EDA with googleplaystore_data

import required libraries

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
%matplotlib inline
```

read the csv data

In [2]:
```
df = pd.read_csv(r'E:\himanshu_2022\Download\googleplaystore.csv')
```

In [3]:
```
df
```

Out[3]:

	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	E
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	E
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	E
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	E
...	...	...	...	...	...	...	...	...	
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53M	5,000+	Free	0	E
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0	E
10838	Parkinson Exercices FR	MEDICAL	NaN	3	9.5M	1,000+	Free	0	E
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	E

10841 rows × 13 columns

In [4]:
```
# show only 5 rows in this df...
df.head()
```

Out[4]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	A
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Des
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	A
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	A
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Desig

In [5]:
```
# show last 5 row...
df.tail()
```

Out[5]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53M	5,000+	Free	0	E
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0	E
10838	Parkinson Exercices FR	MEDICAL	NaN	3	9.5M	1,000+	Free	0	E
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	E

In [6]:
```
# generate random sample of the data...
df.sample(10)
```

Out[6]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Conte Ratii
3418	Galactic Core Free Wallpaper	PERSONALIZATION	4.1	69417	853k	10,000,000+	Free	0	Everyo
9732	Multi Surgery ER Emergency Hospital : Doctor Game	FAMILY	4.1	227	69M	10,000+	Free	0	Te
6111	Hot Bhojpuri Video Song 2018 - Free Movies	FAMILY	4.4	447	3.7M	100,000+	Free	0	Matu 1
7096	Save.ca	SHOPPING	3.7	2094	34M	100,000+	Free	0	Everyo
1054	Nedbank Money	FINANCE	4.2	6076	32M	500,000+	Free	0	Everyo
1157	BankMobile Vibe App	FINANCE	4.3	14627	23M	1,000,000+	Free	0	Everyo
1233	Postmates Food Delivery: Order Eats & Alcohol	FOOD_AND_DRINK	3.6	22875	22M	1,000,000+	Free	0	Everyo
367	WhatsApp Business	COMMUNICATION	4.4	136662	32M	10,000,000+	Free	0	Everyo
6541	BN Pro White Text	LIBRARIES_AND_DEMO	4.4	50	506k	5,000+	Free	0	Everyo
8223	DB FahrtProfi	TRAVEL_AND_LOCAL	NaN	1	10M	1,000+	Free	0	Everyo

In [7]:
```
# information about df....
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
```

Data cleaning

In [8]:
```
df.describe(include='all')
```

Out[8]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Ge
count	10841	10841	9367.000000	10841	10841	10841	10840	10841	10840	1
unique	9660	34	NaN	6002	462	22	3	93	6	
top	ROBLOX	FAMILY	NaN	0	Varies with device	1,000,000+	Free	0	Everyone	
freq	9	1972	NaN	596	1695	1579	10039	10040	8714	
mean	NaN	NaN	4.193338	NaN	NaN	NaN	NaN	NaN	NaN	
std	NaN	NaN	0.537431	NaN	NaN	NaN	NaN	NaN	NaN	
min	NaN	NaN	1.000000	NaN	NaN	NaN	NaN	NaN	NaN	
25%	NaN	NaN	4.000000	NaN	NaN	NaN	NaN	NaN	NaN	
50%	NaN	NaN	4.300000	NaN	NaN	NaN	NaN	NaN	NaN	
75%	NaN	NaN	4.500000	NaN	NaN	NaN	NaN	NaN	NaN	
max	NaN	NaN	19.000000	NaN	NaN	NaN	NaN	NaN	NaN	

In [ ]:
```

```

statistics data..

In [9]:
```
df.describe(include = 'all').T
```

Out[9]:

	count	unique	top	freq	mean	std	min	25%	50%	75%	max
App	10841	9660	ROBLOX	9	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Category	10841	34	FAMILY	1972	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Rating	9367.0	NaN	NaN	NaN	4.193338	0.537431	1.0	4.0	4.3	4.5	19.0
Reviews	10841	6002	0	596	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Size	10841	462	Varies with device	1695	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Installs	10841	22	1,000,000+	1579	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Type	10840	3	Free	10039	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Price	10841	93	0	10040	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Content Rating	10840	6	Everyone	8714	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Genres	10841	120	Tools	842	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Last Updated	10841	1378	August 3, 2018	326	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Current Ver	10833	2832	Varies with device	1459	NaN	NaN	NaN	NaN	NaN	NaN	NaN
Android Ver	10838	33	4.1 and up	2451	NaN	NaN	NaN	NaN	NaN	NaN	NaN

In [10]:
```
## check shape the data...
df[df.duplicated()]
```

Out[10]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating
229	Quick PDF Scanner + OCR FREE	BUSINESS	4.2	80805	Varies with device	5,000,000+	Free	0	Everyone
236	Box	BUSINESS	4.2	159872	Varies with device	10,000,000+	Free	0	Everyone
239	Google My Business	BUSINESS	4.4	70991	Varies with device	5,000,000+	Free	0	Everyone
256	ZOOM Cloud Meetings	BUSINESS	4.4	31614	37M	10,000,000+	Free	0	Everyone
261	join.me - Simple Meetings	BUSINESS	4.0	6989	Varies with device	1,000,000+	Free	0	Everyone
...	...	...	...	...	...	...	...	...	...
8643	Wunderlist: To-Do List & Tasks	PRODUCTIVITY	4.6	404610	Varies with device	10,000,000+	Free	0	Everyone
8654	TickTick: To Do List with Reminder, Day Planner	PRODUCTIVITY	4.6	25370	Varies with device	1,000,000+	Free	0	Everyone
8658	ColorNote Notepad Notes	PRODUCTIVITY	4.6	2401017	Varies with device	100,000,000+	Free	0	Everyone
10049	Airway Ex - Intubate. Anesthetize. Train.	MEDICAL	4.3	123	86M	10,000+	Free	0	Everyone
10768	AAFP	MEDICAL	3.8	63	24M	10,000+	Free	0	Everyone

483 rows × 13 columns

In [11]:
```
## about Reviews columns...
df['Reviews'].head()
```

Out[11]:
```
0       159
1       967
2     87510
3    215644
4       967
Name: Reviews, dtype: object
```

In [12]:
```
## check the other values also...
df['Reviews'].shape
```

Out[12]:
```
(10841,)
```

In [13]:
```
df['Reviews'].dtype
```

Out[13]:
```
dtype('O')
```

In [14]:
```
## check numeric values...
df.Reviews.str.isnumeric().sum()
```

Out[14]:
```
10840
```

In [15]:
```
~df['Reviews'].str.isnumeric()
## wherever we have numeric value it is giving reverse.
```

Out[15]:
```
0        False
1        False
2        False
3        False
4        False
         ...
10836    False
10837    False
10838    False
10839    False
10840    False
Name: Reviews, Length: 10841, dtype: bool
```

In [16]:
```
df[~df['Reviews'].str.isnumeric()]
```

Out[16]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres
10472	Life Made WI-Fi Touchscreen Photo Frame	1.9	19.0	3.0M	1,000+	Free	0	Everyone	NaN	February 11, 2018

In [17]:
```
## know we drop this row ...
```

In [18]:
```
## inside that we store it new variable...
df_copy = df.copy()
```

In [19]:
```
df_copy.head()
```

Out[19]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	A
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Des
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	A
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	A
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Desig

In [20]:
```
## drop the data with index 10472...
df_copy = df_copy.drop(df_copy.index[10472])
```

In [21]:
```
df_copy.shape
```

Out[21]:
```
(10840, 13)
```

In [22]:
```
df['Reviews'].dtype
```

Out[22]:
```
dtype('O')
```

In [23]:
```
# change the datatype this columns...
df_copy["Reviews"]=df_copy["Reviews"].astype('int')
```

In [24]:
```
df_copy["Reviews"].dtype
```

Out[24]:
```
dtype('int32')
```

In [25]:
```
df_copy.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 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
```

In [26]:
```
df_copy.head()
```

Out[26]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	A
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Des
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	A
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	A
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Desig

check the unique values..

In [27]:
```
df_copy['Size'].unique()
```

Out[27]:
```
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)
```

In [28]:
```
df_copy["Size"]=df_copy["Size"].str.replace('M','000')
```

In [29]:
```
df_copy['Size']
```

Out[29]:
```
0                     19000
1                     14000
2                    8.7000
3                     25000
4                    2.8000
                 ...
10836                 53000
10837                3.6000
10838                9.5000
10839    Varies with device
10840                 19000
Name: Size, Length: 10840, dtype: object
```

In [30]:
```
df_copy["Size"]=df_copy["Size"].str.replace('k','')
```

In [31]:
```
df_copy["Size"].unique()
```

Out[31]:
```
array(['19000', '14000', '8.7000', '25000', '2.8000', '5.6000', '29000',
       '33000', '3.1000', '28000', '12000', '20000', '21000', '37000',
       '2.7000', '5.5000', '17000', '39000', '31000', '4.2000', '7.0000',
       '23000', '6.0000', '6.1000', '4.6000', '9.2000', '5.2000', '11000',
       '24000', 'Varies with device', '9.4000', '15000', '10000',
       '1.2000', '26000', '8.0000', '7.9000', '56000', '57000', '35000',
       '54000', '201', '3.6000', '5.7000', '8.6000', '2.4000', '27000',
       '2.5000', '16000', '3.4000', '8.9000', '3.9000', '2.9000', '38000',
       '32000', '5.4000', '18000', '1.1000', '2.2000', '4.5000', '9.8000',
       '52000', '9.0000', '6.7000', '30000', '2.6000', '7.1000', '3.7000',
       '22000', '7.4000', '6.4000', '3.2000', '8.2000', '9.9000',
       '4.9000', '9.5000', '5.0000', '5.9000', '13000', '73000', '6.8000',
       '3.5000', '4.0000', '2.3000', '7.2000', '2.1000', '42000',
       '7.3000', '9.1000', '55000', '23', '6.5000', '1.5000', '7.5000',
       '51000', '41000', '48000', '8.5000', '46000', '8.3000', '4.3000',
       '4.7000', '3.3000', '40000', '7.8000', '8.8000', '6.6000',
       '5.1000', '61000', '66000', '79', '8.4000', '118', '44000', '695',
       '1.6000', '6.2000', '18', '53000', '1.4000', '3.0000', '5.8000',
       '3.8000', '9.6000', '45000', '63000', '49000', '77000', '4.4000',
       '4.8000', '70000', '6.9000', '9.3000', '10.0000', '8.1000',
       '36000', '84000', '97000', '2.0000', '1.9000', '1.8000', '5.3000',
       '47000', '556', '526', '76000', '7.6000', '59000', '9.7000',
       '78000', '72000', '43000', '7.7000', '6.3000', '334', '34000',
       '93000', '65000', '79000', '100000', '58000', '50000', '68000',
       '64000', '67000', '60000', '94000', '232', '99000', '624', '95000',
       '8.5', '41', '292', '11', '80000', '1.7000', '74000', '62000',
       '69000', '75000', '98000', '85000', '82000', '96000', '87000',
       '71000', '86000', '91000', '81000', '92000', '83000', '88000',
       '704', '862', '899', '378', '266', '375', '1.3000', '975', '980',
       '4.1000', '89000', '696', '544', '525', '920', '779', '853', '720',
       '713', '772', '318', '58', '241', '196', '857', '51', '953', '865',
       '251', '930', '540', '313', '746', '203', '26', '314', '239',
       '371', '220', '730', '756', '91', '293', '17', '74', '14', '317',
       '78', '924', '902', '818', '81', '939', '169', '45', '475', '965',
       '90000', '545', '61', '283', '655', '714', '93', '872', '121',
       '322', '1.0000', '976', '172', '238', '549', '206', '954', '444',
       '717', '210', '609', '308', '705', '306', '904', '473', '175',
       '350', '383', '454', '421', '70', '812', '442', '842', '417',
       '412', '459', '478', '335', '782', '721', '430', '429', '192',
       '200', '460', '728', '496', '816', '414', '506', '887', '613',
       '243', '569', '778', '683', '592', '319', '186', '840', '647',
       '191', '373', '437', '598', '716', '585', '982', '222', '219',
       '55', '948', '323', '691', '511', '951', '963', '25', '554', '351',
       '27', '82', '208', '913', '514', '551', '29', '103', '898', '743',
       '116', '153', '209', '353', '499', '173', '597', '809', '122',
       '411', '400', '801', '787', '237', '50', '643', '986', '97', '516',
       '837', '780', '961', '269', '20', '498', '600', '749', '642',
       '881', '72', '656', '601', '221', '228', '108', '940', '176', '33',
       '663', '34', '942', '259', '164', '458', '245', '629', '28', '288',
       '775', '785', '636', '916', '994', '309', '485', '914', '903',
       '608', '500', '54', '562', '847', '957', '688', '811', '270', '48',
       '329', '523', '921', '874', '981', '784', '280', '24', '518',
       '754', '892', '154', '860', '364', '387', '626', '161', '879',
       '39', '970', '170', '141', '160', '144', '143', '190', '376',
       '193', '246', '73', '658', '992', '253', '420', '404', '470',
```

```
       '226', '240', '89', '234', '257', '861', '467', '157', '44', '676',
       '67', '552', '885', '1020', '582', '619'], dtype=object)
```

In [32]:
```
import numpy as np
```

In [33]:
```
np.nan
```

Out[33]:
```
nan
```

In [34]:
```
df_copy["Size"]=df_copy["Size"].str.replace("Varies with device", str(np.nan))
```

In [35]:
```
df_copy["Size"].dtype
```

Out[35]:
```
dtype('O')
```

In [36]:
