
memory usage: 1.3+ MB
```

```
df_copy.head()
```

```
                                                 App        Category  
Rating  \
0     Photo Editor & Candy Camera & Grid & ScrapBook  ART_AND_DESIGN  
4.1   
1                                Coloring book moana  ART_AND_DESIGN  
3.9   
2  U Launcher Lite – FREE Live Cool Themes, Hide ...  ART_AND_DESIGN  
4.7   
3                              Sketch - Draw & Paint  ART_AND_DESIGN  
4.5   
4              Pixel Draw - Number Art Coloring Book  ART_AND_DESIGN  
4.3   

   Reviews  Size  Installs  Type  Price Content Rating  \
0      159   19M     10000  Free    0.0       Everyone   
1      967   14M    500000  Free    0.0       Everyone   
2    87510  8.7M   5000000  Free    0.0       Everyone   
3   215644   25M  50000000  Free    0.0           Teen   
4      967  2.8M    100000  Free    0.0       Everyone   

                      Genres Last Updated         Current Ver  
Android Ver  \
0             Art & Design   2018-01-07               1.0.0  4.0.3 
and up   
1  Art & Design;Pretend Play   2018-01-15               2.0.0  4.0.3 
and up   
2             Art & Design   2018-08-01               1.2.4  4.0.3 
and up   
3             Art & Design   2018-06-08  Varies with device    4.2 
and up   
4    Art & Design;Creativity   2018-06-20                 1.1    4.4 
and up   

   size  Day  Month  Year  
0   19M    7      1  2018  
1   14M   15      1  2018  
```

```
2  8.7M    1       8  2018
3   25M    8       6  2018
4  2.8M   20       6  2018
```

```
df_copy.to_csv('data/google_cleaned.csv')
```

EDA and Feature Engineering.

```
df_copy[df.duplicated('App')].shape
```

```
(1181, 17)
```

Observation

The dataset has duplicate records

```
df_copy=df_copy.drop_duplicates(subset=['App'],keep='first')
```

```
df_copy.shape
```

```
(9659, 17)
```

Explore Data

```
numeric_features = [feature for feature in df_copy.columns if
df_copy[feature].dtype != 'O']
categorical_features = [feature for feature in df_copy.columns if
df_copy[feature].dtype == 'O']

# print columns
print('We have {} numerical features :
{}'.format(len(numeric_features), numeric_features))
print('\nWe have {} categorical features :
{}'.format(len(categorical_features), categorical_features))
```

```
We have 8 numerical features : ['Rating', 'Reviews', 'Installs',
'Price', 'Last Updated', 'Day', 'Month', 'Year']

We have 9 categorical features : ['App', 'Category', 'Size', 'Type',
'Content Rating', 'Genres', 'Current Ver', 'Android Ver', 'size']
```

3.2 Feature Information

1. App :- Name of the App
2. Category :- Category under which the App falls.
3. Rating :- Application's rating on playstore
4. Reviews :- Number of reviews of the App.
5. Size :- Size of the App.
6. Install :- Number of Installs of the App

7. Type :- If the App is free/paid
8. Price :- Price of the app (0 if it is Free)
9. Content Rating :- Appropiate Target Audience of the App.
10. Genres:- Genre under which the App falls.
11. Last Updated :- Date when the App was last updated
12. Current Ver :- Current Version of the Application
13. Android Ver :- Minimum Android Version required to run the App

```
# ## Proportion of count data on categorical columns
# for col in categorical_features:
#     print(df[col].value_counts(normalize=True)*100)
#     print('---------------------------')


for col in categorical_features:
    if col in df.columns:
        print(df[col].value_counts(normalize=True) * 100)
    else:
        print(f"Column '{col}' not found in DataFrame")
```

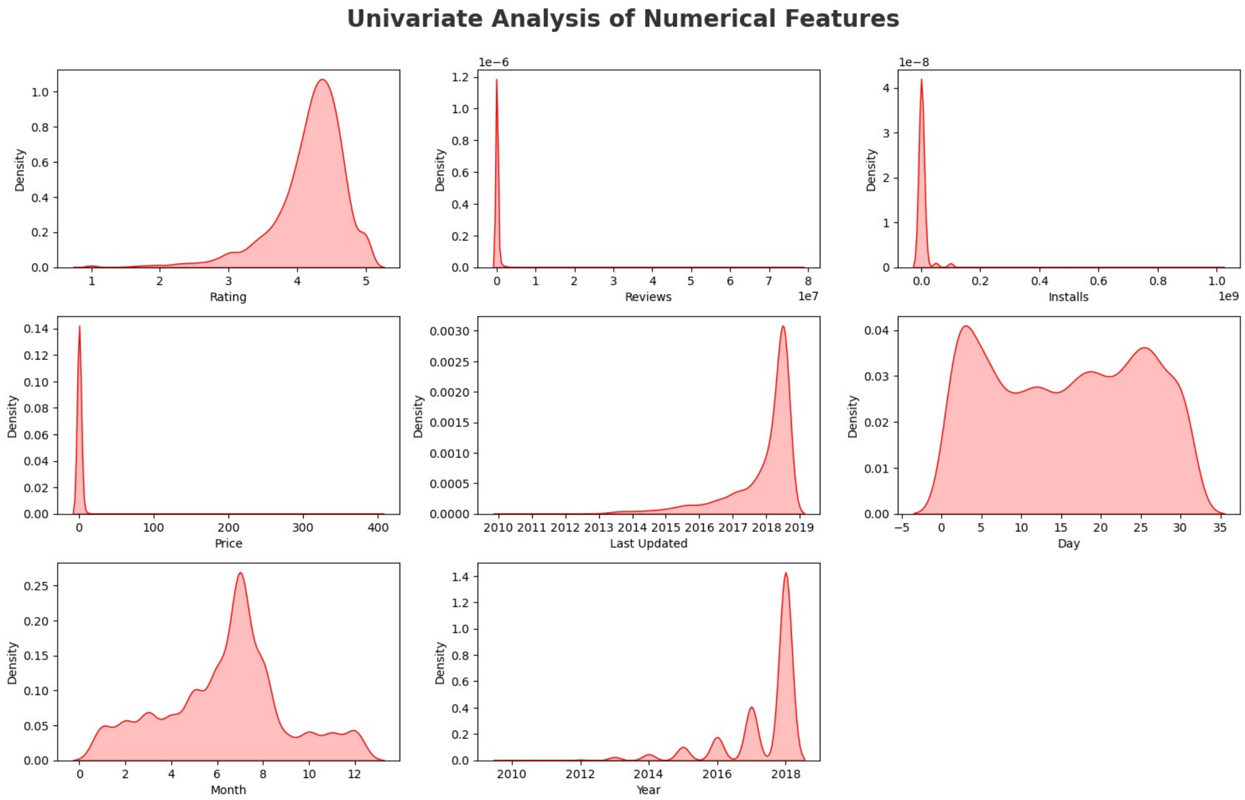
```
App
ROBLOX                                                0.083018
CBS Sports App - Scores, News, Stats & Watch Live     0.073794
ESPN                                                  0.064570
Duolingo: Learn Languages Free                        0.064570
Candy Crush Saga                                      0.064570
                                                        ...
Meet U - Get Friends for Snapchat, Kik & Instagram    0.009224
U-Report                                              0.009224
U of I Community Credit Union                         0.009224
Waiting For U Launcher Theme                          0.009224
iHoroscope - 2018 Daily Horoscope & Astrology         0.009224
Name: proportion, Length: 9660, dtype: float64
Category
FAMILY                 18.190204
GAME                   10.552532
TOOLS                   7.776035
MEDICAL                 4.270824
BUSINESS                4.243151
PRODUCTIVITY            3.911078
PERSONALIZATION         3.615903
COMMUNICATION           3.569781
SPORTS                  3.542109
LIFESTYLE               3.523660
FINANCE                 3.376072
HEALTH_AND_FITNESS      3.145466
PHOTOGRAPHY             3.090121
SOCIAL                  2.721151
NEWS_AND_MAGAZINES      2.610460
```

```
SHOPPING                2.398303
TRAVEL_AND_LOCAL        2.379854
DATING                  2.158472
BOOKS_AND_REFERENCE     2.130800
VIDEO_PLAYERS           1.614242
EDUCATION               1.438982
ENTERTAINMENT           1.374412
MAPS_AND_NAVIGATION     1.263721
FOOD_AND_DRINK          1.171479
HOUSE_AND_HOME          0.811733
LIBRARIES_AND_DEMO      0.784061
AUTO_AND_VEHICLES       0.784061
WEATHER                 0.756388
ART_AND_DESIGN          0.599576
EVENTS                  0.590351
PARENTING               0.553454
COMICS                  0.553454
BEAUTY                  0.488885
1.9                     0.009224
Name: proportion, dtype: float64
Size
Varies with device    15.635089
11M                    1.826400
12M                    1.807951
14M                    1.789503
13M                    1.761830
                        ...
429k                   0.009224
200k                   0.009224
460k                   0.009224
728k                   0.009224
619k                   0.009224
Name: proportion, Length: 462, dtype: float64
Type
Free    92.610701
Paid     7.380074
0        0.009225
Name: proportion, dtype: float64
Content Rating
Everyone           80.387454
Teen               11.143911
Mature 17+          4.603321
Everyone 10+        3.819188
Adults only 18+     0.027675
Unrated             0.018450
Name: proportion, dtype: float64
Genres
Tools                     7.766811
Entertainment             5.746702
```