```
## change the datatypes in float .....
df_copy['Size']=df_copy["Size"].astype("float")
```

In [37]:
```
df_copy['Size'].head()
```

Out[37]:
```
0    19000.0
1    14000.0
2        8.7
3    25000.0
4        2.8
Name: Size, dtype: float64
```

In [38]:
```
# this index less values..
df_copy["Size"][2]*1000
```

Out[38]:
```
8700.0
```

In [39]:
```
# we can iterate it ....
for i in df_copy['Size']:
    if i < 10:
        df_copy['Size']=df_copy['Size'].replace(i,i*1000)
```

In [40]:
```
df_copy['Size'].head()
```

Out[40]:
```
0    19000.0
1    14000.0
2     8700.0
3    25000.0
4     2800.0
Name: Size, dtype: float64
```

In [41]:
```
df_copy["Size"].unique()
```

Out[41]:
```
array([1.90e+04, 1.40e+04, 8.70e+03, 2.50e+04, 2.80e+03, 5.60e+03,
       2.90e+04, 3.30e+04, 3.10e+03, 2.80e+04, 1.20e+04, 2.00e+04,
       2.10e+04, 3.70e+04, 2.70e+03, 5.50e+03, 1.70e+04, 3.90e+04,
       3.10e+04, 4.20e+03, 7.00e+03, 2.30e+04, 6.00e+03, 6.10e+03,
       4.60e+03, 9.20e+03, 5.20e+03, 1.10e+04, 2.40e+04,      nan,
       9.40e+03, 1.50e+04, 1.00e+04, 1.20e+03, 2.60e+04, 8.00e+03,
       7.90e+03, 5.60e+04, 5.70e+04, 3.50e+04, 5.40e+04, 2.01e+02,
       3.60e+03, 5.70e+03, 8.60e+03, 2.40e+03, 2.70e+04, 2.50e+03,
       1.60e+04, 3.40e+03, 8.90e+03, 3.90e+03, 2.90e+03, 3.80e+04,
       3.20e+04, 5.40e+03, 1.80e+04, 1.10e+03, 2.20e+03, 4.50e+03,
       9.80e+03, 5.20e+04, 9.00e+03, 6.70e+03, 3.00e+04, 2.60e+03,
       7.10e+03, 3.70e+03, 2.20e+04, 7.40e+03, 6.40e+03, 3.20e+03,
       8.20e+03, 9.90e+03, 4.90e+03, 9.50e+03, 5.00e+03, 5.90e+03,
       1.30e+04, 7.30e+04, 6.80e+03, 3.50e+03, 4.00e+03, 2.30e+03,
       7.20e+03, 2.10e+03, 4.20e+04, 7.30e+03, 9.10e+03, 5.50e+04,
       2.30e+01, 6.50e+03, 1.50e+03, 7.50e+03, 5.10e+04, 4.10e+04,
       4.80e+04, 8.50e+03, 4.60e+04, 8.30e+03, 4.30e+03, 4.70e+03,
       3.30e+03, 4.00e+04, 7.80e+03, 8.80e+03, 6.60e+03, 5.10e+03,
       6.10e+04, 6.60e+04, 7.90e+01, 8.40e+03, 1.18e+02, 4.40e+04,
       6.95e+02, 1.60e+03, 6.20e+03, 1.80e+01, 5.30e+04, 1.40e+03,
       3.00e+03, 5.80e+03, 3.80e+03, 9.60e+03, 4.50e+04, 6.30e+04,
       4.90e+04, 7.70e+04, 4.40e+03, 4.80e+03, 7.00e+04, 6.90e+03,
       9.30e+03, 1.00e+01, 8.10e+03, 3.60e+04, 8.40e+04, 9.70e+04,
       2.00e+03, 1.90e+03, 1.80e+03, 5.30e+03, 4.70e+04, 5.56e+02,
       5.26e+02, 7.60e+04, 7.60e+03, 5.90e+04, 9.70e+03, 7.80e+04,
       7.20e+04, 4.30e+04, 7.70e+03, 6.30e+03, 3.34e+02, 3.40e+04,
       9.30e+04, 6.50e+04, 7.90e+04, 1.00e+05, 5.80e+04, 5.00e+04,
       6.80e+04, 6.40e+04, 6.70e+04, 6.00e+04, 9.40e+04, 2.32e+02,
       9.90e+04, 6.24e+02, 9.50e+04, 4.10e+01, 2.92e+02, 1.10e+01,
       8.00e+04, 1.70e+03, 7.40e+04, 6.20e+04, 6.90e+04, 7.50e+04,
       9.80e+04, 8.50e+04, 8.20e+04, 9.60e+04, 8.70e+04, 7.10e+04,
       8.60e+04, 9.10e+04, 8.10e+04, 9.20e+04, 8.30e+04, 8.80e+04,
       7.04e+02, 8.62e+02, 8.99e+02, 3.78e+02, 2.66e+02, 3.75e+02,
       1.30e+03, 9.75e+02, 9.80e+02, 4.10e+03, 8.90e+04, 6.96e+02,
       5.44e+02, 5.25e+02, 9.20e+02, 7.79e+02, 8.53e+02, 7.20e+02,
       7.13e+02, 7.72e+02, 3.18e+02, 5.80e+01, 2.41e+02, 1.96e+02,
       8.57e+02, 5.10e+01, 9.53e+02, 8.65e+02, 2.51e+02, 9.30e+02,
       5.40e+02, 3.13e+02, 7.46e+02, 2.03e+02, 2.60e+01, 3.14e+02,
       2.39e+02, 3.71e+02, 2.20e+02, 7.30e+02, 7.56e+02, 9.10e+01,
       2.93e+02, 1.70e+01, 7.40e+01, 1.40e+01, 3.17e+02, 7.80e+01,
       9.24e+02, 9.02e+02, 8.18e+02, 8.10e+01, 9.39e+02, 1.69e+02,
       4.50e+01, 4.75e+02, 9.65e+02, 9.00e+04, 5.45e+02, 6.10e+01,
       2.83e+02, 6.55e+02, 7.14e+02, 9.30e+01, 8.72e+02, 1.21e+02,
       3.22e+02, 1.00e+03, 9.76e+02, 1.72e+02, 2.38e+02, 5.49e+02,
       2.06e+02, 9.54e+02, 4.44e+02, 7.17e+02, 2.10e+02, 6.09e+02,
       3.08e+02, 7.05e+02, 3.06e+02, 9.04e+02, 4.73e+02, 1.75e+02,
       3.50e+02, 3.83e+02, 4.54e+02, 4.21e+02, 7.00e+01, 8.12e+02,
       4.42e+02, 8.42e+02, 4.17e+02, 4.12e+02, 4.59e+02, 4.78e+02,
       3.35e+02, 7.82e+02, 7.21e+02, 4.30e+02, 4.29e+02, 1.92e+02,
       2.00e+02, 4.60e+02, 7.28e+02, 4.96e+02, 8.16e+02, 4.14e+02,
       5.06e+02, 8.87e+02, 6.13e+02, 2.43e+02, 5.69e+02, 7.78e+02,
       6.83e+02, 5.92e+02, 3.19e+02, 1.86e+02, 8.40e+02, 6.47e+02,
       1.91e+02, 3.73e+02, 4.37e+02, 5.98e+02, 7.16e+02, 5.85e+02,
       9.82e+02, 2.22e+02, 2.19e+02, 5.50e+01, 9.48e+02, 3.23e+02,
       6.91e+02, 5.11e+02, 9.51e+02, 9.63e+02, 2.50e+01, 5.54e+02,
```

```
3.51e+02, 2.70e+01, 8.20e+01, 2.08e+02, 9.13e+02, 5.14e+02,
5.51e+02, 2.90e+01, 1.03e+02, 8.98e+02, 7.43e+02, 1.16e+02,
1.53e+02, 2.09e+02, 3.53e+02, 4.99e+02, 1.73e+02, 5.97e+02,
8.09e+02, 1.22e+02, 4.11e+02, 4.00e+02, 8.01e+02, 7.87e+02,
2.37e+02, 5.00e+01, 6.43e+02, 9.86e+02, 9.70e+01, 5.16e+02,
8.37e+02, 7.80e+02, 9.61e+02, 2.69e+02, 2.00e+01, 4.98e+02,
6.00e+02, 7.49e+02, 6.42e+02, 8.81e+02, 7.20e+01, 6.56e+02,
6.01e+02, 2.21e+02, 2.28e+02, 1.08e+02, 9.40e+02, 1.76e+02,
3.30e+01, 6.63e+02, 3.40e+01, 9.42e+02, 2.59e+02, 1.64e+02,
4.58e+02, 2.45e+02, 6.29e+02, 2.80e+01, 2.88e+02, 7.75e+02,
7.85e+02, 6.36e+02, 9.16e+02, 9.94e+02, 3.09e+02, 4.85e+02,
9.14e+02, 9.03e+02, 6.08e+02, 5.00e+02, 5.40e+01, 5.62e+02,
8.47e+02, 9.57e+02, 6.88e+02, 8.11e+02, 2.70e+02, 4.80e+01,
3.29e+02, 5.23e+02, 9.21e+02, 8.74e+02, 9.81e+02, 7.84e+02,
2.80e+02, 2.40e+01, 5.18e+02, 7.54e+02, 8.92e+02, 1.54e+02,
8.60e+02, 3.64e+02, 3.87e+02, 6.26e+02, 1.61e+02, 8.79e+02,
3.90e+01, 9.70e+02, 1.70e+02, 1.41e+02, 1.60e+02, 1.44e+02,
1.43e+02, 1.90e+02, 3.76e+02, 1.93e+02, 2.46e+02, 7.30e+01,
6.58e+02, 9.92e+02, 2.53e+02, 4.20e+02, 4.04e+02, 4.70e+02,
2.26e+02, 2.40e+02, 8.90e+01, 2.34e+02, 2.57e+02, 8.61e+02,
4.67e+02, 1.57e+02, 4.40e+01, 6.76e+02, 6.70e+01, 5.52e+02,
8.85e+02, 1.02e+03, 5.82e+02, 6.19e+02])
```

In [42]:
```
df_copy["Size"]=df_copy["Size"]/1000
```

In [43]:
```
df_copy["Size"].unique()
```

Out[43]:
```
array([1.90e+01, 1.40e+01, 8.70e+00, 2.50e+01, 2.80e+00, 5.60e+00,
       2.90e+01, 3.30e+01, 3.10e+00, 2.80e+01, 1.20e+01, 2.00e+01,
       2.10e+01, 3.70e+01, 2.70e+00, 5.50e+00, 1.70e+01, 3.90e+01,
       3.10e+01, 4.20e+00, 7.00e+00, 2.30e+01, 6.00e+00, 6.10e+00,
       4.60e+00, 9.20e+00, 5.20e+00, 1.10e+01, 2.40e+01,      nan,
       9.40e+00, 1.50e+01, 1.00e+01, 1.20e+00, 2.60e+01, 8.00e+00,
       7.90e+00, 5.60e+01, 5.70e+01, 3.50e+01, 5.40e+01, 2.01e-01,
       3.60e+00, 5.70e+00, 8.60e+00, 2.40e+00, 2.70e+01, 2.50e+00,
       1.60e+01, 3.40e+00, 8.90e+00, 3.90e+00, 2.90e+00, 3.80e+01,
       3.20e+01, 5.40e+00, 1.80e+01, 1.10e+00, 2.20e+00, 4.50e+00,
       9.80e+00, 5.20e+01, 9.00e+00, 6.70e+00, 3.00e+01, 2.60e+00,
       7.10e+00, 3.70e+00, 2.20e+01, 7.40e+00, 6.40e+00, 3.20e+00,
       8.20e+00, 9.90e+00, 4.90e+00, 9.50e+00, 5.00e+00, 5.90e+00,
       1.30e+01, 7.30e+01, 6.80e+00, 3.50e+00, 4.00e+00, 2.30e+00,
       7.20e+00, 2.10e+00, 4.20e+01, 7.30e+00, 9.10e+00, 5.50e+01,
       2.30e-02, 6.50e+00, 1.50e+00, 7.50e+00, 5.10e+01, 4.10e+01,
       4.80e+01, 8.50e+00, 4.60e+01, 8.30e+00, 4.30e+00, 4.70e+00,
       3.30e+00, 4.00e+01, 7.80e+00, 8.80e+00, 6.60e+00, 5.10e+00,
       6.10e+01, 6.60e+01, 7.90e-02, 8.40e+00, 1.18e-01, 4.40e+01,
       6.95e-01, 1.60e+00, 6.20e+00, 1.80e-02, 5.30e+01, 1.40e+00,
       3.00e+00, 5.80e+00, 3.80e+00, 9.60e+00, 4.50e+01, 6.30e+01,
       4.90e+01, 7.70e+01, 4.40e+00, 4.80e+00, 7.00e+01, 6.90e+00,
       9.30e+00, 1.00e-02, 8.10e+00, 3.60e+01, 8.40e+01, 9.70e+01,
       2.00e+00, 1.90e+00, 1.80e+00, 5.30e+00, 4.70e+01, 5.56e-01,
       5.26e-01, 7.60e+01, 7.60e+00, 5.90e+01, 9.70e+00, 7.80e+01,
       7.20e+01, 4.30e+01, 7.70e+00, 6.30e+00, 3.34e-01, 3.40e+01,
       9.30e+01, 6.50e+01, 7.90e+01, 1.00e+02, 5.80e+01, 5.00e+01,
       6.80e+01, 6.40e+01, 6.70e+01, 6.00e+01, 9.40e+01, 2.32e-01,
       9.90e+01, 6.24e-01, 9.50e+01, 4.10e-02, 2.92e-01, 1.10e-02,
       8.00e+01, 1.70e+00, 7.40e+01, 6.20e+01, 6.90e+01, 7.50e+01,
       9.80e+01, 8.50e+01, 8.20e+01, 9.60e+01, 8.70e+01, 7.10e+01,
       8.60e+01, 9.10e+01, 8.10e+01, 9.20e+01, 8.30e+01, 8.80e+01,
       7.04e-01, 8.62e-01, 8.99e-01, 3.78e-01, 2.66e-01, 3.75e-01,
       1.30e+00, 9.75e-01, 9.80e-01, 4.10e+00, 8.90e+01, 6.96e-01,
       5.44e-01, 5.25e-01, 9.20e-01, 7.79e-01, 8.53e-01, 7.20e-01,
       7.13e-01, 7.72e-01, 3.18e-01, 5.80e-02, 2.41e-01, 1.96e-01,
       8.57e-01, 5.10e-02, 9.53e-01, 8.65e-01, 2.51e-01, 9.30e-01,
       5.40e-01, 3.13e-01, 7.46e-01, 2.03e-01, 2.60e-02, 3.14e-01,
       2.39e-01, 3.71e-01, 2.20e-01, 7.30e-01, 7.56e-01, 9.10e-02,
       2.93e-01, 1.70e-02, 7.40e-02, 1.40e-02, 3.17e-01, 7.80e-02,
       9.24e-01, 9.02e-01, 8.18e-01, 8.10e-02, 9.39e-01, 1.69e-01,
       4.50e-02, 4.75e-01, 9.65e-01, 9.00e+01, 5.45e-01, 6.10e-02,
       2.83e-01, 6.55e-01, 7.14e-01, 9.30e-02, 8.72e-01, 1.21e-01,
       3.22e-01, 1.00e+00, 9.76e-01, 1.72e-01, 2.38e-01, 5.49e-01,
       2.06e-01, 9.54e-01, 4.44e-01, 7.17e-01, 2.10e-01, 6.09e-01,
       3.08e-01, 7.05e-01, 3.06e-01, 9.04e-01, 4.73e-01, 1.75e-01,
       3.50e-01, 3.83e-01, 4.54e-01, 4.21e-01, 7.00e-02, 8.12e-01,
       4.42e-01, 8.42e-01, 4.17e-01, 4.12e-01, 4.59e-01, 4.78e-01,
       3.35e-01, 7.82e-01, 7.21e-01, 4.30e-01, 4.29e-01, 1.92e-01,
       2.00e-01, 4.60e-01, 7.28e-01, 4.96e-01, 8.16e-01, 4.14e-01,
       5.06e-01, 8.87e-01, 6.13e-01, 2.43e-01, 5.69e-01, 7.78e-01,
       6.83e-01, 5.92e-01, 3.19e-01, 1.86e-01, 8.40e-01, 6.47e-01,
       1.91e-01, 3.73e-01, 4.37e-01, 5.98e-01, 7.16e-01, 5.85e-01,
       9.82e-01, 2.22e-01, 2.19e-01, 5.50e-02, 9.48e-01, 3.23e-01,
       6.91e-01, 5.11e-01, 9.51e-01, 9.63e-01, 2.50e-02, 5.54e-01,
```

```
       3.51e-01, 2.70e-02, 8.20e-02, 2.08e-01, 9.13e-01, 5.14e-01,
       5.51e-01, 2.90e-02, 1.03e-01, 8.98e-01, 7.43e-01, 1.16e-01,
       1.53e-01, 2.09e-01, 3.53e-01, 4.99e-01, 1.73e-01, 5.97e-01,
       8.09e-01, 1.22e-01, 4.11e-01, 4.00e-01, 8.01e-01, 7.87e-01,
       2.37e-01, 5.00e-02, 6.43e-01, 9.86e-01, 9.70e-02, 5.16e-01,
       8.37e-01, 7.80e-01, 9.61e-01, 2.69e-01, 2.00e-02, 4.98e-01,
       6.00e-01, 7.49e-01, 6.42e-01, 8.81e-01, 7.20e-02, 6.56e-01,
       6.01e-01, 2.21e-01, 2.28e-01, 1.08e-01, 9.40e-01, 1.76e-01,
       3.30e-02, 6.63e-01, 3.40e-02, 9.42e-01, 2.59e-01, 1.64e-01,
       4.58e-01, 2.45e-01, 6.29e-01, 2.80e-02, 2.88e-01, 7.75e-01,
       7.85e-01, 6.36e-01, 9.16e-01, 9.94e-01, 3.09e-01, 4.85e-01,
       9.14e-01, 9.03e-01, 6.08e-01, 5.00e-01, 5.40e-02, 5.62e-01,
       8.47e-01, 9.57e-01, 6.88e-01, 8.11e-01, 2.70e-01, 4.80e-02,
       3.29e-01, 5.23e-01, 9.21e-01, 8.74e-01, 9.81e-01, 7.84e-01,
       2.80e-01, 2.40e-02, 5.18e-01, 7.54e-01, 8.92e-01, 1.54e-01,
       8.60e-01, 3.64e-01, 3.87e-01, 6.26e-01, 1.61e-01, 8.79e-01,
       3.90e-02, 9.70e-01, 1.70e-01, 1.41e-01, 1.60e-01, 1.44e-01,
       1.43e-01, 1.90e-01, 3.76e-01, 1.93e-01, 2.46e-01, 7.30e-02,
       6.58e-01, 9.92e-01, 2.53e-01, 4.20e-01, 4.04e-01, 4.70e-01,
       2.26e-01, 2.40e-01, 8.90e-02, 2.34e-01, 2.57e-01, 8.61e-01,
       4.67e-01, 1.57e-01, 4.40e-02, 6.76e-01, 6.70e-02, 5.52e-01,
       8.85e-01, 1.02e+00, 5.82e-01, 6.19e-01])
```

In [44]:
```
## check the columns...
df_copy.columns
```

Out[44]:
```
Index(['App', 'Category', 'Rating', 'Reviews', 'Size', 'Installs', 'Type',
       'Price', 'Content Rating', 'Genres', 'Last Updated', 'Current Ver',
       'Android Ver'],
      dtype='object')
```

In [45]:
```
df_copy.head(2)
```

Out[45]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	C
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10,000+	Free	0	Everyone	Art &
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500,000+	Free	0	Everyone	Design;F

In [46]:
```
## check the Installs columns...
df_copy['Installs'].dtype
```

Out[46]:
```
dtype('O')
```

In [47]:
```
## check the unique value this columns...
# and remove the + sign ..
df_copy['Installs'].unique()
```

Out[47]:
```
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'], dtype=object)
```

In [48]:
```
## check the price columns...
df_copy["Price"].unique()
```

Out[48]:
```
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)
```

In [49]:
```
## handle these two columns..
```

In [50]:
```
chars_to_remove=['+',',','$']
cols_to_clean=['Installs',"Price"]
for item in chars_to_remove:
    for col in cols_to_clean:
        df_copy[col]=df_copy[col].str.replace(item,'')
```

In [51]:
```
df_copy["Price"].unique()
```

Out[51]:
```
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)
```

In [52]:
```
df_copy["Installs"].unique()
```

Out[52]:
```
array(['10000', '500000', '5000000', '50000000', '100000', '50000',
       '1000000', '10000000', '5000', '100000000', '1000000000', '1000',
       '500000000', '50', '100', '500', '10', '1', '5', '0'], dtype=object)
```

In [53]:
```
df_copy["Installs"]=df_copy["Installs"].astype('int')
```

In [54]:
```
df_copy["Price"]=df_copy["Price"].astype('float')
```

In [55]:
```
# last conclusions...
```

In [57]:
```
df_copy.describe()
```

Out[57]:

	Rating	Reviews	Size	Installs	Price
count	9366.000000	1.084000e+04	9145.000000	1.084000e+04	10840.000000
mean	4.191757	4.441529e+05	21.506534	1.546434e+07	1.027368
std	0.515219	2.927761e+06	22.596021	8.502936e+07	15.949703
min	1.000000	0.000000e+00	0.010000	0.000000e+00	0.000000
25%	4.000000	3.800000e+01	4.900000	1.000000e+03	0.000000
50%	4.300000	2.094000e+03	13.000000	1.000000e+05	0.000000
75%	4.500000	5.477550e+04	30.000000	5.000000e+06	0.000000
max	5.000000	7.815831e+07	100.000000	1.000000e+09	400.000000

In [58]:
```
df_copy.head()
```

Out[58]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10000	Free	0.0	Everyone	Art
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500000	Free	0.0	Everyone	Design
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0.0	Everyone	Art
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50000000	Free	0.0	Teen	Art
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100000	Free	0.0	Everyone	Design;C

In [59]:
```
# check this columns...
df_copy["Last Updated"]
```

Out[59]:
```
0         January 7, 2018
1        January 15, 2018
2          August 1, 2018
3            June 8, 2018
4           June 20, 2018
               ...
10836       July 25, 2017
10837        July 6, 2018
10838    January 20, 2017
10839    January 19, 2015
10840       July 25, 2018
Name: Last Updated, Length: 10840, dtype: object
```

In [60]:
```
## sepearete this columns....
```

In [61]:
```
# check this columns datatype...
df_copy["Last Updated"].dtype
```

Out[61]:
```
dtype('O')
```

In [62]:
```
## convert into date time ....
df_copy["Last Updated"]=pd.to_datetime(df_copy["Last Updated"])
```

In [63]:
```
df_copy.head()
```

Out[63]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10000	Free	0.0	Everyone	Art
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500000	Free	0.0	Everyone	Design
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0.0	Everyone	Art
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50000000	Free	0.0	Teen	Art
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100000	Free	0.0	Everyone	Design;(

In [64]:
```
## segrgate the day ....
df_copy["day"]=df_copy["Last Updated"].dt.day
```

In [65]:
```
# month...
df_copy["month"]=df_copy["Last Updated"].dt.month
```

In [66]:
```
# year...
df_copy["year"]=df_copy["Last Updated"].dt.year
```

In [67]:
```
df_copy.head()
```

Out[67]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10000	Free	0.0	Everyone	Art
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500000	Free	0.0	Everyone	Design
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0.0	Everyone	Art
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50000000	Free	0.0	Teen	Art
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100000	Free	0.0	Everyone	Design;(

In [68]:
```
df.head()
```

Out[68]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	A
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Des
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	A
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	A
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Desig

In [69]:
```
# save the data...
df_copy.to_csv("google_cleaned.csv",index=False)
```

After cleaned_csv data some more EDA & feature engineering.....