```
Education                 5.064108
Medical                   4.270824
Business                  4.243151
                            ...
Arcade;Pretend Play       0.009224
Card;Brain Games          0.009224
Lifestyle;Pretend Play    0.009224
Comics;Creativity         0.009224
Strategy;Creativity       0.009224
Name: proportion, Length: 120, dtype: float64
Current Ver
Varies with device    13.468107
1.0                    7.467922
1.1                    2.436998
1.2                    1.643127
2.0                    1.393889
                        ...
1.0.17.3905            0.009231
15.1.2                 0.009231
4.94.19                0.009231
1.1.11.11              0.009231
2.0.148.0              0.009231
Name: proportion, Length: 2832, dtype: float64
Android Ver
4.1 and up            22.614874
4.0.3 and up          13.849419
4.0 and up            12.686843
Varies with device    12.566894
4.4 and up             9.042259
2.3 and up             6.015870
5.0 and up             5.545304
4.2 and up             3.635357
2.3.3 and up           2.592729
2.2 and up             2.251338
4.3 and up             2.242111
3.0 and up             2.223658
2.1 and up             1.236390
1.6 and up             1.070308
6.0 and up             0.553608
7.0 and up             0.387525
3.2 and up             0.332165
2.0 and up             0.295257
5.1 and up             0.221443
1.5 and up             0.184536
4.4W and up            0.110722
3.1 and up             0.092268
2.0.1 and up           0.064588
8.0 and up             0.055361
7.1 and up             0.027680
```

```
4.0.3 - 7.1.1         0.018454
5.0 - 8.0             0.018454
1.0 and up            0.018454
7.0 - 7.1.1           0.009227
4.1 - 7.1.1           0.009227
5.0 - 6.0             0.009227
2.2 - 7.1.1           0.009227
5.0 - 7.1.1           0.009227
Name: proportion, dtype: float64
Column 'size' not found in DataFrame
```

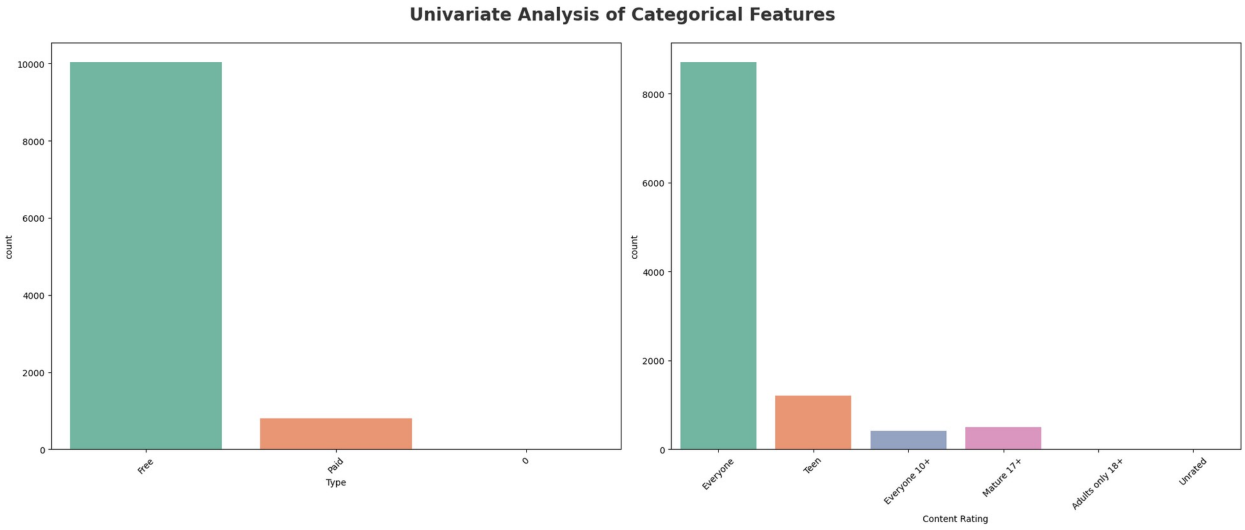
```
## Proportion of count data on numerical columns
plt.figure(figsize=(15, 15))
plt.suptitle('Univariate Analysis of Numerical Features', fontsize=20,
fontweight='bold', alpha=0.8, y=1.)