read the data...

In [70]:
```
# now its our clean dataset...
df1 = pd.read_csv("google_cleaned.csv")
```

In [71]:
```
df1
```

Out[71]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Cont Rat
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10000	Free	0.0	Every
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500000	Free	0.0	Every
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0.0	Every
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50000000	Free	0.0	T
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100000	Free	0.0	Every
...	...	...	...	...	...	...	...	...	
10835	Sya9a Maroc - FR	FAMILY	4.5	38	53.0	5000	Free	0.0	Every
10836	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6	100	Free	0.0	Every
10837	Parkinson Exercices FR	MEDICAL	NaN	3	9.5	1000	Free	0.0	Every
10838	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	4.5	114	NaN	1000	Free	0.0	Ma
10839	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	4.5	398307	19.0	10000000	Free	0.0	Every

10840 rows × 16 columns

In [72]:
```
pd.read_csv("google_cleaned.csv").info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10840 entries, 0 to 10839
Data columns (total 16 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  int64  
 4   Size            9145 non-null   float64
 5   Installs        10840 non-null  int64  
 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  day             10840 non-null  int64  
 14  month           10840 non-null  int64  
 15  year            10840 non-null  int64  
dtypes: float64(3), int64(5), object(8)
memory usage: 1.3+ MB
```

In [73]:
```
# show only top 5 rows...
df1.head()
```

Out[73]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10000	Free	0.0	Everyone	Art
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500000	Free	0.0	Everyone	Design
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0.0	Everyone	Art
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50000000	Free	0.0	Teen	Art
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100000	Free	0.0	Everyone	Design;(

In [74]:
```
# show only 5 last rows..
df.tail()
```

Out[74]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53M	5,000+	Free	0	E
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0	E
10838	Parkinson Exercices FR	MEDICAL	NaN	3	9.5M	1,000+	Free	0	E
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	E

In [75]:
```
# shape of the data...
df1.shape
```

Out[75]: (10840, 16)

In [76]:
```
# random sample of the data...
df1.sample(5)
```

Out[76]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating
7380	CI Staff App	LIFESTYLE	NaN	0	10.0	10	Free	0.0	Everyone
1765	Wordscapes	GAME	4.8	230727	87.0	10000000	Free	0.0	Everyone
88	AutoScout24 Switzerland – Find your new car	AUTO_AND_VEHICLES	4.6	13372	NaN	1000000	Free	0.0	Everyone
5768	Amber Weather	WEATHER	4.4	260137	13.0	10000000	Free	0.0	Everyone 10+
9105	Météo Algérie DZ	WEATHER	4.1	1238	4.7	100000	Free	0.0	Everyone

In [77]:
```
# information about the df...
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 10840 entries, 0 to 10839
Data columns (total 16 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  int64  
 4   Size            9145 non-null   float64
 5   Installs        10840 non-null  int64  
 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  day             10840 non-null  int64  
 14  month           10840 non-null  int64  
 15  year            10840 non-null  int64  
dtypes: float64(3), int64(5), object(8)
memory usage: 1.3+ MB
```

In [78]:
```
# check the null values....
df1.isna().sum()
```

Out[78]:
```
App                0
Category           0
Rating          1474
Reviews            0
Size            1695
Installs           0
Type               1
Price              0
Content Rating     0
Genres             0
Last Updated       0
Current Ver        8
Android Ver        2
day                0
month              0
year               0
dtype: int64
```

statistics data.....

In [79]:
```
df1.describe().T
```

Out[79]:

	count	mean	std	min	25%	50%	75%	max
Rating	9366.0	4.191757e+00	5.152189e-01	1.00	4.0	4.3	4.5	5.000000e+00
Reviews	10840.0	4.441529e+05	2.927761e+06	0.00	38.0	2094.0	54775.5	7.815831e+07
Size	9145.0	2.150653e+01	2.259602e+01	0.01	4.9	13.0	30.0	1.000000e+02
Installs	10840.0	1.546434e+07	8.502936e+07	0.00	1000.0	100000.0	5000000.0	1.000000e+09
Price	10840.0	1.027368e+00	1.594970e+01	0.00	0.0	0.0	0.0	4.000000e+02
day	10840.0	1.560904e+01	9.561621e+00	1.00	6.0	16.0	24.0	3.100000e+01
month	10840.0	6.422325e+00	2.578388e+00	1.00	5.0	7.0	8.0	1.200000e+01
year	10840.0	2.017400e+03	1.100914e+00	2010.00	2017.0	2018.0	2018.0	2.018000e+03

In [80]:
```
# information all the describe data....
df1.describe(include='all')
```

Out[80]:

	App	Category	Rating	Reviews	Size	Installs	Type	
count	10840	10840	9366.000000	1.084000e+04	9145.000000	1.084000e+04	10839	10840.0
unique	9659	33	NaN	NaN	NaN	NaN	2	
top	ROBLOX	FAMILY	NaN	NaN	NaN	NaN	Free	
freq	9	1972	NaN	NaN	NaN	NaN	10039	
mean	NaN	NaN	4.191757	4.441529e+05	21.506534	1.546434e+07	NaN	1.0
std	NaN	NaN	0.515219	2.927761e+06	22.596021	8.502936e+07	NaN	15.9
min	NaN	NaN	1.000000	0.000000e+00	0.010000	0.000000e+00	NaN	0.0
25%	NaN	NaN	4.000000	3.800000e+01	4.900000	1.000000e+03	NaN	0.0
50%	NaN	NaN	4.300000	2.094000e+03	13.000000	1.000000e+05	NaN	0.0
75%	NaN	NaN	4.500000	5.477550e+04	30.000000	5.000000e+06	NaN	0.0
max	NaN	NaN	5.000000	7.815831e+07	100.000000	1.000000e+09	NaN	400.0

In [81]:
```
## entire sum of null values...
df1.isnull().sum().sum()
```

Out[81]: 3180

duplicate value in data...

In [82]:
```
df1.duplicated()
```

Out[82]:
```
0        False
1        False
2        False
3        False
4        False
         ...
10835    False
10836    False
10837    False
10838    False
10839    False
Length: 10840, dtype: bool
```

In [83]:
```
## how many duplicated rows in dataset...
df1[df1.duplicated()]
```

Out[83]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating
229	Quick PDF Scanner + OCR FREE	BUSINESS	4.2	80805	NaN	5000000	Free	0.0	Everyone
236	Box	BUSINESS	4.2	159872	NaN	10000000	Free	0.0	Everyone
239	Google My Business	BUSINESS	4.4	70991	NaN	5000000	Free	0.0	Everyone
256	ZOOM Cloud Meetings	BUSINESS	4.4	31614	37.0	10000000	Free	0.0	Everyone
261	join.me - Simple Meetings	BUSINESS	4.0	6989	NaN	1000000	Free	0.0	Everyone
...	...	...	...	...	...	...	...	...	...
8643	Wunderlist: To-Do List & Tasks	PRODUCTIVITY	4.6	404610	NaN	10000000	Free	0.0	Everyone
8654	TickTick: To Do List with Reminder, Day Planner	PRODUCTIVITY	4.6	25370	NaN	1000000	Free	0.0	Everyone
8658	ColorNote Notepad Notes	PRODUCTIVITY	4.6	2401017	NaN	100000000	Free	0.0	Everyone
10049	Airway Ex - Intubate. Anesthetize. Train.	MEDICAL	4.3	123	86.0	10000	Free	0.0	Everyone
10767	AAFP	MEDICAL	3.8	63	24.0	10000	Free	0.0	Everyone

483 rows × 16 columns

In [84]:
```
df1 = df1.drop_duplicates()
```

In [86]:
```
df1
```

Out[86]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Cont Rat
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10000	Free	0.0	Every
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500000	Free	0.0	Every
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0.0	Every
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50000000	Free	0.0	T
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100000	Free	0.0	Every
...	...	...	...	...	...	...	...	...	
10835	Sya9a Maroc - FR	FAMILY	4.5	38	53.0	5000	Free	0.0	Every
10836	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6	100	Free	0.0	Every
10837	Parkinson Exercices FR	MEDICAL	NaN	3	9.5	1000	Free	0.0	Every
10838	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	4.5	114	NaN	1000	Free	0.0	Ma
10839	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	4.5	398307	19.0	10000000	Free	0.0	Every

10357 rows × 16 columns

In [91]:
```
df1.shape
```

Out[91]:
```
(10357, 16)
```

In [87]:
```
## example how to check duplicate values...
l1 = [1,2,10,11,3,3,3,4,4,5,5,5,5]
```

In [88]:
```
dff = pd.DataFrame(l1)
```

In [89]:
```
dff[dff.duplicated()]
```

Out[89]:

	0
5	3
6	3
8	4
10	5
11	5
12	5

In [90]:
```
## drop duplicates values...
dff.drop_duplicates()
```

Out[90]:

	0
0	1
1	2
2	10
3	11
4	3
7	4
9	5

Exploring the data

segregate the cat and num feature

In [92]:
```
df1
```

Out[92]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Cont Rat
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10000	Free	0.0	Every
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500000	Free	0.0	Every
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0.0	Every
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50000000	Free	0.0	T
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100000	Free	0.0	Every
...	...	...	...	...	...	...	...	...	
10835	Sya9a Maroc - FR	FAMILY	4.5	38	53.0	5000	Free	0.0	Every
10836	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6	100	Free	0.0	Every
10837	Parkinson Exercices FR	MEDICAL	NaN	3	9.5	1000	Free	0.0	Every
10838	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	4.5	114	NaN	1000	Free	0.0	Ma
10839	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	4.5	398307	19.0	10000000	Free	0.0	Every

10357 rows × 16 columns

In [93]:
```
numeric_features = [feature for feature in df1.columns if df1[feature].dtype != '
categorical_features = [feature for feature in df1.columns if df1[feature].dtype
```

In [94]:
```
numeric_features
```

Out[94]:
```
['Rating', 'Reviews', 'Size', 'Installs', 'Price', 'day', 'month', 'year']
```

In [95]:
```
num_df1 = df1[numeric_features]
```

In [96]:
```
categorical_features
```

Out[96]:
```
['App',
 'Category',
 'Type',
 'Content Rating',
 'Genres',
 'Last Updated',
 'Current Ver',
 'Android Ver']
```

counts the categorical features...

In [97]:
```
cat_df1 = df1[categorical_features]
```

In [98]:
```
# count the  APP columns...
df1['App'].value_counts()
```

Out[98]:
```
ROBLOX                                               9
8 Ball Pool                                          7
Bubble Shooter                                       6
Helix Jump                                           6
Zombie Catchers                                      6
                                                    ..
Popsicle Launcher for Android P 9.0 launcher         1
PixelLab - Text on pictures                          1
P Launcher for Android™ 9.0                          1
Pacify (Android P theme) - Theme for Xperia™         1
iHoroscope - 2018 Daily Horoscope & Astrology        1
Name: App, Length: 9659, dtype: int64
```

In [99]:
```
# check how many category ...
len(df1['App'].value_counts())
```

Out[99]:
```
9659
```

In [100]:
```
# check in percentage...
df1['App'].value_counts(normalize=True)
```

Out[100]:
```
ROBLOX                                                 0.000869
8 Ball Pool                                            0.000676
Bubble Shooter                                         0.000579
Helix Jump                                             0.000579
Zombie Catchers                                        0.000579
                                                           ...
Popsicle Launcher for Android P 9.0 launcher           0.000097
PixelLab - Text on pictures                            0.000097
P Launcher for Android™ 9.0                            0.000097
Pacify (Android P theme) - Theme for Xperia™           0.000097
iHoroscope - 2018 Daily Horoscope & Astrology          0.000097
Name: App, Length: 9659, dtype: float64
```

In [101]:
```
num_df1
```

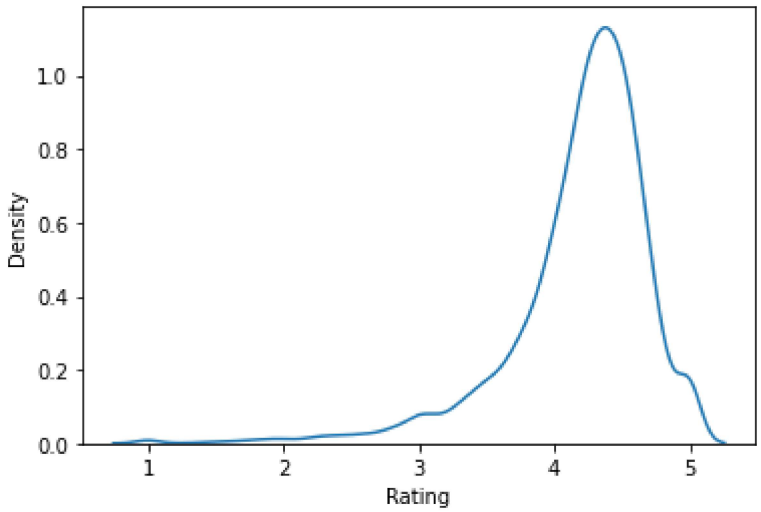
Out[101]:

	Rating	Reviews	Size	Installs	Price	day	month	year
0	4.1	159	19.0	10000	0.0	7	1	2018
1	3.9	967	14.0	500000	0.0	15	1	2018
2	4.7	87510	8.7	5000000	0.0	1	8	2018
3	4.5	215644	25.0	50000000	0.0	8	6	2018
4	4.3	967	2.8	100000	0.0	20	6	2018
...	...	...	...	...	...	...	...	...
10835	4.5	38	53.0	5000	0.0	25	7	2017
10836	5.0	4	3.6	100	0.0	6	7	2018
10837	NaN	3	9.5	1000	0.0	20	1	2017
10838	4.5	114	NaN	1000	0.0	19	1	2015
10839	4.5	398307	19.0	10000000	0.0	25	7	2018

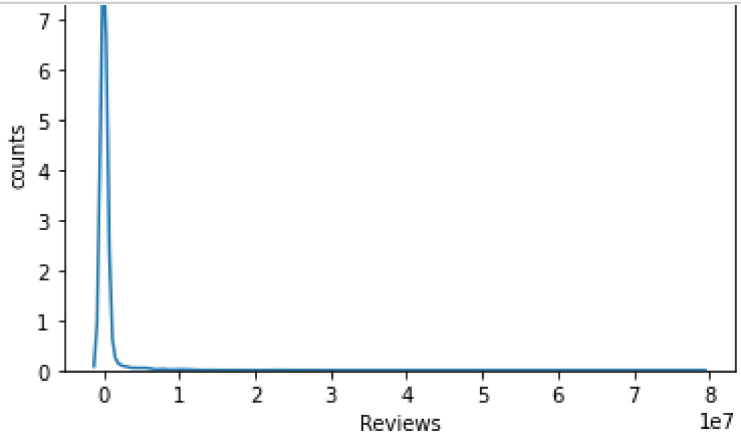
10357 rows × 8 columns

In [102]:
```
## check the distribution  of the numerical variable....
sns.kdeplot(num_df1['Rating'])
```

Out[102]: <AxesSubplot:xlabel='Rating', ylabel='Density'>

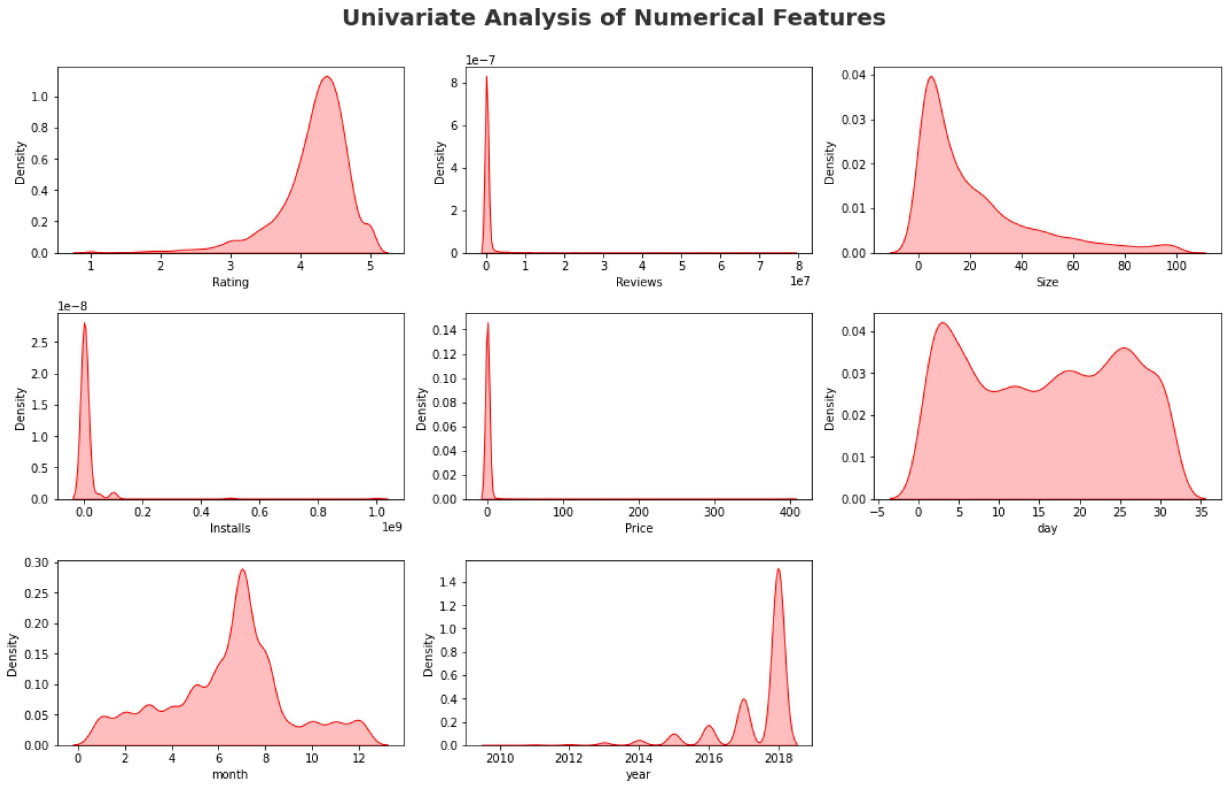


In [103]:
```
## check the distribution entire variable...
for feature in numeric_features:
    sns.kdeplot(num_df1[feature])
    plt.xlabel(feature)
    plt.ylabel('counts')
    plt.title('Numerical features')
    plt.show()
```



In [104]:
```
plt.figure(figsize=(15,15))
plt.suptitle('Univariate Analysis of Numerical Features', fontsize=20 ,fontweight

for i in range(0,len(numeric_features)):
    plt.subplot(5,3,i+1)
    sns.kdeplot(x=df1[numeric_features[i]],shade=True,color='r')
    plt.xlabel(numeric_features[i])
    plt.tight_layout()
```



In [105]:
```
## distribution with categorical variable....
cat_df1
```

Out[105]:

	App	Category	Type	Content Rating	Genres	Last Updated	Current Ver	A
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	Free	Everyone	Art & Design	2018-01-07	1.0.0	
1	Coloring book moana	ART_AND_DESIGN	Free	Everyone	Art & Design;Pretend Play	2018-01-15	2.0.0	
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	Free	Everyone	Art & Design	2018-08-01	1.2.4	
3	Sketch - Draw & Paint	ART_AND_DESIGN	Free	Teen	Art & Design	2018-06-08	Varies with device	
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	Free	Everyone	Art & Design;Creativity	2018-06-20	1.1	
...	...	...	...	...	...	...	...	...
10835	Sya9a Maroc - FR	FAMILY	Free	Everyone	Education	2017-07-25	1.48	
10836	Fr. Mike Schmitz Audio Teachings	FAMILY	Free	Everyone	Education	2018-07-06	1.0	
10837	Parkinson Exercices FR	MEDICAL	Free	Everyone	Medical	2017-01-20	1.0	
10838	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	Free	Mature 17+	Books & Reference	2015-01-19	Varies with device	
10839	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	Free	Everyone	Lifestyle	2018-07-25	Varies with device	

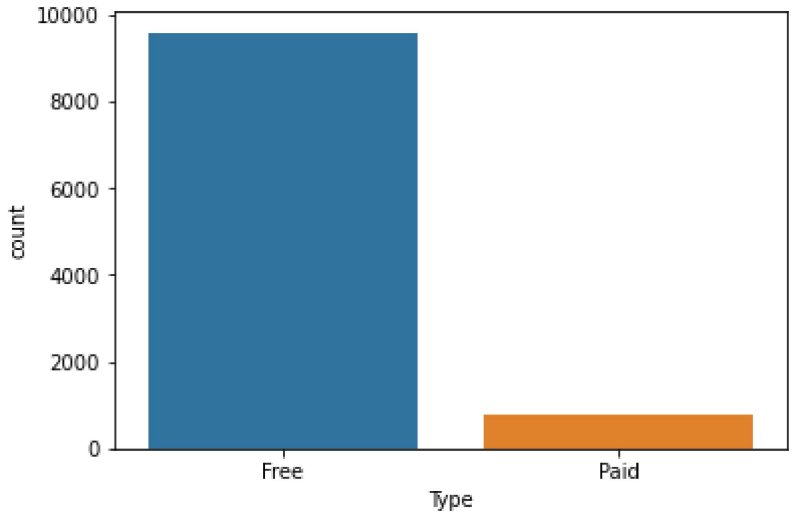
10357 rows × 8 columns

In [106]:
```
## check counts  Type the cate.. variable...
cat_df1['Type'].value_counts()
```

Out[106]:
```
Free    9591
Paid     765
Name: Type, dtype: int64
```

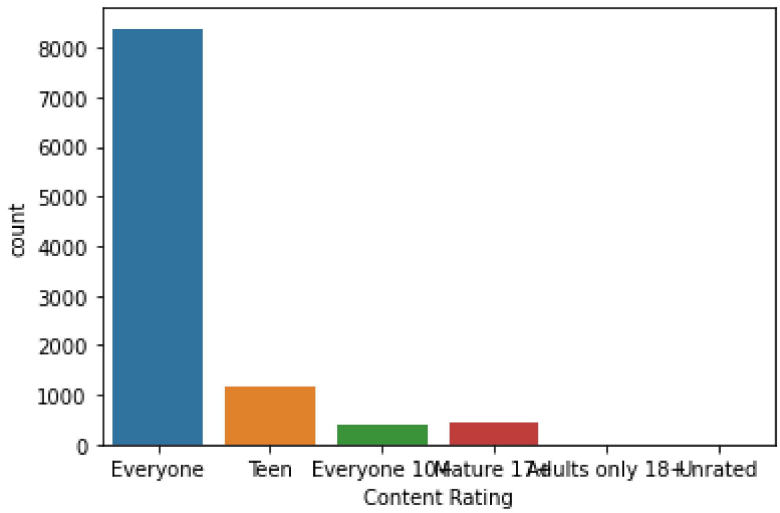
In [107]:
```
sns.countplot(cat_df1['Type'])
```

Out[107]:
```
<AxesSubplot:xlabel='Type', ylabel='count'>
```

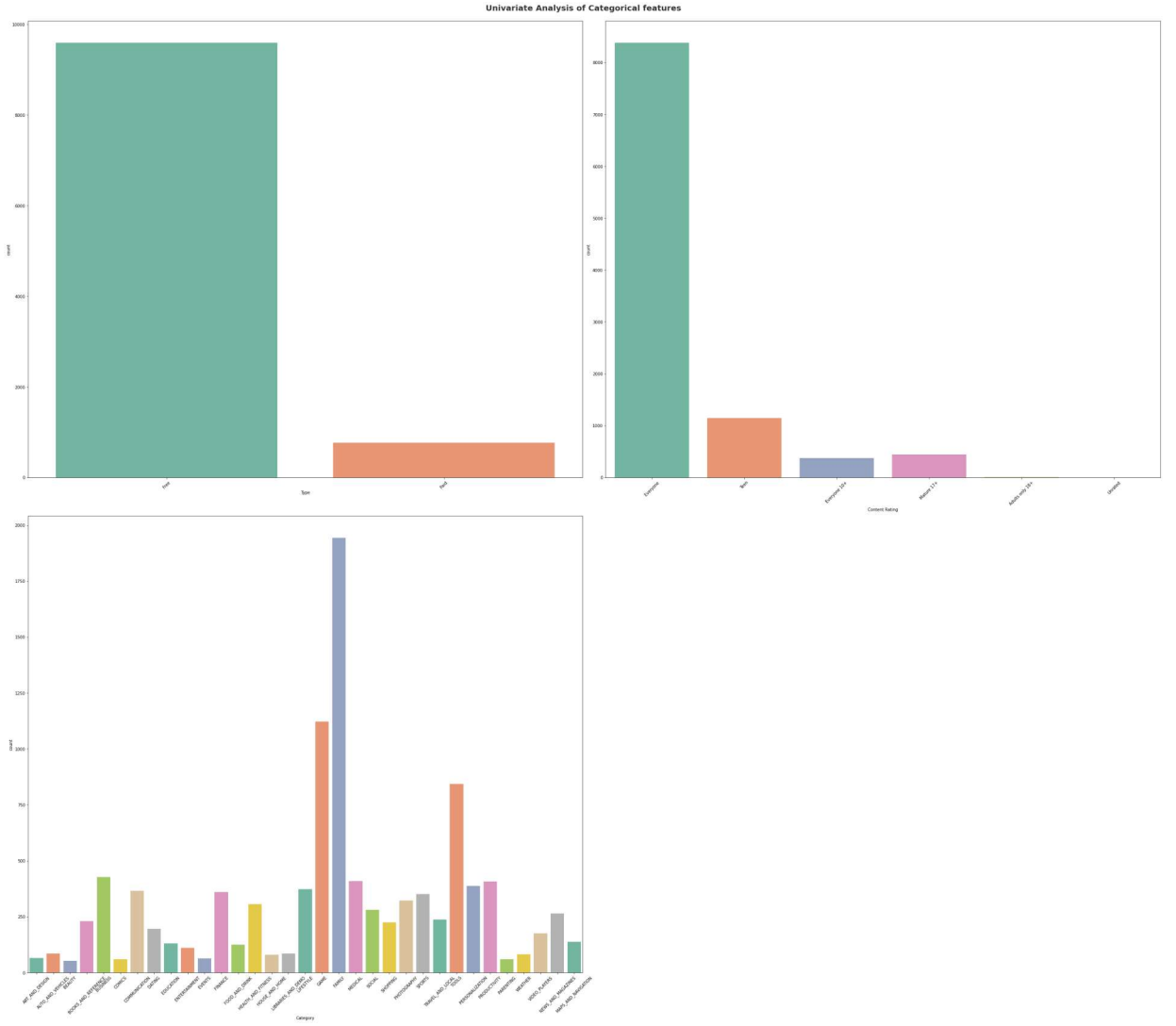


In [108]:
```
sns.countplot(cat_df1['Content Rating'])
```

Out[108]:
```
<AxesSubplot:xlabel='Content Rating', ylabel='count'>
```



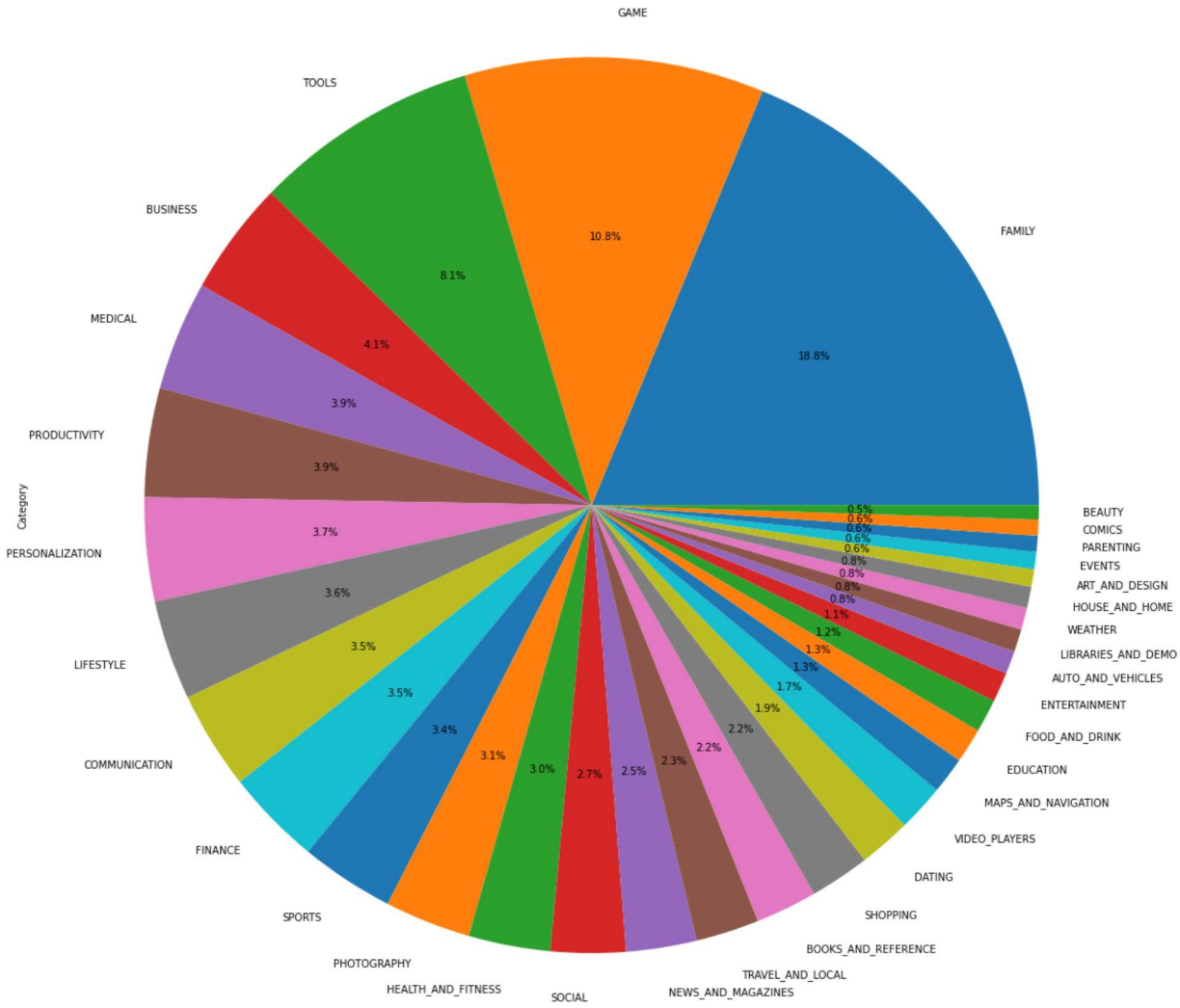
In [109]:
```
## categorical columns...
plt.figure(figsize=(40,35))
plt.suptitle('Univariate Analysis of Categorical features',fontsize=20,fontweight
category = ['Type' ,'Content Rating','Category']
for i in range(0, len(category)):
    plt.subplot(2,2,i+1)
    sns.countplot(x= df1[category[i]],palette='Set2')
    plt.xlabel(category[i])
    plt.xticks(rotation=45)
    plt.tight_layout()
```



which one will be a most popular category ?

In [110]:
```
cat_df1['Category'].value_counts().plot.pie(figsize=(20,20),autopct = '%1.1f%%')
```

Out[110]:
```
<AxesSubplot:ylabel='Category'>
```



In [111]:
```
# store in dataframe ...
category = pd.DataFrame(cat_df1['Category'].value_counts())
```

In [112]:
```
category.head(10)
```

Out[112]:

	Category
FAMILY	1943
GAME	1121
TOOLS	843
BUSINESS	427
MEDICAL	408
PRODUCTIVITY	407
PERSONALIZATION	388
LIFESTYLE	373
COMMUNICATION	366
FINANCE	360

In [113]:
```
## rename the particular columns...
category.rename(columns={"Category":"Count"},inplace=True)
```

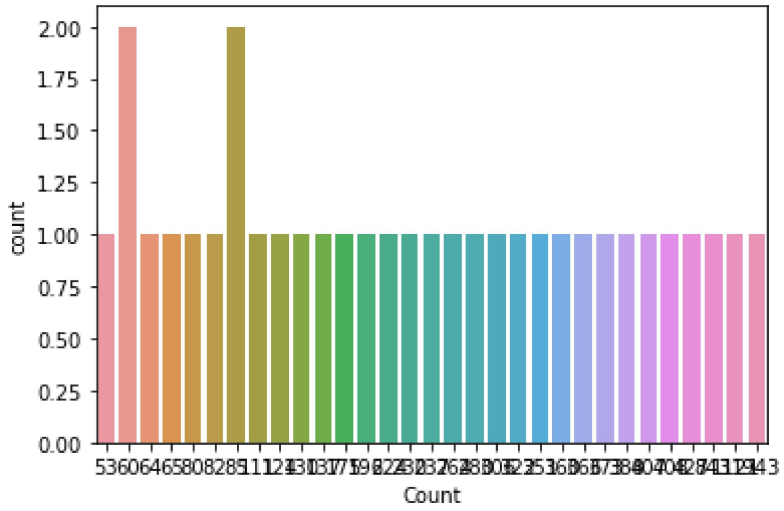
In [114]:
```
category.head(10)
```

Out[114]:

	Count
FAMILY	1943
GAME	1121
TOOLS	843
BUSINESS	427
MEDICAL	408
PRODUCTIVITY	407
PERSONALIZATION	388
LIFESTYLE	373
COMMUNICATION	366
FINANCE	360

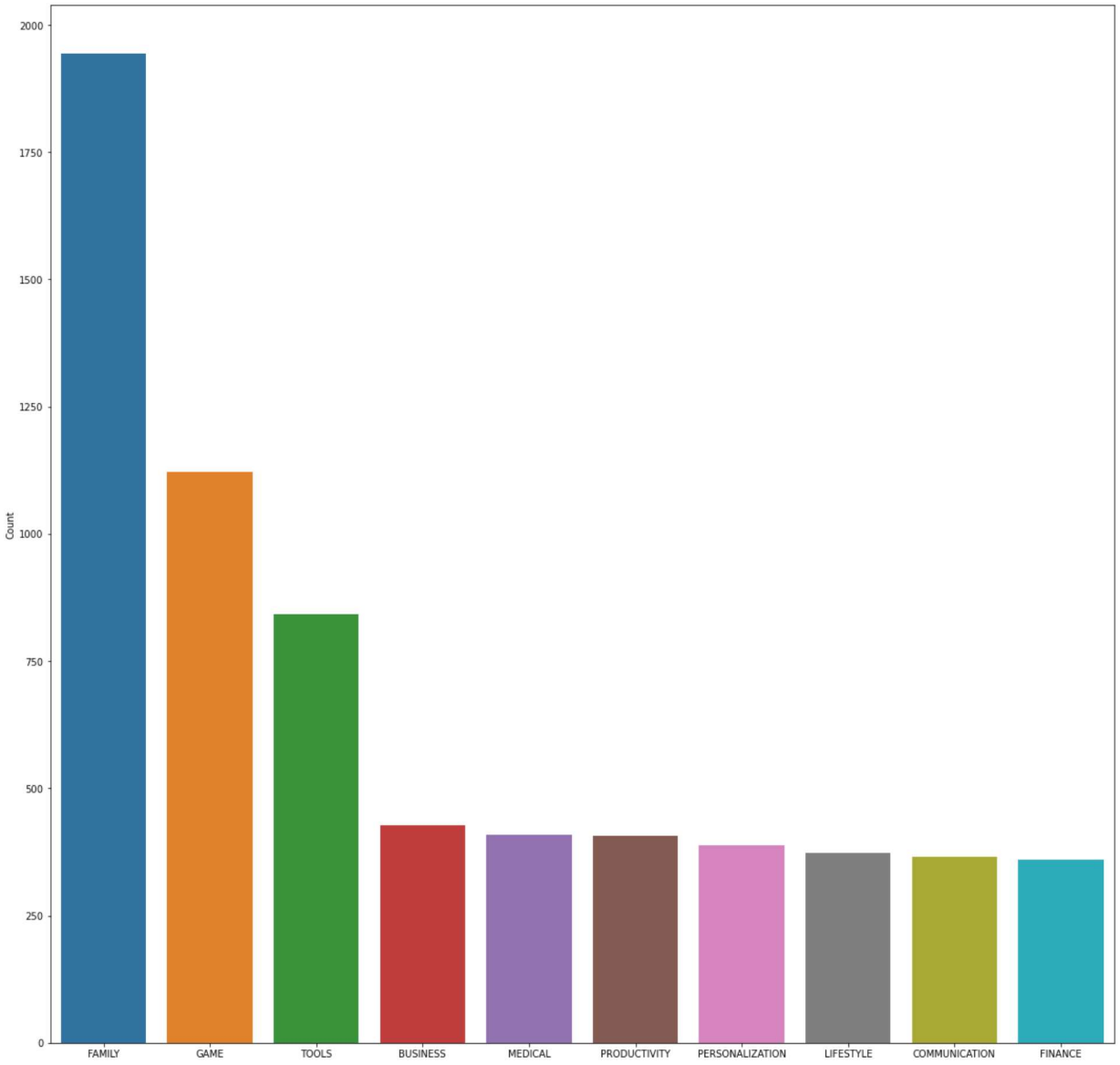
In [115]:
```
sns.countplot(category['Count'])
```

Out[115]: <AxesSubplot:xlabel='Count', ylabel='count'>



In [116]:
```
# countplot...
plt.figure(figsize=(20,20))
sns.barplot(x=category.index[:10],y= "Count",data=category[:10])
```

Out[116]: <AxesSubplot:ylabel='Count'>



In [117]:
```
cat_df1.head()
```

Out[117]:

	App	Category	Type	Content Rating	Genres	Last Updated	Current Ver	Android Ver
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	Free	Everyone	Art & Design	2018-01-07	1.0.0	4.0.3 and up
1	Coloring book moana	ART_AND_DESIGN	Free	Everyone	Art & Design;Pretend Play	2018-01-15	2.0.0	4.0.3 and up
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	Free	Everyone	Art & Design	2018-08-01	1.2.4	4.0.3 and up
3	Sketch - Draw & Paint	ART_AND_DESIGN	Free	Teen	Art & Design	2018-06-08	Varies with device	4.2 and up
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	Free	Everyone	Art & Design;Creativity	2018-06-20	1.1	4.4 and up

In [118]:
```
num_df1.head()
```

Out[118]:

	Rating	Reviews	Size	Installs	Price	day	month	year
0	4.1	159	19.0	10000	0.0	7	1	2018
1	3.9	967	14.0	500000	0.0	15	1	2018
2	4.7	87510	8.7	5000000	0.0	1	8	2018
3	4.5	215644	25.0	50000000	0.0	8	6	2018
4	4.3	967	2.8	100000	0.0	20	6	2018

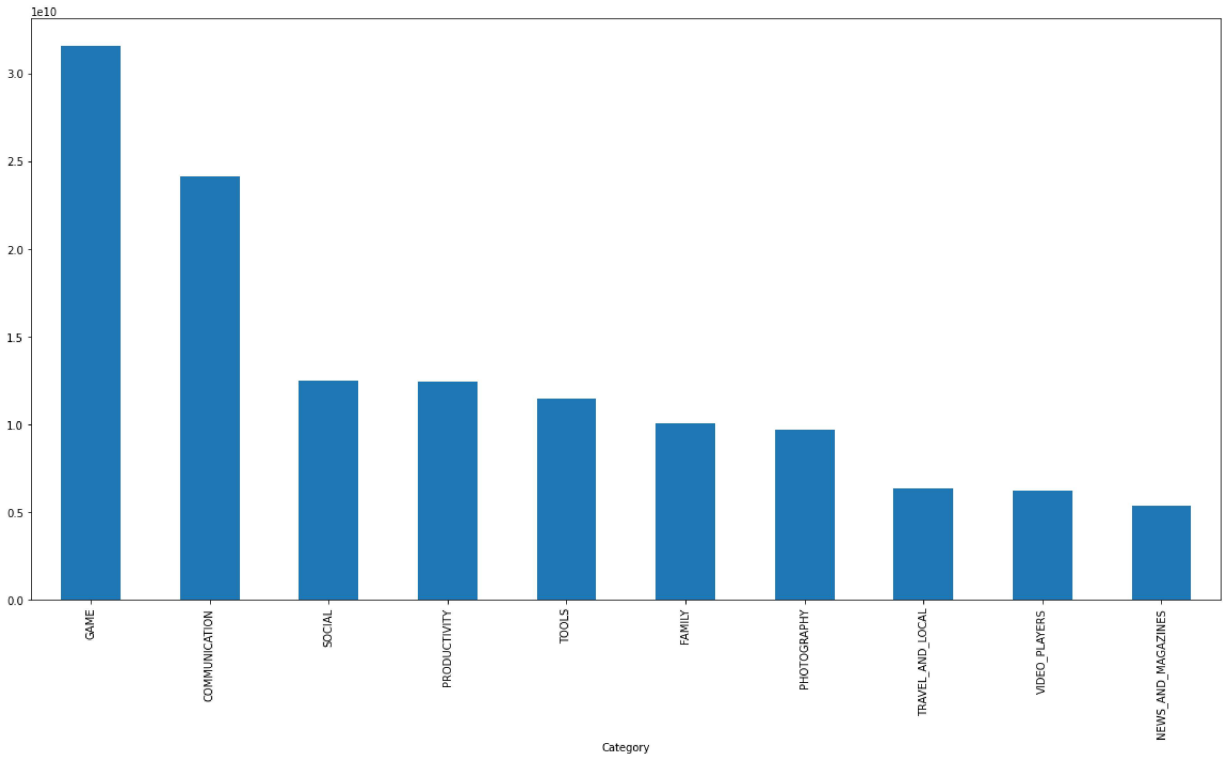
Which category has largest numbers of instalation ?

In [119]:
```
df1.groupby(['Category'])["Installs"].sum().sort_values(ascending=False)
```

Out[119]:
```
Category
GAME                   31544024415
COMMUNICATION          24152276251
SOCIAL                 12513867902
PRODUCTIVITY           12463091369
TOOLS                  11452771915
FAMILY                 10041692505
PHOTOGRAPHY             9721247655
TRAVEL_AND_LOCAL        6361887146
VIDEO_PLAYERS           6222002720
NEWS_AND_MAGAZINES      5393217760
SHOPPING                2573348785
ENTERTAINMENT           2455660000
PERSONALIZATION         2074494782
BOOKS_AND_REFERENCE     1916469576
SPORTS                  1528574498
HEALTH_AND_FITNESS      1361022512
BUSINESS                 863664865
FINANCE                  770348734
MAPS_AND_NAVIGATION      724281890
LIFESTYLE                534823539
EDUCATION                533952000
WEATHER                  426100520
FOOD_AND_DRINK           257898751
DATING                   206536107
HOUSE_AND_HOME           125212461
ART_AND_DESIGN           124338100
LIBRARIES_AND_DEMO        62995910
COMICS                    56086150
AUTO_AND_VEHICLES         53130211
MEDICAL                   42204177
PARENTING                 31521110
BEAUTY                    27197050
EVENTS                    15973161
Name: Installs, dtype: int64
```

In [120]:
```
df1.groupby(['Category'])["Installs"].sum().nlargest(10).plot(kind='bar',figsize=
```

Out[120]: <AxesSubplot:xlabel='Category'>



How many apps are there on google play store which get 5 ratings ?

In [121]:
```
df1['App']
```

Out[121]:
```
0           Photo Editor & Candy Camera & Grid & ScrapBook
1                                       Coloring book moana
2        U Launcher Lite – FREE Live Cool Themes, Hide ...
3                                     Sketch - Draw & Paint
4                      Pixel Draw - Number Art Coloring Book
                               ...
10835                                       Sya9a Maroc - FR
10836                      Fr. Mike Schmitz Audio Teachings
10837                               Parkinson Exercices FR
10838                          The SCP Foundation DB fr nn5n
10839        iHoroscope - 2018 Daily Horoscope & Astrology
Name: App, Length: 10357, dtype: object
```

In [122]:
```
df1[df1['Rating']==5][['App','Rating']].head(5)
```

Out[122]:

	App	Rating
329	Hojiboy Tojiboyev Life Hacks	5.0
612	American Girls Mobile Numbers	5.0
615	Awake Dating	5.0
633	Spine- The dating app	5.0
636	Girls Live Talk - Free Text and Video Chat	5.0

In [123]:
```
len(df1[df1['Rating']==5])
```

Out[123]:
```
271
```

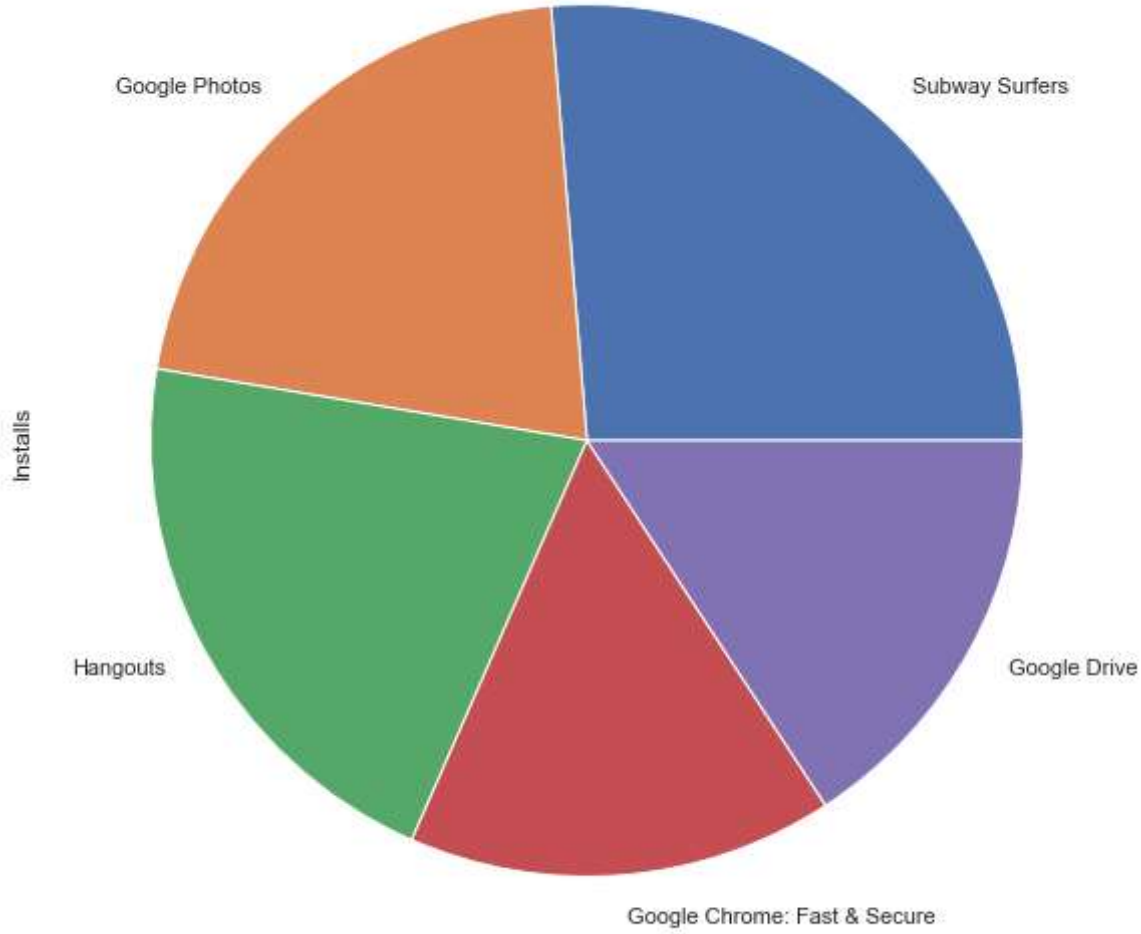
what are the top 5 most installed apps in each popular category ?

In [131]:
```
df1.groupby(['App'])["Installs"].sum().nlargest(5)
```

Out[131]:
```
App
Subway Surfers                  5000000000
Google Photos                   4000000000
Hangouts                        4000000000
Google Chrome: Fast & Secure    3000000000
Google Drive                    3000000000
Name: Installs, dtype: int64
```

In [132]:
```
df1.groupby(['App'])["Installs"].sum().nlargest(5).plot.pie()
```

Out[132]:
```
<AxesSubplot:ylabel='Installs'>
```



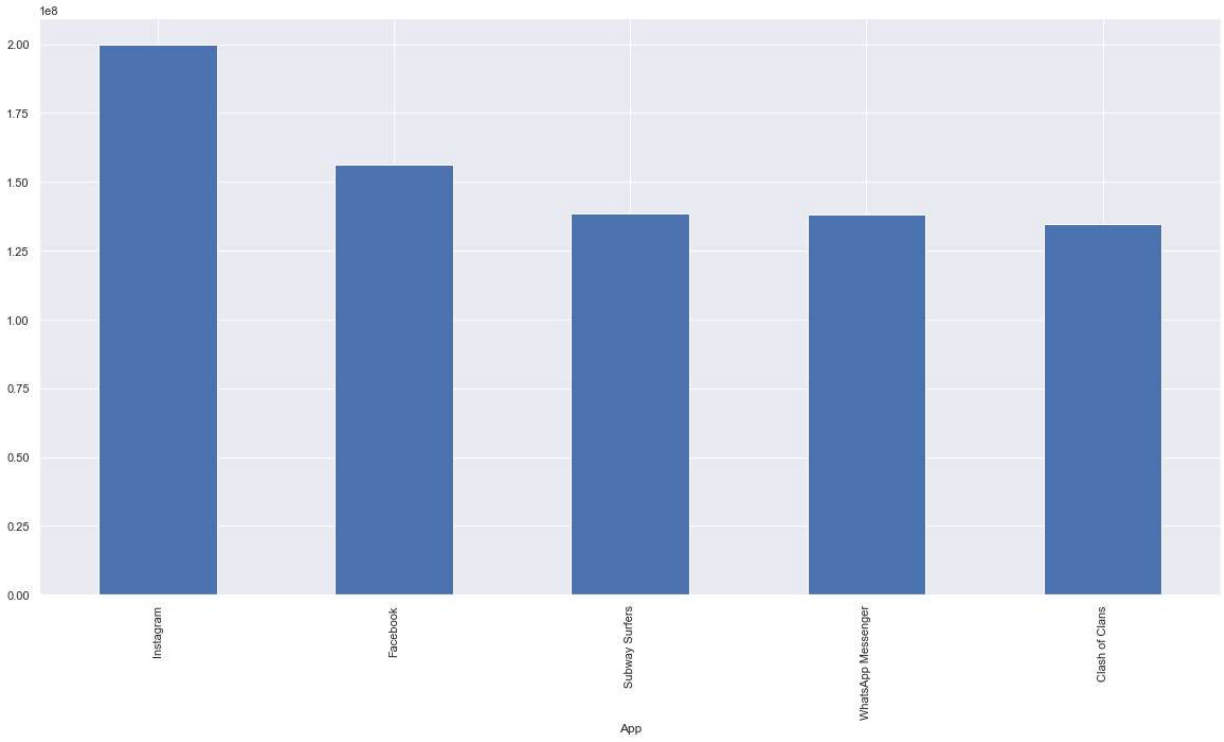
which category app users are reviewing the most ?