for i in range(0, len(numeric_features)):
    plt.subplot(5, 3, i+1)
    sns.kdeplot(x=df_copy[numeric_features[i]],shade=True, color='r')
    plt.xlabel(numeric_features[i])
    plt.tight_layout()
```



Observations

Rating and Year is left skewed while Reviews , Size, installs and Price are right skewed

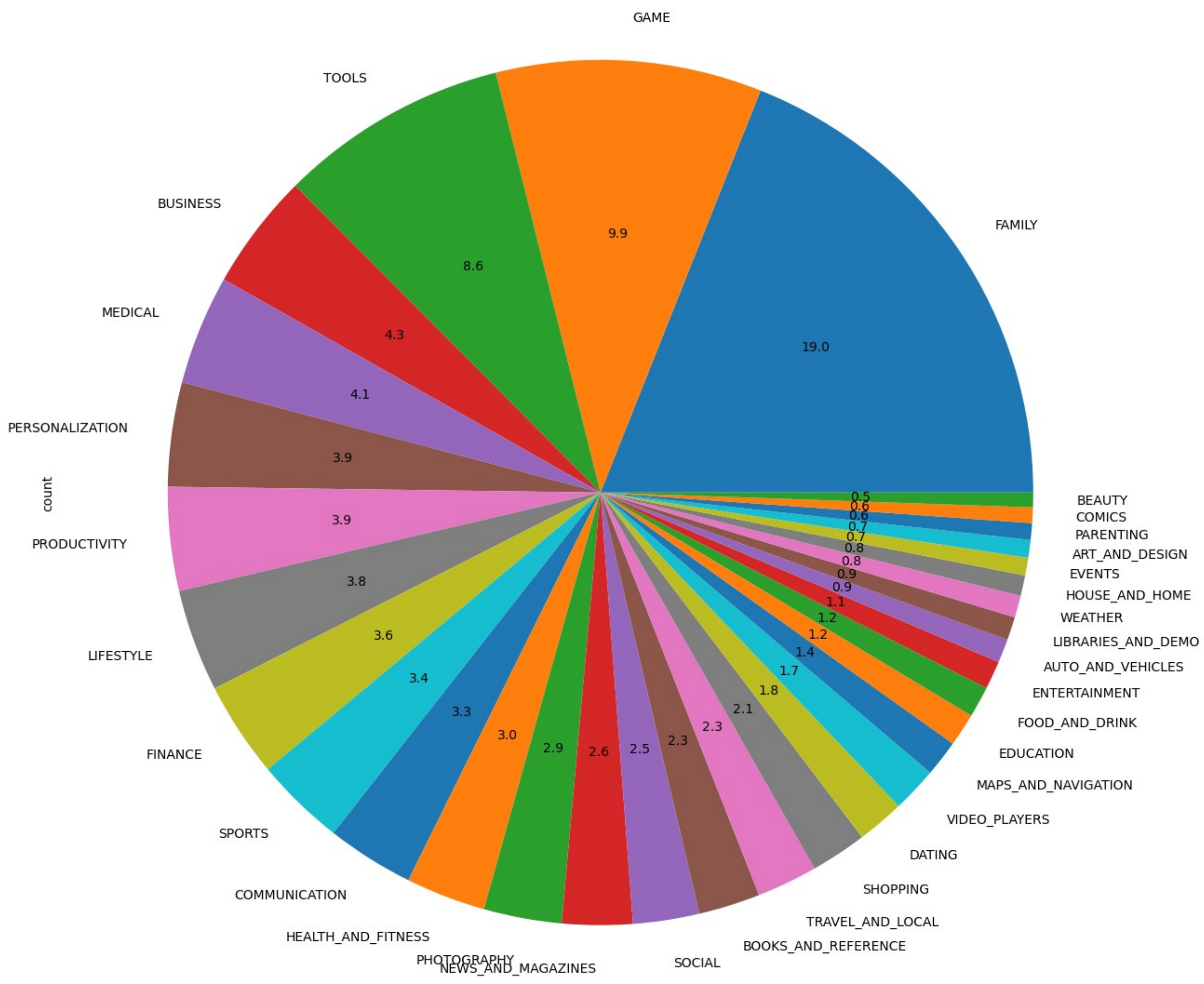
```
# categorical columns
plt.figure(figsize=(20, 15))
plt.suptitle('Univariate Analysis of Categorical Features',
fontsize=20, fontweight='bold', alpha=0.8, y=1.)
category = [ 'Type', 'Content Rating']
for i in range(0, len(category)):
    plt.subplot(2, 2, i+1)
    sns.countplot(x=df[category[i]],palette="Set2")
    plt.xlabel(category[i])
    plt.xticks(rotation=45)
    plt.tight_layout()
```



Which is the most popular app category?

```
df_copy.head(2)

                                              App        Category
Rating  \
0  Photo Editor & Candy Camera & Grid & ScrapBook  ART_AND_DESIGN
4.1
1                             Coloring book moana  ART_AND_DESIGN
3.9

  Reviews Size  Installs  Type  Price Content Rating  \
0     159  19M     10000  Free    0.0       Everyone
1     967  14M    500000  Free    0.0       Everyone

                      Genres Last Updated Current Ver   Android Ver
size  Day  \
0               Art & Design   2018-01-07       1.0.0  4.0.3 and up
19M    7
1  Art & Design;Pretend Play   2018-01-15       2.0.0  4.0.3 and up
14M   15
```

```
   Month  Year
0      1  2018
1      1  2018

df_copy['Category'].value_counts().plot.pie(y=df['Category'],figsize=(
15,16),autopct='%1.1f')

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



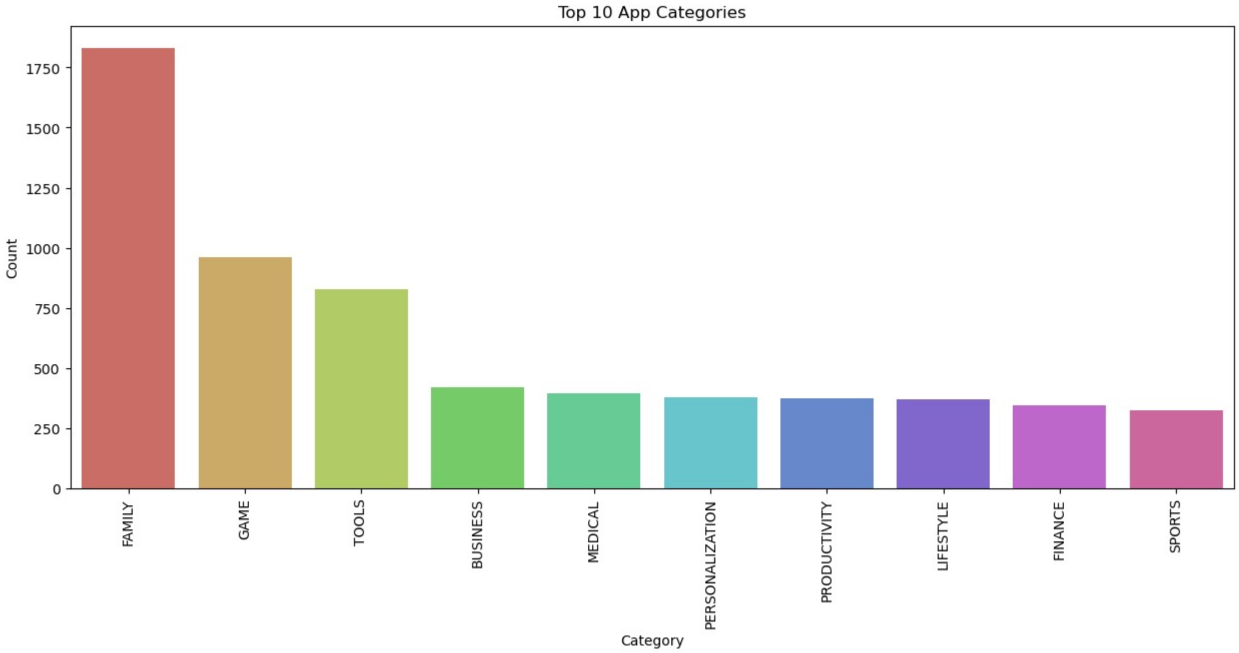
Observations

1. There are more kinds of app in playstore whi\ch are under category of family, game & tools.

2. Beauty,comics,arts and weather kinds of apps are very less in playstore.

```
## Top 10 App Categories
category = pd.DataFrame(df_copy['Category'].value_counts())
#Dataframe of apps on the basis of category
category.rename(columns = {'Category':'Count'},inplace=True)

category

                     count
Category
FAMILY                1832
GAME                   959
TOOLS                  827
BUSINESS               420
MEDICAL                395
PERSONALIZATION        376
PRODUCTIVITY           374
LIFESTYLE              369
FINANCE                345
SPORTS                 325
COMMUNICATION          315
HEALTH_AND_FITNESS     288
PHOTOGRAPHY            281
NEWS_AND_MAGAZINES     254
SOCIAL                 239
BOOKS_AND_REFERENCE    222
TRAVEL_AND_LOCAL       219
SHOPPING               202
DATING                 171
VIDEO_PLAYERS          163
MAPS_AND_NAVIGATION    131
EDUCATION              119
FOOD_AND_DRINK         112
ENTERTAINMENT          102
AUTO_AND_VEHICLES       85
LIBRARIES_AND_DEMO      84
WEATHER                 79
HOUSE_AND_HOME          74
EVENTS                  64
ART_AND_DESIGN          64
PARENTING               60
COMICS                  56
BEAUTY                  53

import matplotlib.pyplot as plt
import seaborn as sns

# Convert Series to DataFrame
category = category.reset_index()
category.columns = ['Category', 'Count']
```

```
# Plot
plt.figure(figsize=(15,6))
sns.barplot(x=category['Category'][:10], y=category['Count'][:10],
palette='hls')
plt.title('Top 10 App Categories')
plt.xticks(rotation=90)
plt.show()
```



Insights

1. Family category has the most number of apps with 18% of apps belonging to it, followed by Games category which has 11% of the apps.
2. Least number of apps belong to the Beauty category with less than 1% of the total apps belonging to it.

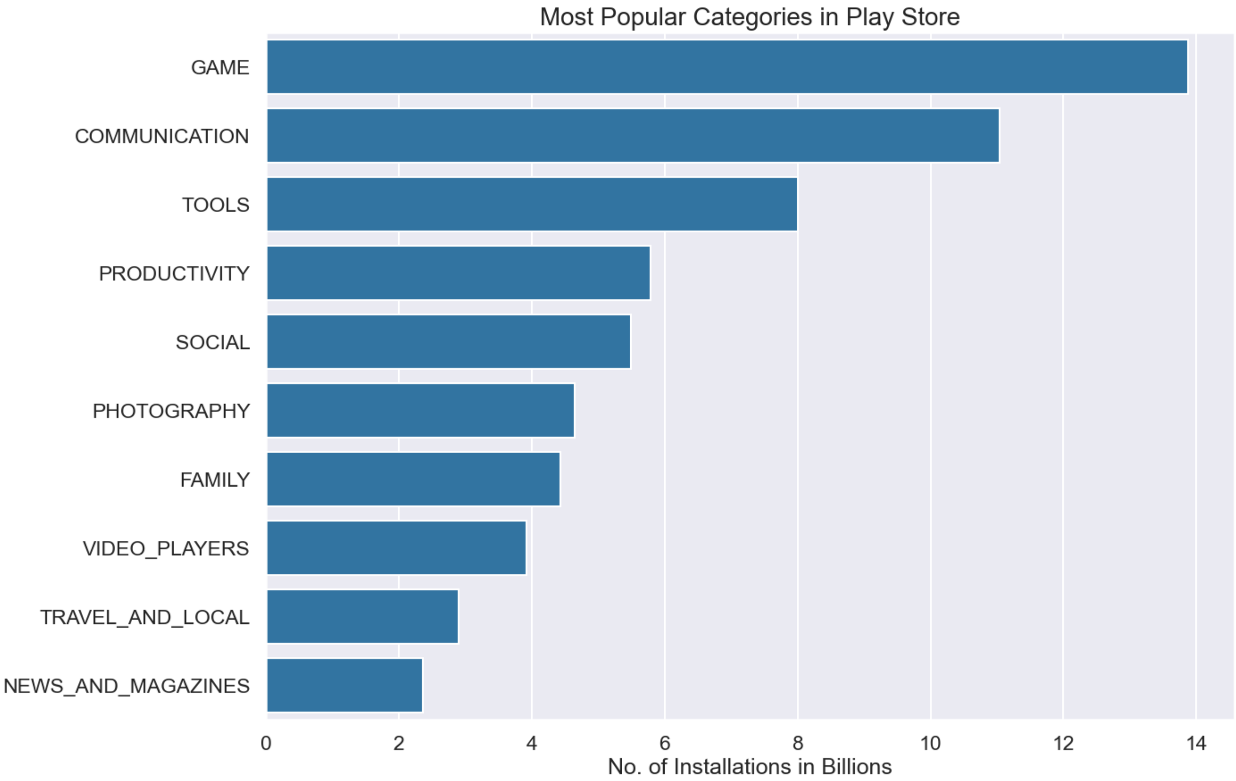
Internal Assignments

1. Which Category has largest number of installations??
2. What are the Top 5 most installed Apps in Each popular Categories ??
3. How many apps are there on Google Play Store which get 5 ratings??

Which Category has largest number of installations??

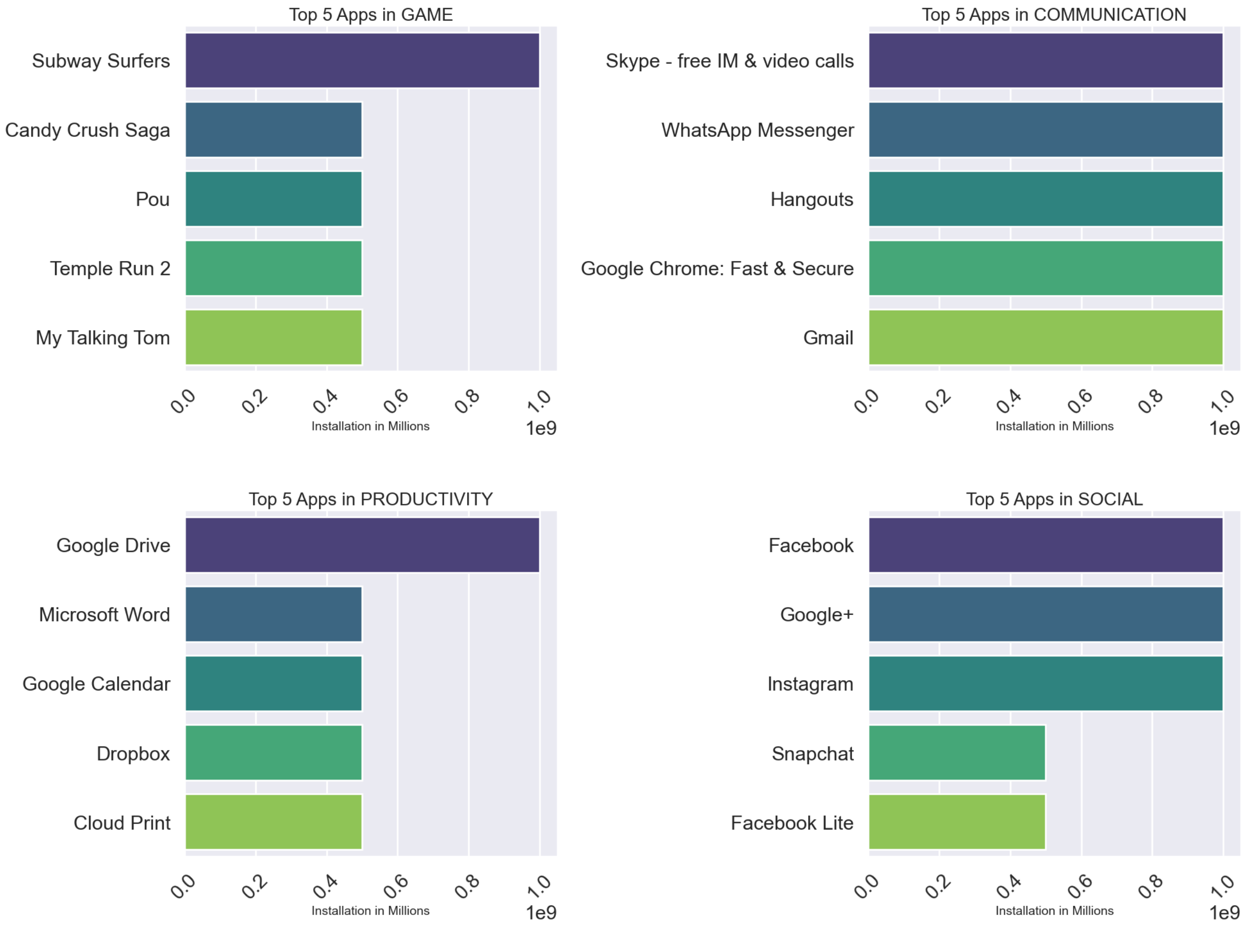
```
df_cat_installs = df_copy.groupby(['Category'])
['Installs'].sum().sort_values(ascending = False).reset_index()
df_cat_installs.Installs = df_cat_installs.Installs/1000000000#
converting into billions
df2 = df_cat_installs.head(10)
```

```
plt.figure(figsize = (14,10))
sns.set_context("talk")
sns.set_style("darkgrid")

ax = sns.barplot(x = 'Installs' , y = 'Category' , data = df2 )
ax.set_xlabel('No. of Installations in Billions')
ax.set_ylabel('')
ax.set_title("Most Popular Categories in Play Store", size = 20)

Text(0.5, 1.0, 'Most Popular Categories in Play Store')
```



What are the Top 5 most installed Apps in Each popular Categories ??

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

# Assuming df_copy is already defined
dfa = df_copy.groupby(['Category', 'App'])
['Installs'].sum().reset_index()
dfa = dfa.sort_values('Installs', ascending=False)

apps = ['GAME', 'COMMUNICATION', 'PRODUCTIVITY', 'SOCIAL']
sns.set_context("poster")
sns.set_style("darkgrid")

plt.figure(figsize=(20, 15))  # Adjusted figure size for better
readability

for i, app in enumerate(apps):
    df2 = dfa[dfa['Category'] == app]  # Ensure column names are
correct
    df3 = df2.head(5)  # Top 5 apps in each category

    plt.subplot(2, 2, i+1)  # Adjusted subplot layout
    sns.barplot(data=df3, x='Installs', y='App', palette='viridis')  #
Added color for better visuals

    plt.xlabel('Installation in Millions', fontsize=14)
    plt.ylabel('')
    plt.title(f"Top 5 Apps in {app}", size=20)
    plt.xticks(rotation=45)

plt.tight_layout()
plt.subplots_adjust(hspace=0.4)
plt.show()
```



Insights

- Most popular game is Subway Surfers.
- Most popular communication app is Hangouts.
- Most popular productivity app is Google Drive.
- Most popular social app is Instagram.

How many apps are there on Google Play Store which get 5 ratings??

```
rating = df_copy.groupby(['Category','Installs', 'App'])
['Rating'].sum().sort_values(ascending = False).reset_index()

toprating_apps = rating[rating.Rating == 5.0]
print("Number of 5 rated apps",toprating_apps.shape[0])
toprating_apps.head(1)
```

```
Number of 5 rated apps 271
```

```
  Category  Installs                              App  Rating
0   FAMILY      1000  CS & IT Interview Questions     5.0
```

Result

- There are 271 five rated apps on Google Play store
- Top most is 'CT Brain Interpretation' from 'Family' Category

Summary: Google Play Store Data Analysis

Objective The analysis focuses on understanding trends within the Google Play Store by exploring various app categories, installation counts, and app sizes. Given the vast number of available applications—over 2.56 million for Android users—this study aims to identify key insights, including:

The most popular app categories. Apps with the highest number of installations. The impact of app size on downloads and user engagement. Methodology The study follows a structured approach:

Data Cleaning – Handling missing values, ensuring data consistency, and preparing the dataset for analysis. Exploratory Data Analysis (EDA) – Identifying trends, visualizing top-performing categories, and uncovering key insights. Feature Engineering – Enhancing data attributes to improve the depth of analysis. Key Findings Most Installed App Categories: Certain categories, such as Games, Communication, Productivity, and Social, dominate the Play Store in terms of total installs. Top-Performing Apps: A deep dive into the top 5 most installed apps per category showcases industry leaders and emerging trends. Size vs. Popularity: The correlation between app size and installs provides insights into user preferences for lightweight vs. feature-rich applications. Visual Insights Using Seaborn and Matplotlib, bar plots were generated to illustrate the top 5 apps in each selected category. These visualizations highlight how app installs vary across different market segments, providing valuable insights for developers and marketers.

Conclusion This analysis provides actionable insights for app developers, businesses, and investors looking to optimize their strategies within the Google Play Store ecosystem. Future studies could incorporate user ratings, reviews, and revenue data to further refine the understanding of what drives app success.