In [133]:
```
df1.groupby(['App'])["Reviews"].sum().nlargest()
```

Out[133]:
```
App
Instagram             199664676
Facebook              156286514
Subway Surfers        138606606
WhatsApp Messenger    138228988
Clash of Clans        134667058
Name: Reviews, dtype: int64
```

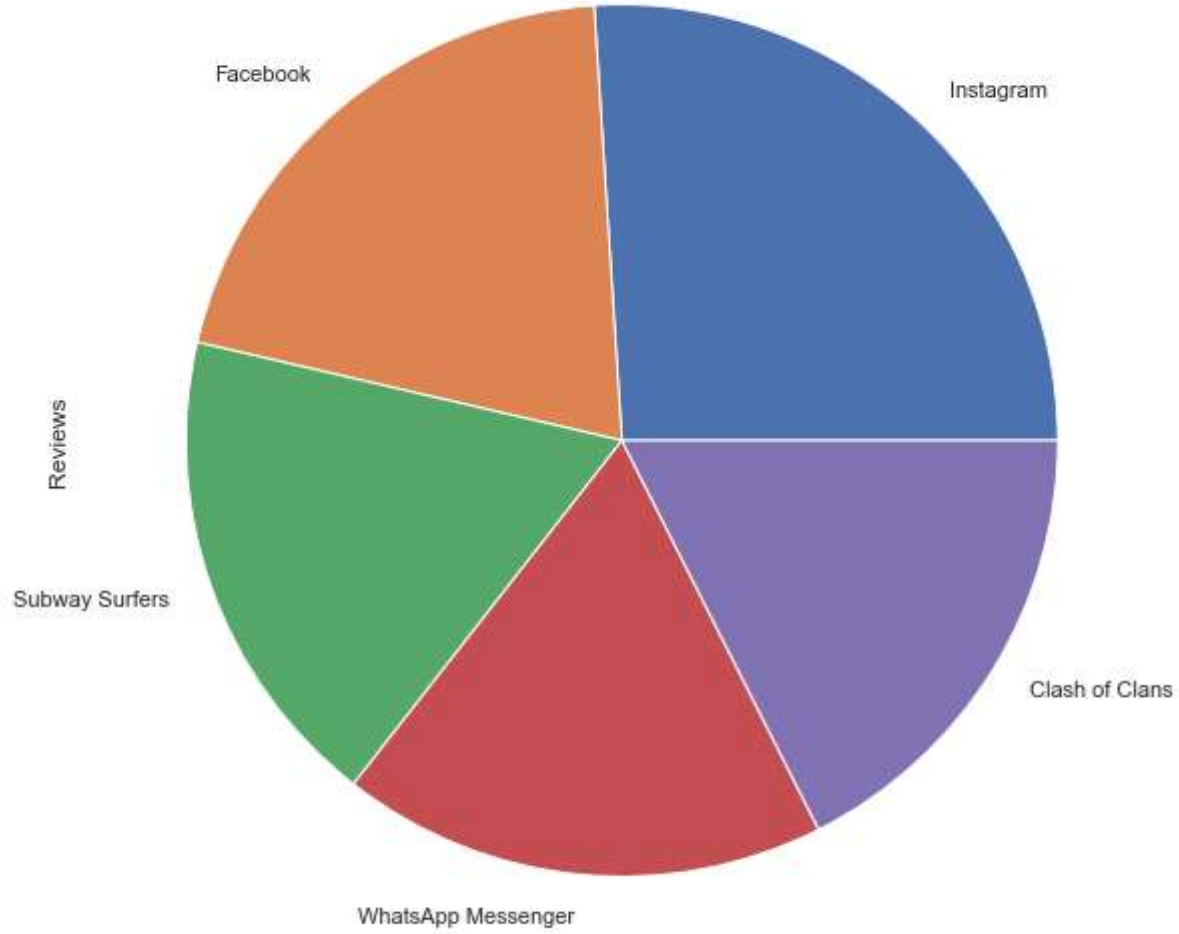
In [134]:
```
df1.groupby(['App'])["Reviews"].sum().nlargest().plot(kind='bar',figsize=(20,10))
```

Out[134]:
```
<AxesSubplot:xlabel='App'>
```



In [135]:
```
df1.groupby(['App'])["Reviews"].sum().nlargest().plot.pie()
```

Out[135]:
```
<AxesSubplot:ylabel='Reviews'>
```



which kind of app user are downloading the most free\paid ?

In [136]:
```
df1.groupby(['App',"Type","Installs"]).sum()
```

Out[136]:

App	Type	Installs	Rating	Reviews	Size	Price	day	month	year
"i DT" Fútbol. Todos Somos Técnicos.	Free	500	0.0	27	3.600	0.00	7	10	2017
+Download 4 Instagram Twitter	Free	1000000	4.5	40467	22.000	0.00	2	8	2018
- Free Comics - Comic Apps	Free	10000	3.5	115	9.100	0.00	13	7	2018
.R	Free	10000	4.5	259	0.203	0.00	16	9	2014
/u/app	Free	10000	4.7	573	53.000	0.00	3	7	2018
...	...	...	...	...	...	...	...	...	...
뽕티비 - 개인방송, 인터넷방송, BJ방송	Free	100000	0.0	414	59.000	0.00	18	7	2018
💎 I'm rich	Paid	10000	3.8	718	26.000	399.99	11	3	2018
💘 WhatsLov: Smileys of love, stickers and GIF	Free	1000000	4.6	22098	18.000	0.00	24	7	2018
📏 Smart Ruler ↔ cm/inch measuring for homework!	Free	10000	4.0	19	3.200	0.00	21	10	2017
🔥 Football Wallpapers 4K | Full HD Backgrounds 😍	Free	1000000	4.7	11661	4.000	0.00	14	7	2018

9673 rows × 7 columns

In [137]:
```
df1_free=df[df['Type']=="Free"]
```

In [138]:
```
df1_free
```

Out[138]:

	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	E
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	E
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	E
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	E
...	...	...	...	...	...	...	...	...	
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53M	5,000+	Free	0	E
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3.6M	100+	Free	0	E
10838	Parkinson Exercices FR	MEDICAL	NaN	3	9.5M	1,000+	Free	0	E
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	E

10039 rows × 13 columns

In [139]:
```
df1_paid=df[df['Type']=="Paid"]
```

In [140]:
```
df1_paid
```

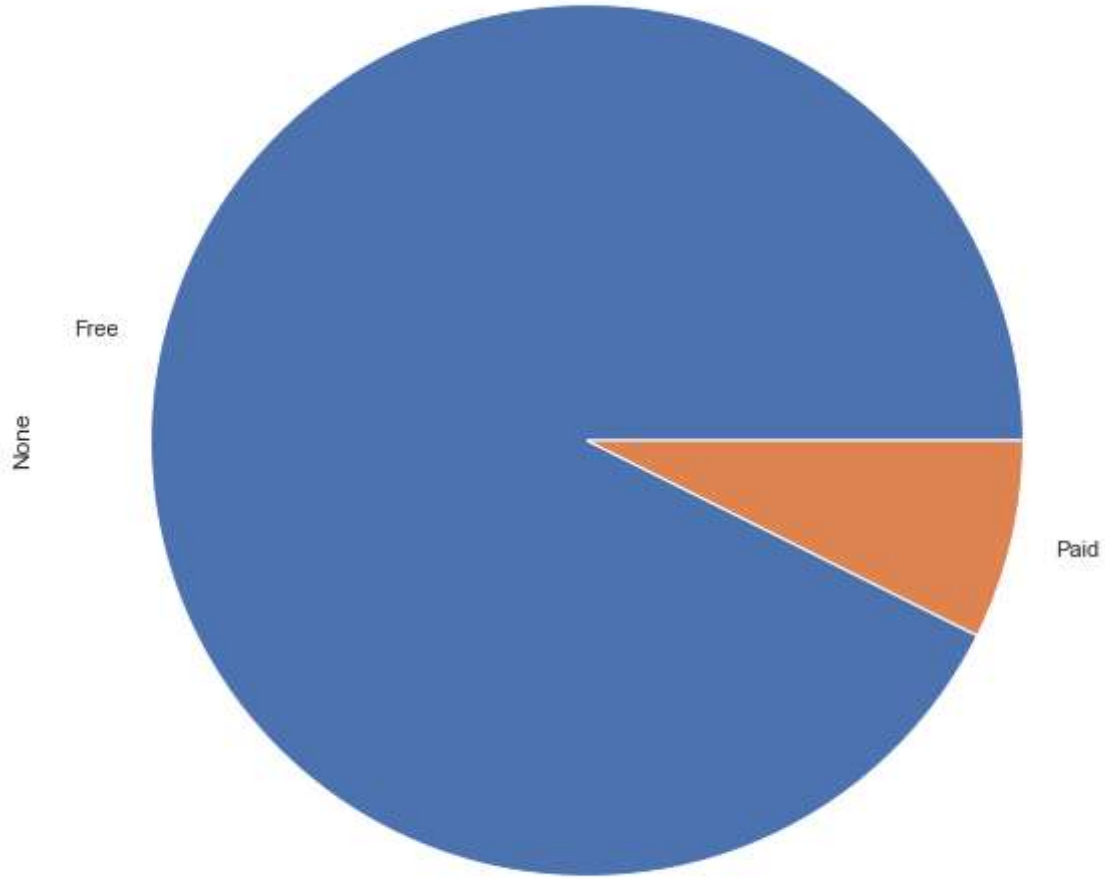
Out[140]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Conte Rati
234	TurboScan: scan documents and receipts in PDF	BUSINESS	4.7	11442	6.8M	100,000+	Paid	$4.99	Everyc
235	Tiny Scanner Pro: PDF Doc Scan	BUSINESS	4.8	10295	39M	100,000+	Paid	$4.99	Everyc
290	TurboScan: scan documents and receipts in PDF	BUSINESS	4.7	11442	6.8M	100,000+	Paid	$4.99	Everyc
291	Tiny Scanner Pro: PDF Doc Scan	BUSINESS	4.8	10295	39M	100,000+	Paid	$4.99	Everyc
427	Puffin Browser Pro	COMMUNICATION	4.0	18247	Varies with device	100,000+	Paid	$3.99	Everyc
...	...	...	...	...	...	...	...	...	
10735	FP VoiceBot	FAMILY	NaN	17	157k	100+	Paid	$0.99	Matu 1
10760	Fast Tract Diet	HEALTH_AND_FITNESS	4.4	35	2.4M	1,000+	Paid	$7.99	Everyc
10782	Trine 2: Complete Story	GAME	3.8	252	11M	10,000+	Paid	$16.99	Te
10785	sugar, sugar	FAMILY	4.2	1405	9.5M	10,000+	Paid	$1.20	Everyc
10798	Word Search Tab 1 FR	FAMILY	NaN	0	1020k	50+	Paid	$1.04	Everyc

800 rows × 13 columns

In [141]:
```
df1.value_counts('Type').plot(kind="pie",figsize=(10,10))
```

Out[141]:
```
<AxesSubplot:ylabel='None'>
```



In [ ]:

In [ ]:

In [ ]: