GOOGLE PLAYSTORE-ANALYSIS:

Ojective:

Google Play Store team is about to launch a new feature where in certain apps that are promising are boosted in visibility. The boost will manifest in multiple ways – higher priority in recommendations sections (“Similar apps”, “You might also like”, “New and updated games”). These will also get a boost in visibility in search results. This feature will help bring more attention to newer apps that have potential. The task is to understand what makes an app perform well - size? price? category? multiple factors together? Analyze the data and present your insights in a format consumable by business – the final output of the analysis would be presented to business as insights with supporting data/visualizations

IMPORT LIBRARY

In [109]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
color = sns.color_palette()
import plotly.graph_objects as go
import os
import warnings
warnings.simplefilter(action='ignore', category=FutureWarning)
```

In [107]:

```
pip install plotly
```

```
Collecting plotly
  Downloading plotly-5.4.0-py2.py3-none-any.whl (25.3 MB)
Requirement already satisfied: six in c:\users\yuvak\anaconda3\lib\site-pac
kages (from plotly) (1.15.0)
Collecting tenacity>=6.2.0
  Downloading tenacity-8.0.1-py3-none-any.whl (24 kB)
Installing collected packages: tenacity, plotly
Successfully installed plotly-5.4.0 tenacity-8.0.1
Note: you may need to restart the kernel to use updated packages.
```

In [4]:

```
print(os.listdir())
```

```
['.conda', '.condarc', '.IBM', '.idlerc', '.ipynb_checkpoints', '.ipython',
'.jupyter', '.matplotlib', '.spss', '.VirtualBox', '3D Objects', 'anaconda3
', 'AppData', 'Application Data', 'Asgn - Playstore Analysis v0.1.pdf', 'Co
ntacts', 'Cookies', 'Documents', 'Downloads', 'Favorites', 'Google playstor
e-analysis.ipynb', 'IntelGraphicsProfiles', 'Links', 'Local Settings', 'Mus
ic', 'My Documents', 'NetHood', 'NTUSER.DAT', 'ntuser.dat.LOG1', 'ntuser.da
t.LOG2', 'NTUSER.DAT{35edd092-3ed9-11ec-8c61-000d3a425817}.TM.blf', 'NTUSER
.DAT{35edd092-3ed9-11ec-8c61-000d3a425817}.TMContainer00000000000000000001.
regtrans-ms', 'NTUSER.DAT{35edd092-3ed9-11ec-8c61-000d3a425817}.TMContainer
00000000000000000002.regtrans-ms', 'ntuser.ini', 'OneDrive', 'playstore-ana
lysis (2) (1).csv', 'PrintHood', 'Recent', 'Saved Games', 'Searches', 'Send
To', 'source', 'Start Menu', 'Templates', 'Videos', 'VirtualBox VMs']
```

In [5]:

```
df=pd.read_csv('C:/Users/yuvak/OneDrive/Desktop/playstore-analysis.csv')
```

In [6]:

```
df.head()
```

Out[6]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19000.0	10,000+	Free	0	Everyone	Art & Design	January 7, 2018	1.0.0	4.0.3 and up
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14000.0	500,000+	Free	0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0	4.0.3 and up
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8700.0	5,000,000+	Free	0	Everyone	Art & Design	August 1, 2018	1.2.4	4.0.3 and up
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25000.0	50,000,000+	Free	0	Teen	Art & Design	June 8, 2018	Varies with device	4.2 and up
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2800.0	100,000+	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1	4.4 and up

In [7]:

```
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  float64
 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(2), object(11)
memory usage: 1.1+ MB
```

In [8]:

```
df.describe()
```

Out[8]:

	Rating	Size
count	9367.000000	10841.000000
mean	4.193338	21516.529524
std	0.537431	20746.537567
min	1.000000	8.500000
25%	4.000000	5900.000000
50%	4.300000	18000.000000
75%	4.500000	26000.000000
max	19.000000	100000.000000

1.Data cleaning-Missing value identification & treating.

a.)Drop record values where rating is missing since rating is our target/study variable.

In [9]:

```
df.isnull().sum()
```

Out[9]:

```
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
```

Missing values @Rating -1474 @Type -01 @Content Rating -01 @Current ver -08 @Andriod ver -03

In [10]:

```
df1=df.dropna(subset=['Rating'])
```

In [11]:

```
df1.isnull().sum()
```

Out[11]:

```
App               0
Category          0
Rating            0
Reviews           0
Size              0
Installs          0
Type              0
Price             0
Content Rating    1
Genres            0
Last Updated      0
Current Ver       4
Android Ver       3
dtype: int64
```

b.)Check null values for the andriod ver column.

In [12]:

```
df1['Android Ver'].isnull().sum()
```

Out[12]:

```
3
```

In [13]:

```
df1[df1.isna().any(axis=1)]
```

Out[13]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
15	Learn To Draw Kawa	ART_AND_DESIGN	3.2	55	2700.00000	5,000+	Free	0	Everyone	Art & Design	June 6,	NaN	4.2 and up

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
	ii Characters										2018		
1553	Market Update Helper	LIBRARIES_AND_DEMO	4.1	20145	11.00000	1,000,000+	Free	0	Everyone	Libraries & Demo	February 12, 2013	NaN	1.5 and up
4453	[substratum] Vacuum: P	PERSONALIZATION	4.4	230	11000.00000	1,000+	Paid	$1.49	Everyone	Personalization	July 20, 2018	4.4	NaN
4490	Pi Dark [substratum]	PERSONALIZATION	4.5	189	2100.00000	10,000+	Free	0	Everyone	Personalization	March 27, 2018	1.1	NaN
6322	Virtual DJ Sound Mixer	TOOLS	4.2	4010	8700.00000	500,000+	Free	0	Everyone	Tools	May 10, 2017	NaN	4.0 and up
7333	Dots puzzle	FAMILY	4.0	179	14000.00000	50,000+	Paid	$0.99	Everyone	Puzzle	April 18, 2018	NaN	4.0 and up
10472	Life Made WI-Fi Touchscreen Photo Frame	1.9	19.0	3.0M	21516.52952	Free	0	Everyone	NaN	February 11, 2018	1.0.19	4.0 and up	NaN

In [14]:

```
df.loc[[4453,4490,10472]]
```

Out[14]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
4453	[substratum] Vacuum: P	PERSONALIZATION	4.4	230	11000.00000	1,000+	Paid	$1.49	Everyone	Personalization	July 20, 2018	4.4	NaN
4490	Pi Dark [substratum]	PERSONALIZATION	4.5	189	2100.00000	10,000+	Free	0	Everyone	Personalization	March 27, 2018	1.1	NaN
10472	Life Made WI-Fi Touchscreen Photo Frame	1.9	19.0	3.0M	21516.52952	Free	0	Everyone	NaN	February 11, 2018	1.0.19	4.0 and up	NaN

Two missing values from 3rd record.

1.content rating.

2.andriod ver.

$droping down the 3rd record.

In [15]:

```
df2=df1.drop(10472)
```

In [17]:

```
try:
    df2.loc[[10472]]
except KeyError:
    print("successfully deleted")
```

```
successfully deleted
```

Replace remaining missing values with mode.

In [18]:

```
df3=df2.copy(deep=True)
df3['Android Ver']=df2['Android Ver'].fillna(df2['Android Ver'].mode()[0])
```

In [19]:

```
df3.loc[[4453,4490]]
```

Out[19]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
4453	[substratum] Vacuum: P	PERSONALIZATION	4.4	230	11000.0	1,000+	Paid	$1.49	Everyone	Personalization	July 20, 2018	4.4	4.1 and up
4490	Pi Dark [substratum]	PERSONALIZATION	4.5	189	2100.0	10,000+	Free	0	Everyone	Personalization	March 27, 2018	1.1	4.1 and up

Missing values of Android ver is now 4.1 and up

C.)Current ver - replace with most common value.

In [20]:

```
df3[df3.isna().any(axis=1)]
```

Out[20]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
15	Learn To Draw Kawaii Characters	ART_AND_DESIGN	3.2	55	2700.0	5,000+	Free	0	Everyone	Art & Design	June 6, 2018	NaN	4.2 and up
1553	Market Update Helper	LIBRARIES_AND_DEMO	4.1	20145	11.0	1,000,000+	Free	0	Everyone	Libraries & Demo	February 12, 2013	NaN	1.5 and up
6322	Virtual DJ Sound Mixer	TOOLS	4.2	4010	8700.0	500,000+	Free	0	Everyone	Tools	May 10, 2017	NaN	4.0 and up
7333	Dots puzzle	FAMILY	4.0	179	14000.0	50,000+	Paid	$0.99	Everyone	Puzzle	April 18, 2018	NaN	4.0 and up

Most common value current ver

In [21]:

```
mode_cv=df3['Current Ver'].value_counts().idxmax()
print(mode_cv)
```

```
Varies with device
```

In [22]:

```
df4=df3.copy(deep=True)
df4[df4.isna().any(axis=1)]
```

Out[22]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
15	Learn To Draw Kawaii Characters	ART_AND_DESIGN	3.2	55	2700.0	5,000+	Free	0	Everyone	Art & Design	June 6, 2018	NaN	4.2 and up
1553	Market Update Helper	LIBRARIES_AND_DEMO	4.1	20145	11.0	1,000,000+	Free	0	Everyone	Libraries & Demo	February 12, 2013	NaN	1.5 and up
6322	Virtual DJ Sound Mixer	TOOLS	4.2	4010	8700.0	500,000+	Free	0	Everyone	Tools	May 10, 2017	NaN	4.0 and up
7333	Dots puzzle	FAMILY	4.0	179	14000.0	50,000+	Paid	$0.99	Everyone	Puzzle	April 18, 2018	NaN	4.0 and up

In [23]:

```
df4['Current Ver']=df3['Current Ver'].fillna(mode_cv)
df4.loc[[15,1553,6322,7333]]
```

Out[23]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
15	Learn To Draw Kawaii Characters	ART_AND_DESIGN	3.2	55	2700.0	5,000+	Free	0	Everyone	Art & Design	June 6, 2018	Varies with device	4.2 and up

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
1553	Market Update Helper	LIBRARIES_AND_DEMO	4.1	20145	11.0	1,000,000+	Free	0	Everyone	Libraries & Demo	February 12, 2013	Varies with device	1.5 and up
6322	Virtual DJ Sound Mixer	TOOLS	4.2	4010	8700.0	500,000+	Free	0	Everyone	Tools	May 10, 2017	Varies with device	4.0 and up
7333	Dots puzzle	FAMILY	4.0	179	14000.0	50,000+	Paid	$0.99	Everyone	Puzzle	April 18, 2018	Varies with device	4.0 and up

2.Data cleanup and correcting the data types

a.Which all variables need to be brought to numeroc types?

In [24]:

```
df4.dtypes
```

Out[24]:

```
App                 object
Category            object
Rating             float64
Reviews             object
Size               float64
Installs            object
Type                object
Price               object
Content Rating      object
Genres              object
Last Updated        object
Current Ver         object
Android Ver         object
dtype: object
```

Following variables need to be brought to numeric types.

*Reviews

*Installs

*Price

In [25]:

```
df5=df4.copy(deep=True)
```

b.Price variable-remove$sign and convert to float.

In [27]:

```
df5['Price']=df5['Price'].str.replace('$','')
```

In [28]:

```
df5.loc[[4453,7333]]
```

Out[28]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
4453	[substratum] Vacuum: P	PERSONALIZATION	4.4	230	11000.0	1,000+	Paid	1.49	Everyone	Personalization	July 20, 2018	4.4	4.1 and up
7333	Dots puzzle	FAMILY	4.0	179	14000.0	50,000+	Paid	0.99	Everyone	Puzzle	April 18, 2018	Varies with device	4.0 and up

$ sign operator from price is removed

In [44]:

```
df5['Price']=df5['Price'].astype(float)
```

In [45]:

```
df5['Price'].dtypes
```

Out[45]:

```
dtype('float64')
```

price variable is now a float type.

c.Installs - remove ',' and '+' sign, convert to integer.

In [31]:

```
df5['Installs']=df5['Installs'].str.replace('+','')
df5['Installs']=df5['Installs'].str.replace(',','')
```

In [32]:

```
df5.head()
```

Out[32]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
0	Photo Editor & Candy Came	ART_AND_DESIGN	4.1	159	19000.0	10000	Free	0.0	Everyone	Art & Design	January 7, 2018	1.0.0	4.0.3 and up

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
	ra & Grid & Scrap Book												
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14000.0	500000	Free	0.0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0	4.0.3 and up
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8700.0	5000000	Free	0.0	Everyone	Art & Design	August 1, 2018	1.2.4	4.0.3 and up
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25000.0	50000000	Free	0.0	Teen	Art & Design	June 8, 2018	Varies with device	4.2 and up
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2800.0	100000	Free	0.0	Everyone	Art & Design;Creativity	June 20, 2018	1.1	4.4 and up

In [33]:

```
df5['Installs']=df5['Installs'].astype(int)
```

In [34]:

```
df5['Installs'].dtypes
```

Out[34]:

```
dtype('int32')
```

signs are removed and converted to integer types.

d.convert all other identified coloumns to numeric.

In [37]:

```
df5.dtypes
```

Out[37]:

```
App                  object
Category             object
Rating              float64
Reviews              object
Size                float64
Installs              int32
Type                 object
Price               float64
Content Rating       object
Genres               object
Last Updated         object
Current Ver          object
Android Ver          object
dtype: object
```

Reviews are converted to be numeric data types.

In [39]:

```
df5['Reviews']=df5['Reviews'].astype(int)
```

In [40]:

```
df5['Reviews'].dtypes
```

Out[40]:

```
dtype('int32')
```

In [41]:

```
df5.dtypes
```

Out[41]:

```
App                  object
Category             object
Rating              float64
Reviews               int32
Size                float64
Installs              int32
Type                 object
Price               float64
Content Rating       object
Genres               object
Last Updated         object
Current Ver          object
Android Ver          object
dtype: object
```

As before indicated variables are now numeric types

*Reviews

*Installs

*Price

3.Sanity checks - check for the following and handle accordingly.

a. Avg.rating should be between 1 and 5, as only these values are allowed in play store.

1.Are they are such records?Drip if so.

In [46]:

```
check1=df5['Rating'] > 5
```

In [47]:

```
check1.any()
```

Out[47]:

```
False
```

In [48]:

```
check2=df5['Rating'] < 1
```

In [49]:

```
check2.any()
```

Out[49]:

```
False
```

No such records are founded.

b.Reviews should not be more than installs as only those who installed can Review the app.

1.Are they such records?drop if so.

In [54]:

```
dfcheck=pd.DataFrame()
dfcheck=df5[df5.Reviews > df5.Installs]
```

In [55]:

```
dfcheck.shape
```

Out[55]:

```
(7, 13)
```

In [57]:

```
dfcheck.head(7)
```

Out[57]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
2454	KBA-EZ Health Guide	MEDICAL	5.0	4	25000.00000	1	Free	0.0	Everyone	Medical	August 2, 2018	1.0.72	4.0.3 and up
4663	Alarmy (Sleep If U Can) - Pro	LIFESTYLE	4.8	10249	21516.52952	10000	Paid	2.0	Everyone	Lifestyle	July 30, 2018	Varies with device	Varies with device
5917	Ra Ga Ba	GAME	5.0	2	20000.00000	1	Paid	1.0	Everyone	Arcade	February 8, 2017	1.0.4	2.3 and up

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
6700	Brick Breaker BR	GAME	5.0	7	19000.00000	5	Free	0.0	Everyone	Arcade	July 23, 2018	1	4.1 and up
7402	Trovami se ci riesci	GAME	5.0	11	6100.00000	10	Free	0.0	Everyone	Arcade	March 11, 2017	0.1	2.3 and up
8591	DN Blog	SOCIAL	5.0	20	4200.00000	10	Free	0.0	Teen	Social	July 23, 2018	1	4.0 and up
10697	Mu.F.O.	GAME	5.0	2	16000.00000	1	Paid	0.0	Everyone	Arcade	March 3, 2017	1	2.3 and up

In this we have identified 7 invalid records.

In [58]:

```
df6=df5.copy(deep=0)
df6.drop(df5[df5.Reviews > df5.Installs].index,inplace = True)
```

In [60]:

```
dfcheck1 = df6[df6.Reviews >df6.Installs]
dfcheck1.shape
```

Out[60]:

```
(0, 13)
```

All invalid records are dropped.

4.Identify and handle outliers.

a.Price column

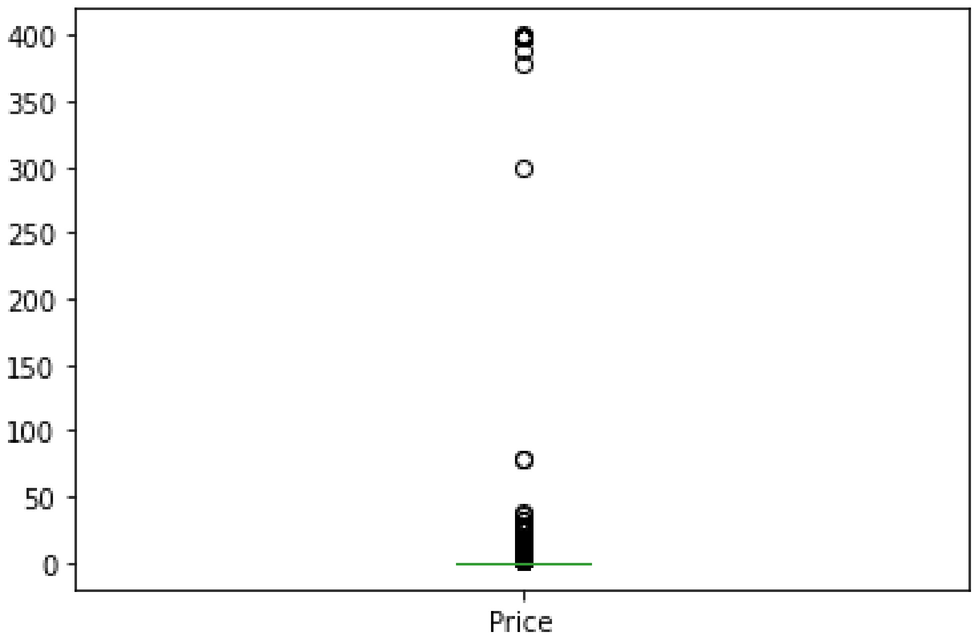
1.Make suitable plot to identify outliers in place.

In [67]:

```
def plot_box(df,c1):
    df.boxplot(column=[c1])
    plt.grid(False)
    plt.show()
```

In [68]:

```
plot_box(df6,"Price")
```



It indicates they have many outliers.

In [69]:

```
def outliers(df,c1):
    q1=df[c1].quantile(0.25)
    q3=df[c1].quantile(0.75)
    iqr=q3-q1
    lower_bound=q1-1.5*iqr
    upper_bound=q3+1.5*iqr

    ls=df.index[(df[c1]<lower_bound) | (df[c1]>upper_bound)]
    return ls
```

In [70]:

```
indexes=outliers(df6,"Price")
```

In [71]:

```
indexes
```

Out[71]:

```
Int64Index([  234,   235,   290,   291,   427,   476,   477,   481,   571,
              851,
            ...
            10531, 10540, 10570, 10583, 10594, 10645, 10679, 10760, 10782,
            10785],
           dtype='int64', length=538)
```

In [72]:

```
len(indexes)
```

Out[72]:

```
538
```

There are totally 538 outliers are founded in Price.

2.Do you expect apps on the play store to cost $200?Check out these cases.

In [73]:

```
df6.loc[df6['Price'] > 200]
```

Out[73]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
4197	most expensive app (H)	FAMILY	4.3	6	1500.0	100	Paid	399.0	Everyone	Entertainment	July 16, 2018	1	7.0 and up
4362	💎 I'm rich	LIFESTYLE	3.8	718	26000.0	10000	Paid	399.0	Everyone	Lifestyle	March 11, 2018	1.0.0	4.4 and up
4367	I'm Rich - Trump Edition	LIFESTYLE	3.6	275	7300.0	10000	Paid	400.0	Everyone	Lifestyle	May 3, 2018	1.0.1	4.1 and up
5351	I am rich	LIFESTYLE	3.8	3547	1800.0	100000	Paid	399.0	Everyone	Lifestyle	January 12, 2018	2	4.0.3 and up
5354	I am Rich Plus	FAMILY	4.0	856	8700.0	10000	Paid	399.0	Everyone	Entertainment	May 19, 2018	3	4.4 and up
5355	I am rich VIP	LIFESTYLE	3.8	411	2600.0	10000	Paid	299.0	Everyone	Lifestyle	July 21, 2018	1.1.1	4.3 and up
5356	I Am Rich Premium	FINANCE	4.1	1867	4700.0	50000	Paid	399.0	Everyone	Finance	November 12, 2017	1.6	4.0 and up
5357	I am extremely Rich	LIFESTYLE	2.9	41	2900.0	1000	Paid	379.0	Everyone	Lifestyle	July 1, 2018	1	4.0 and up
5358	I am Rich!	FINANCE	3.8	93	22000.0	1000	Paid	399.0	Everyone	Finance	December 11, 2017	1	4.1 and up
5359	I am rich(premium)	FINANCE	3.5	472	965.0	5000	Paid	399.0	Everyone	Finance	May 1, 2017	3.4	4.4 and up

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
5362	I Am Rich Pro	FAMILY	4.4	201	2700.0	5000	Paid	399.0	Everyone	Entertainment	May 30, 2017	1.54	1.6 and up
5364	I am rich (Most expensive app)	FINANCE	4.1	129	2700.0	1000	Paid	399.0	Teen	Finance	December 6, 2017	2	4.0.3 and up
5366	I Am Rich	FAMILY	3.6	217	4900.0	10000	Paid	389.0	Everyone	Entertainment	June 22, 2018	1.5	4.2 and up
5369	I am Rich	FINANCE	4.3	180	3800.0	5000	Paid	399.0	Everyone	Finance	March 22, 2018	1	4.2 and up
5373	I AM RICH PRO PLUS	FINANCE	4.0	36	41000.0	1000	Paid	399.0	Everyone	Finance	June 25, 2018	1.0.2	4.1 and up

As per above statements the costs of apps represents $200.

3.After dropping the useless records, make the suitable plot again to identify outliers.

In [74]:

```
def remove(df,ls):
    ls=sorted(set(ls))
    df=df.drop(ls)
    return df
```

In [75]:

```
dfcleaned=remove(df6,indexes)
```

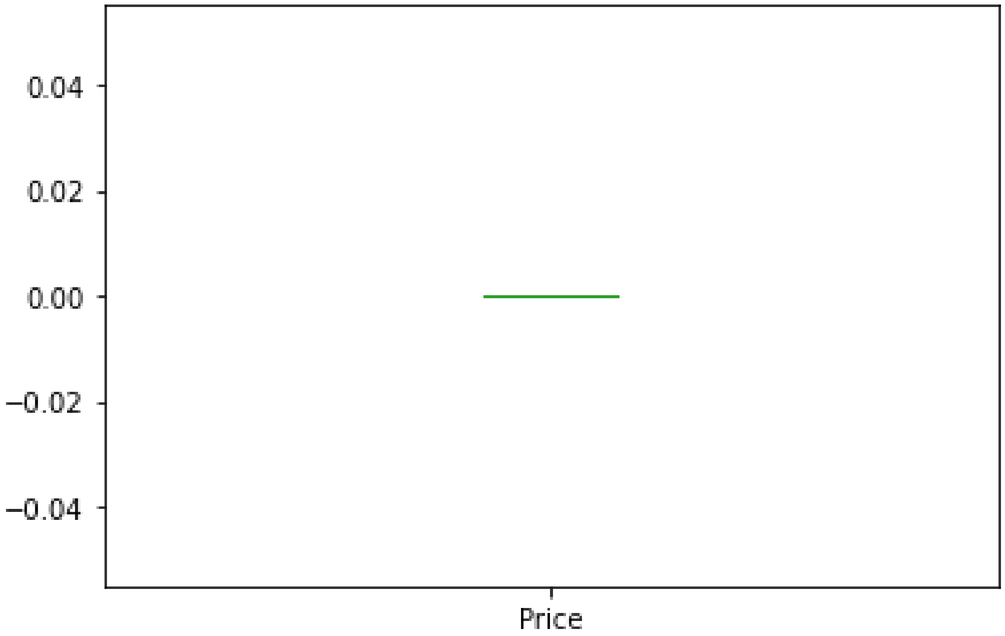
In [76]:

```
print(df6.shape,
dfcleaned.shape)
```

```
(9359, 13) (8821, 13)
```

In [77]:

```
plot_box(dfcleaned,"Price")
```



4.Limit data to records with price <$30.

In [78]:

```
dflimit=df6[df6['Price']<30]
```

In [81]:

```
print(df6.shape,
      dflimit.shape)
```

```
(9359, 13) (9338, 13)
```

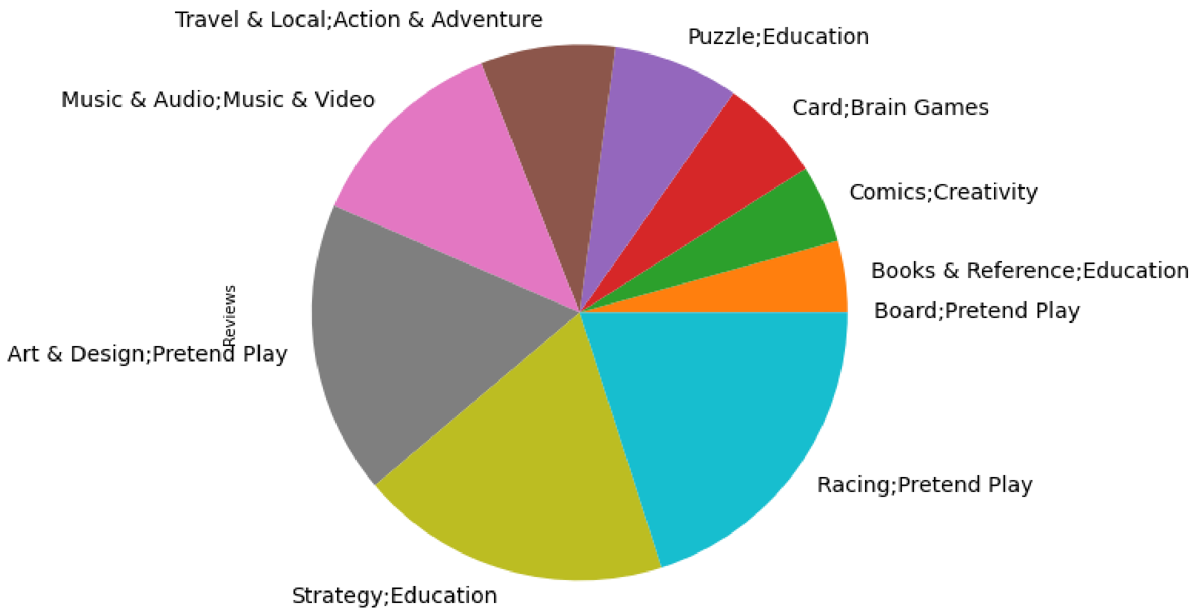
b.Reviews column.

1.Make suitable plot.

In [86]:

```
total=df6.groupby('Genres')['Reviews'].sum().sort_values()
plt.subplots(figsize=(15,8))
total.head(10).plot(kind='pie',fontsize=14)

print(total.sort_values(ascending=False))
plt.show()
```

```
Genres
Communication                    815461799
Social                           621241071
Casual                           412078812
Action                           350303919
Arcade                           336990376
                                   ...
Puzzle;Education                       834
Card;Brain Games                       685
Comics;Creativity                      516
Books & Reference;Education            471
Board;Pretend Play                       4
Name: Reviews, Length: 115, dtype: int32
```



Top 10 reviewd apps by Genre

2.Limit data to apps with < 1Million reviews.

In [90]:

```
dflim=df6[df6['Reviews']<1000000]
dflim=dflimit.sort_values(["Reviews"],ascending=False)
dflim.head()
```

Out[90]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
10383	Family Guy The Quest for Stuff	GAME	4.0	995002	21516.52952	10000000	Free	0.0	Mature 17+	Adventure	July 25, 2018	1.73.0	4.1 and up
1982	Zombie Catchers	GAME	4.7	990796	75000.00000	10000000	Free	0.0	Everyone	Action	May 24, 2018	1.0.27	4.1 and up
1898	Zombie Catchers	GAME	4.7	990723	75000.00000	10000000	Free	0.0	Everyone	Action	May 24, 2018	1.0.27	4.1 and up

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
1924	Zombie Catchers	GAME	4.7	990663	75000.00000	10000000	Free	0.0	Everyone	Action	May 24, 2018	1.0.27	4.1 and up
1727	Zombie Catchers	GAME	4.7	990586	75000.00000	10000000	Free	0.0	Everyone	Action	May 24, 2018	1.0.27	4.1 and up

In [91]:

```
print(df6.shape,dflim.shape)
```

```
(9359, 13) (8655, 13)
```

c.Installs

1.What is the 95th percentile of the installs?

In [92]:

```
print("95th percentile of the installs:\n",df6.Installs.quantile(0.95))
```

```
95th percentile of the installs:
 100000000.0
```

2.Drop records having a value more than the 95th percentile.

In [94]:

```
df6[df6['Reviews'] > 100000000.0]
```

Out[94]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver

There are no values greater than 95th percentile.

In [95]:

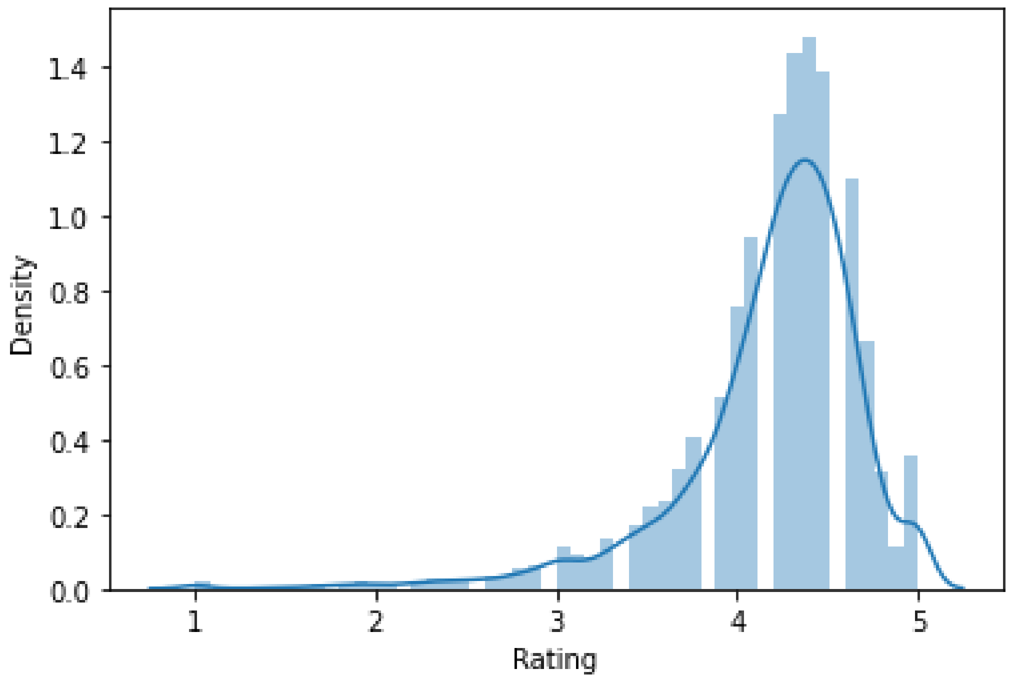
```
indices=df6[df6['Reviews'] > 100000000.0].index
df6.drop(indices,inplace = True)
```

Data analysis to answer business questions

5.What is the distribution of ratings like?(use seaborn)More skewed towards higher/lower values?

In [96]:

```
sns.distplot(df6['Rating'])
plt.show()
```



From the above representing chart most of the rating lies between 4 and 5.

b.what is the implication of this in your analysis?

Real life distributions are usually skewed. If there are too much skewness in the data, then many statistical model don't work. So in skewed data, the tail region may act as an outlier for the statistical model and we know that outliers adversely affect the model's performance especially regression-based models. So there is a necessity to transform the skewed data to close enough to a Gaussian distribution or Normal distribution. This will allow us to try more number of statistical model.

Conclusion: If we have a skewed data then it may harm our results. So, in order to use a skewed data we have to apply a log transformation over the whole set of values to discover patterns in the data and make it usable for the statistical model.

6.What are the top content rating values?

In [98]:

```
print("top Content Rating values :\n",df6['Content Rating'].value_counts())
```

```
top Content Rating values :
 Everyone          7414
Teen              1083
Mature 17+         461
Everyone 10+       397
Adults only 18+      3
Unrated              1
Name: Content Rating, dtype: int64
```

In [99]:

```
Adult_rating = df[df['Content Rating'] == 'Adults only 
18+'].index.to_list()
unrated =df[df['Content Rating'] == 'Unrated'].index.to_list()
df.drop(Adult_rating, inplace = True)
df.drop(unrated, inplace = True)
df['Content Rating'].value_counts()
```

Out[99]:

```
Everyone        8714
Teen            1208
Mature 17+       499
Everyone 10+     414
Name: Content Rating, dtype: int64
```

From the above values in the content rating adults+18 and unrated has only a few records and it has been removed/droped.

In [180]:

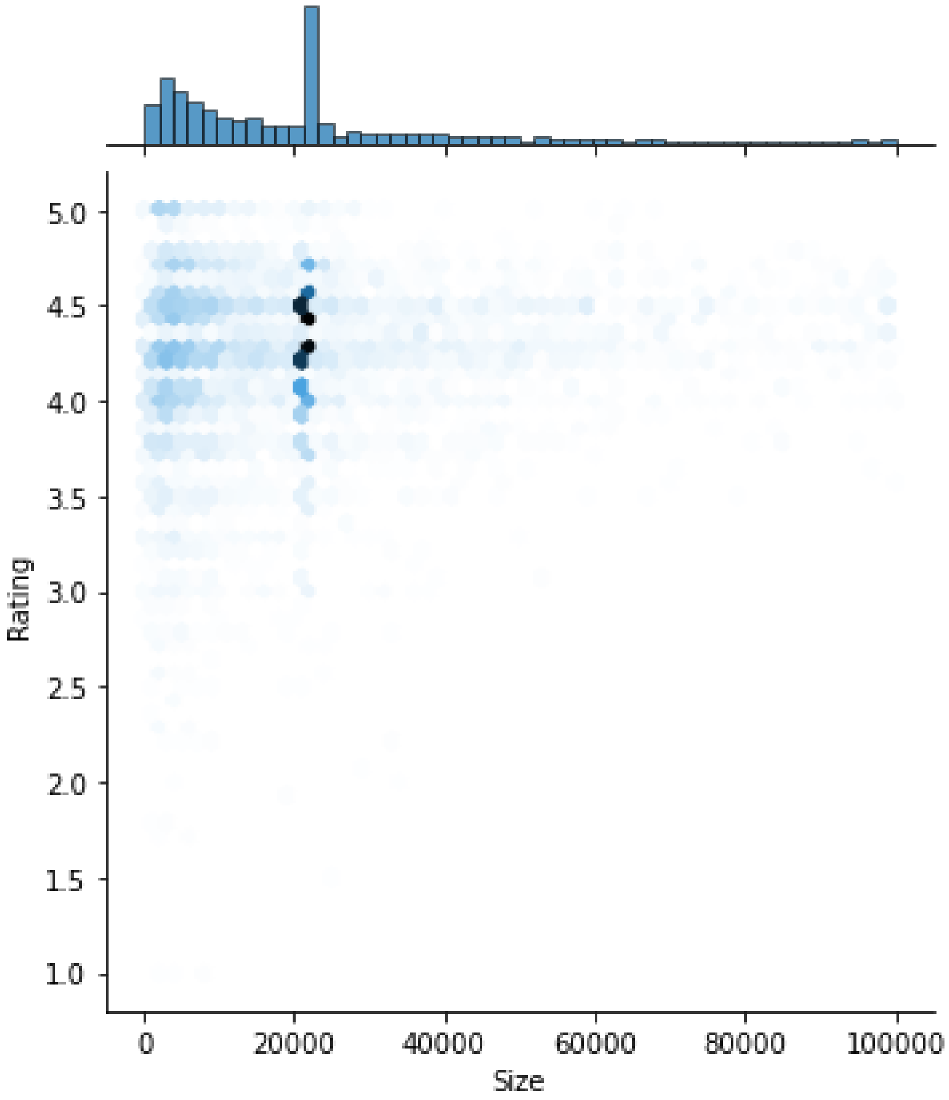
```
import plotly.graph_objects as go

fig = go.Figure(go.Pie(
    name = "",
    values = [7414,1083,461,397],
    labels = ['Everyone','Teen','Mature 17+','Everyone 10+'],
))
fig.show()
```

7. Effect of size on rating.

a. Make a joinplot to understand the effect of size on rating.

In [113]:

```
sns.jointplot(x=df6['Size'],y=df6['Rating'],data=df6,kind='hex')
plt.show()
```



b. Do you see any patterns?

The most of the data is in between Rating 3.5-5.0 and size 0-40000. and data is dense on rating 4.5 and little bellow and size of 20000

c. How do you explain the pattern?

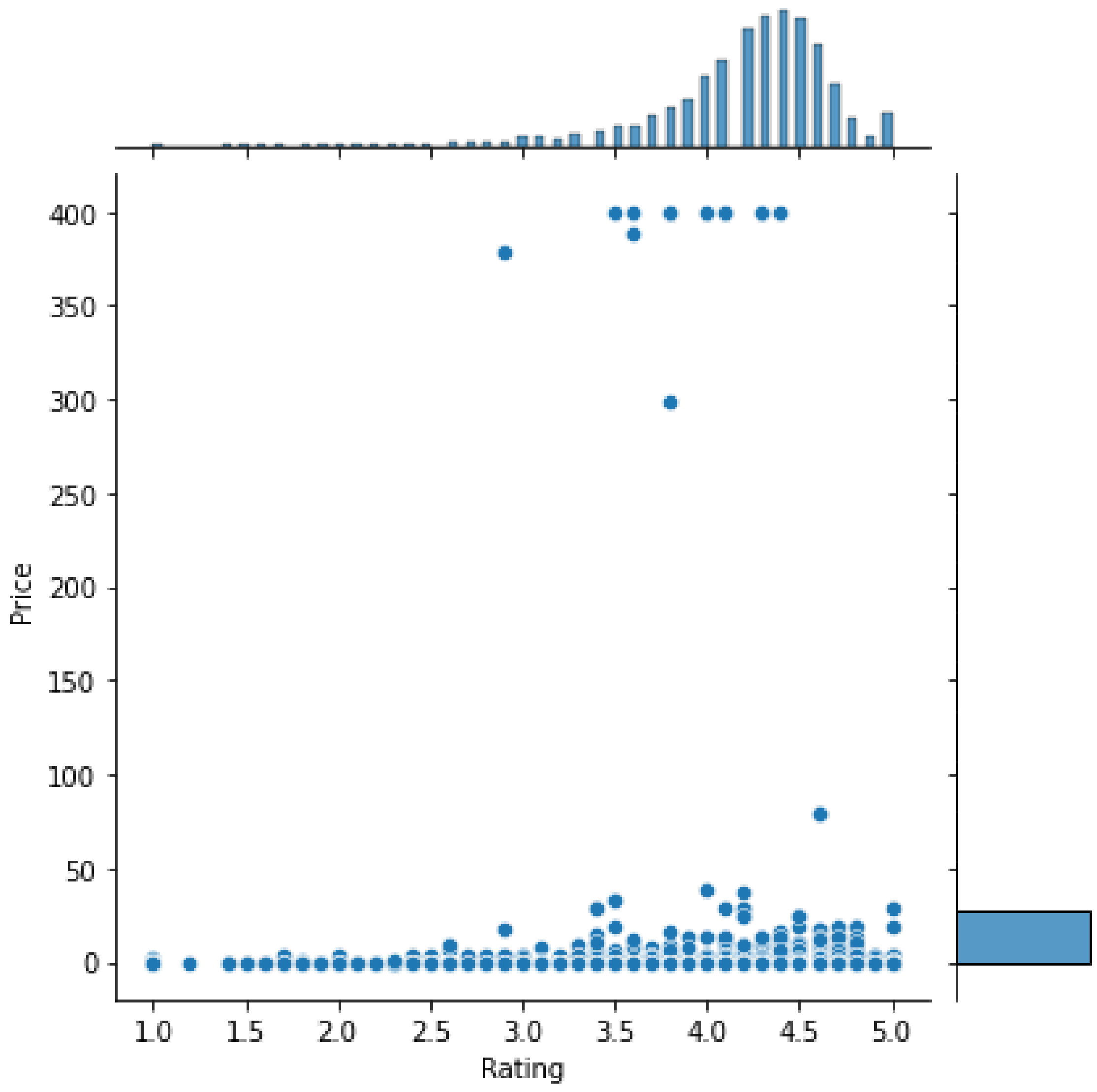
Apps that has size of 20mb are most rated and apps with size less than 20mb are not much rated also it gets even worse after 20mb as size increases ratings decreases

8. Effect of price on rating.

a. Make a jointplot (with regression line).

In [129]:

```
sns.jointplot(x ="Rating" , y = "Price" ,data = df6)
plt.show()
```



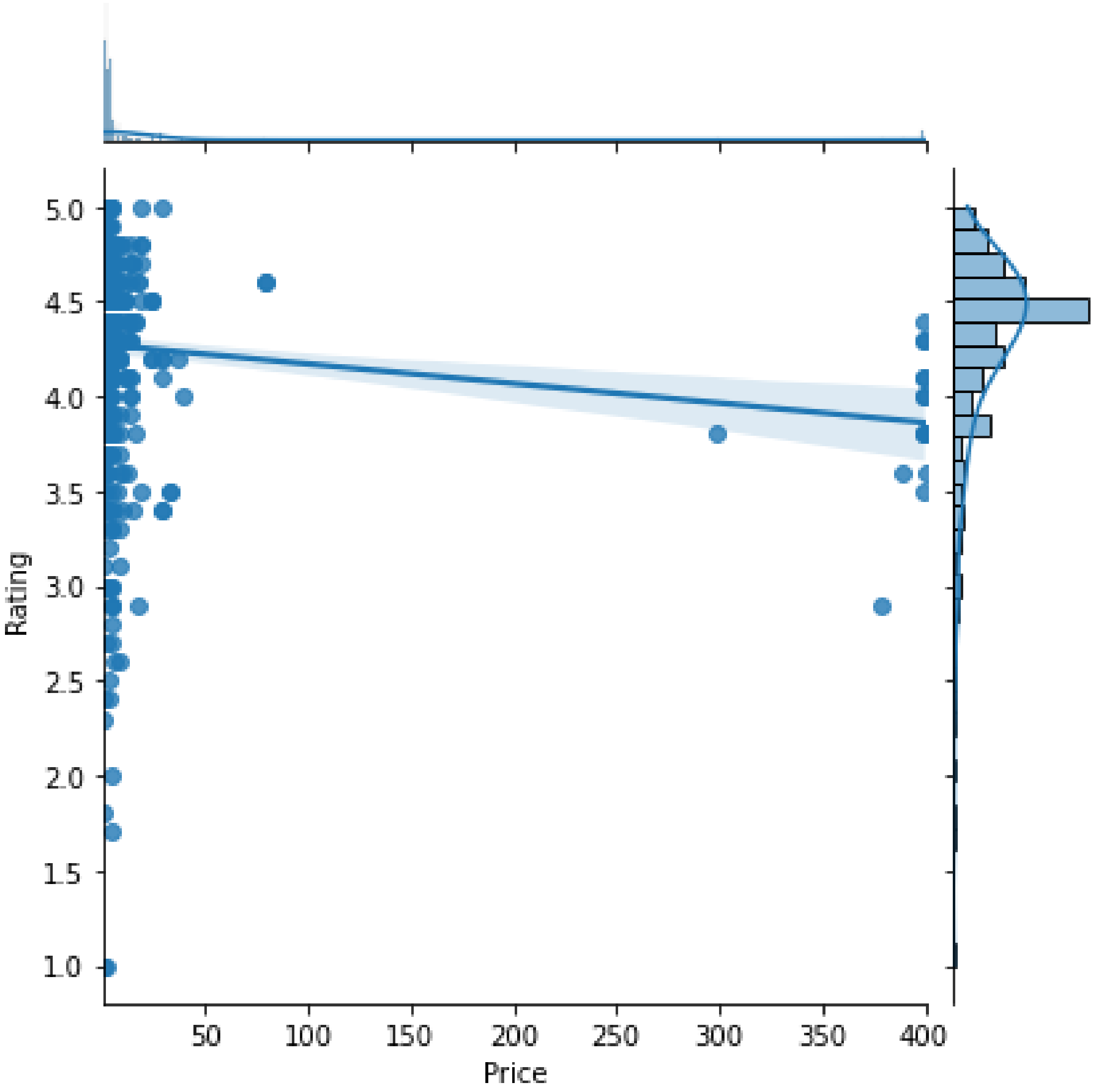
b. What pattern do you see? most rated apps are under $50

c. How do you explain the pattern? Most expensive apps don't get much rating

d. Replot the data, this time with only records with price >0.

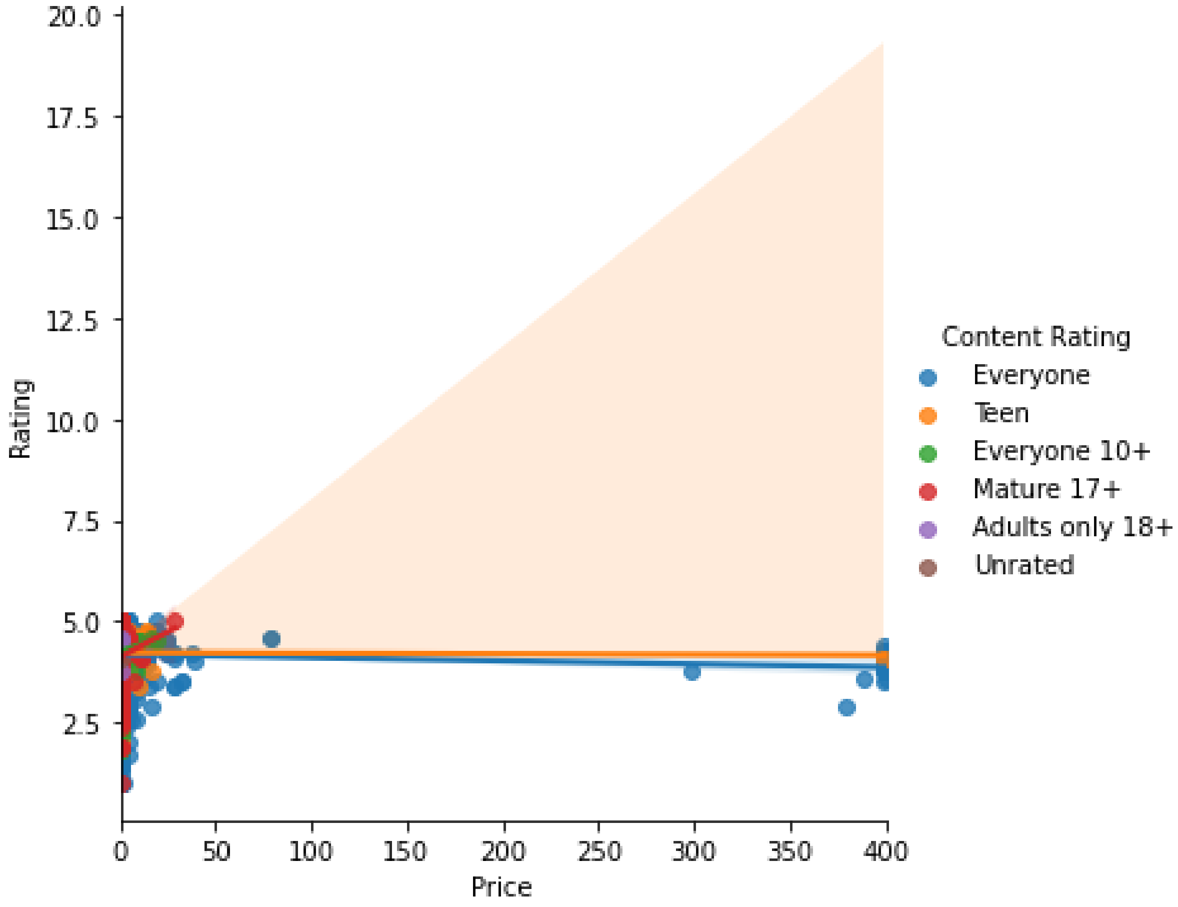
In [143]:

```
Price_greaterthan_zero = df6[df6['Price'] > 0]
sns.jointplot(x ="Price" , y = "Rating" ,data = Price_greaterthan_zero,
kind = "reg" )
plt.show()
```



In [145]:

```
sns.lmplot(x='Price', y='Rating', hue ='Content Rating', data=df6)
plt.show()
```

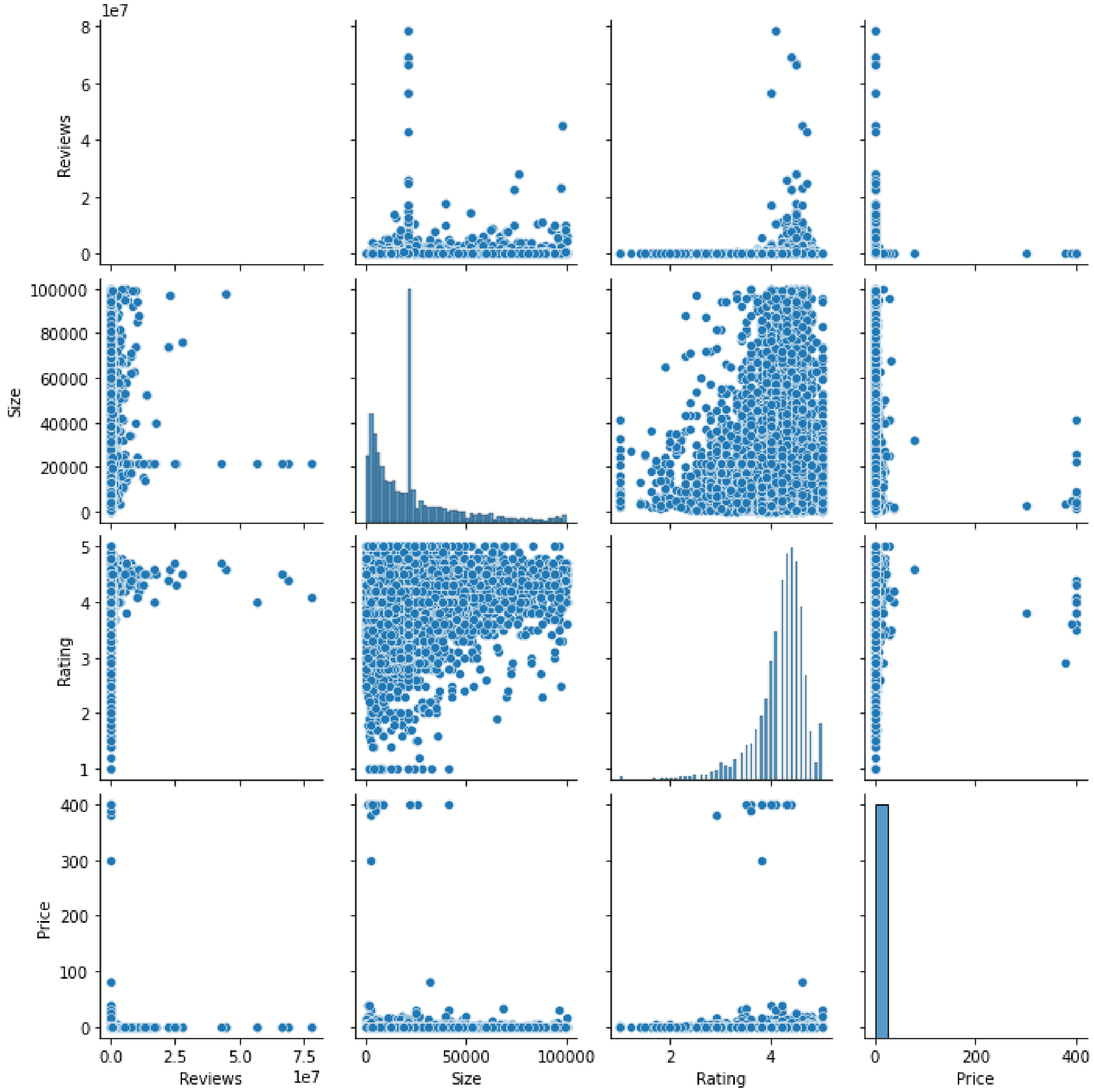


9. Look at all the numeric interactions together –

a. Make a pairplort with the colulmns - 'Reviews', 'Size', 'Rating', 'Price'.

In [148]:

```
sns.pairplot(df6,vars=['Reviews','Size', 'Rating', 'Price'])
plt.show()
```

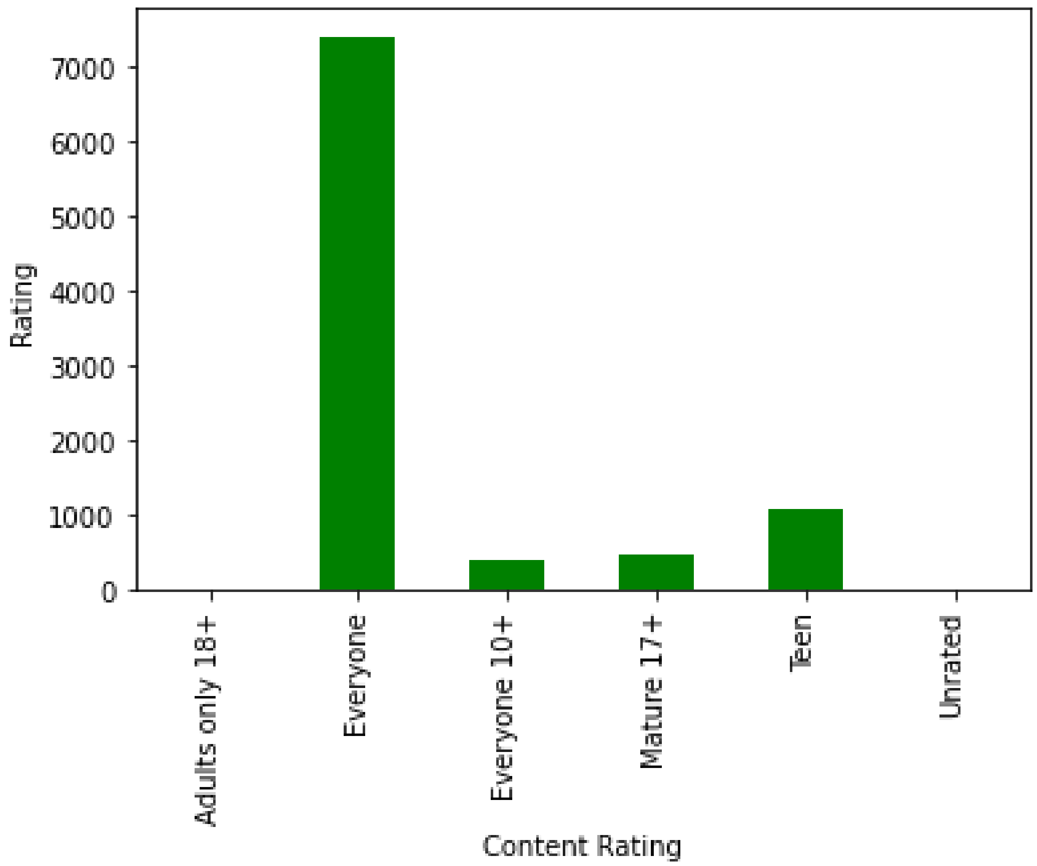


10.Rating vs. content rating.

a. Make a bar plot displaying the rating for each content rating.

In [149]:

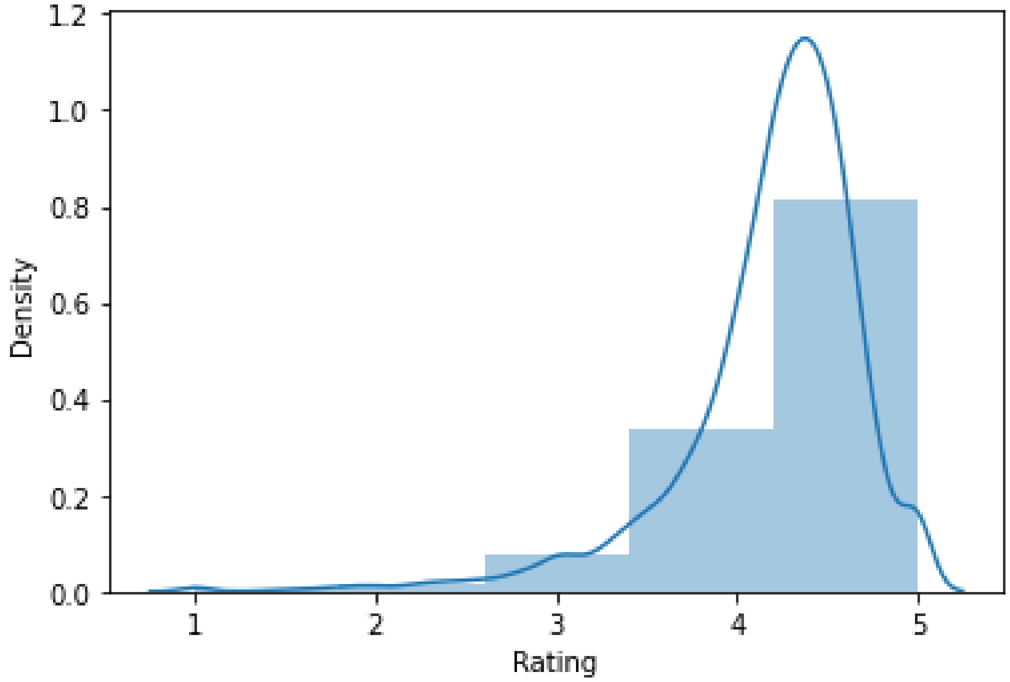
```
df6.groupby(['Content Rating'])['Rating'].count().plot.bar(color="green")
plt.ylabel('Rating')
plt.show()
```



b. Which metric would you use? Mean? Median? Some other quantile?

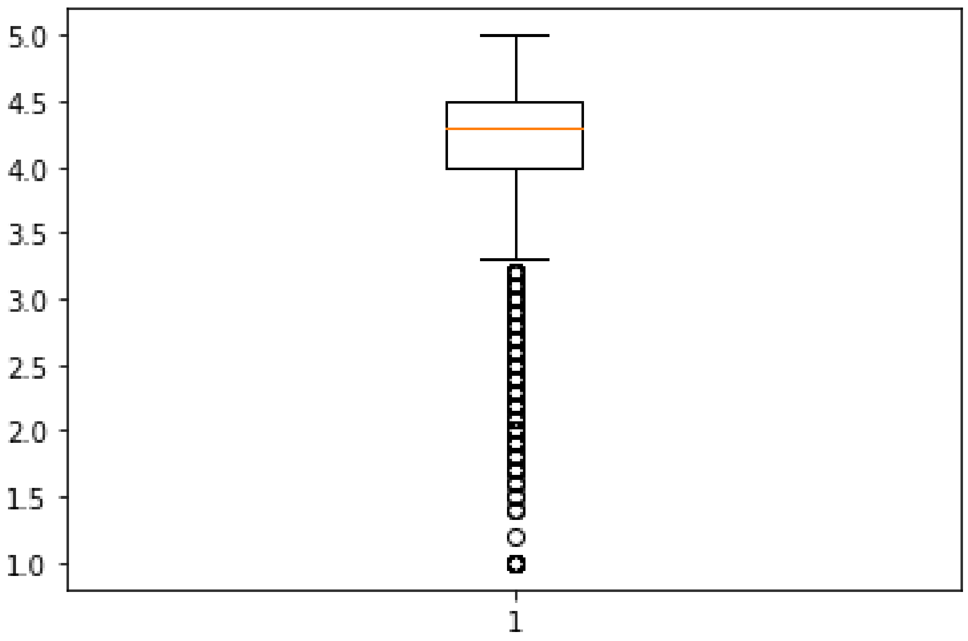
In [150]:

```
sns.distplot(df6['Rating'],bins=5)
plt.show()
```



In [155]:

```
plt.boxplot(df6['Rating'])
plt.show()
```

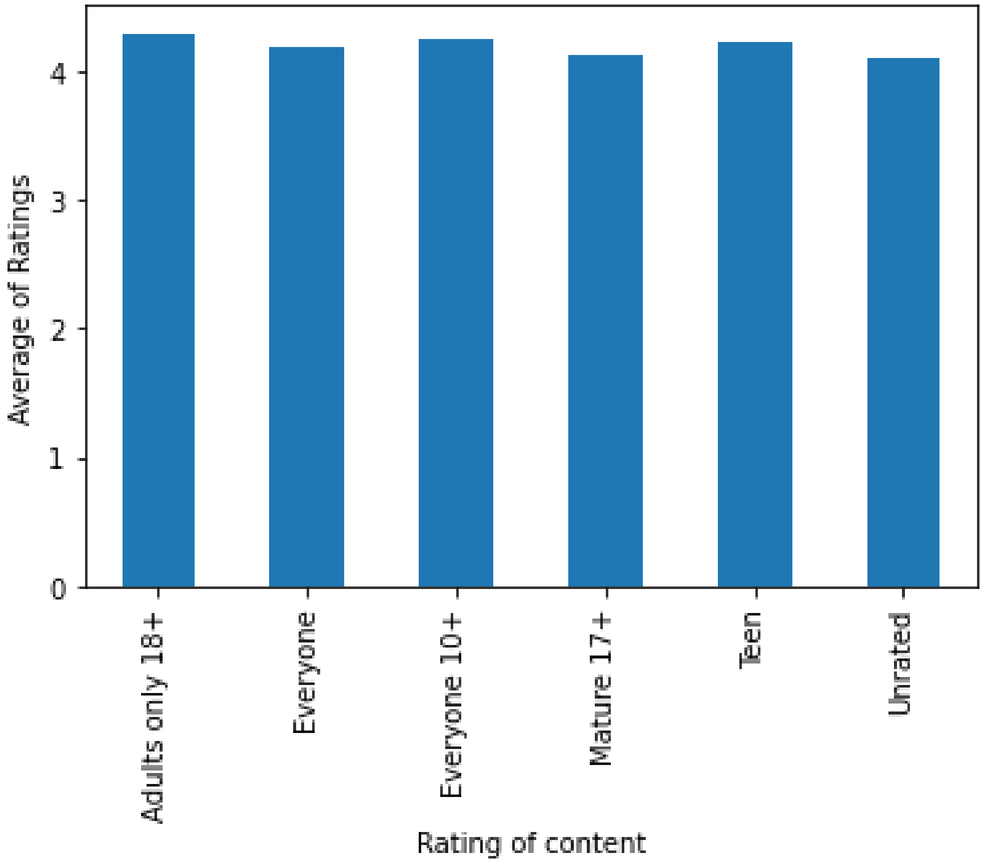


Mean

The distribution of data is left skewed and has outliers.The mean is better than the median because it isn't influenced by Outliers.

In [156]:

```
ax=df6['Rating'].groupby(df6['Content Rating']).mean().plot(kind = 'bar')
ax.set(xlabel ='Rating of content', ylabel = 'Average of Ratings')
plt.show()
```



11. Content rating vs. size vs. rating – 3 variables at a time

a. Create 5 buckets (20% records in each) based on Size.

In [166]:

```
bins=[0, 4600, 12000, 21516, 32000, 100000]
df['Size_Buckets'] = pd.cut(df['Size'], bins, labels=['VERY
LOW','LOW','MED','HIGH','VERY HIGH'])
pd.pivot_table(df, values='Rating', index='Size_Buckets', columns='Content
Rating')
```

Out[166]:

Content Rating	Everyone	Everyone 10+	Mature 17+	Teen
Size_Buckets				
VERY LOW	4.116056	4.188889	3.951429	4.232323
LOW	4.161853	4.207143	4.129592	4.209655
MED	4.188627	4.300000	3.900000	4.131847
HIGH	4.245527	4.227273	4.208497	4.243333
VERY HIGH	4.208134	4.287805	4.197170	4.279603

b. By Content Rating vs. Size buckets, get the rating (20th percentile) for each combination.

In [171]:

```
df.Size.quantile([0.2, 0.4,0.6,0.8])
```

Out[171]:

```
0.2      4600.00000
0.4     12000.00000
0.6     21516.52952
0.8     31000.00000
Name: Size, dtype: float64
```

In [172]:

```
df.Rating.quantile([0.2, 0.4,0.6,0.8])
```

Out[172]:

```
0.2    3.9
0.4    4.2
0.6    4.4
0.8    4.6
Name: Rating, dtype: float64
```

c. Make a heatmap of this

i. Annotated

ii. Greens color map

In [175]:

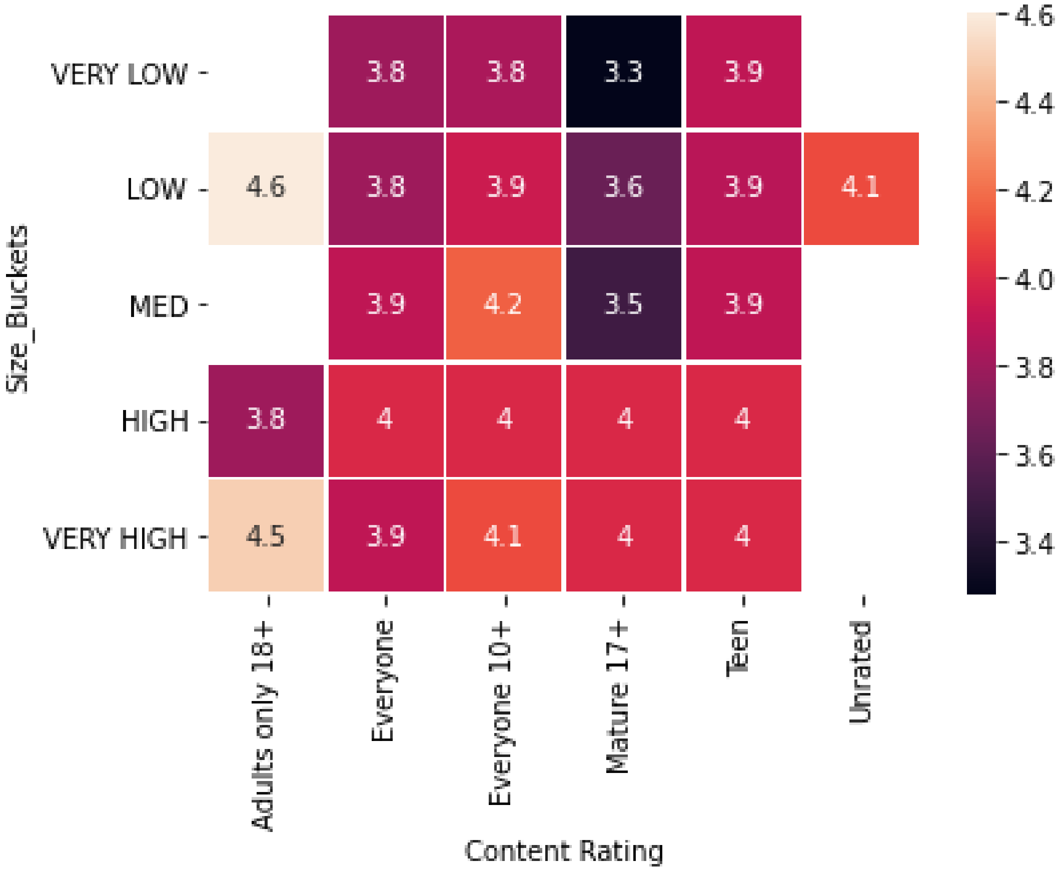
```
Size_Buckets =pd.pivot_table(df6, values='Rating', index='Size_Buckets', 
columns='Content Rating',
                     aggfunc=lambda x:np.quantile(x,0.2))
Size_Buckets
```

Out[175]:

Content Rating	Adults only 18+	Everyone	Everyone 10+	Mature 17+	Teen	Unrated
Size_Buckets						
VERY LOW	NaN	3.8	3.84	3.28	3.90	NaN
LOW	4.6	3.8	3.94	3.64	3.88	4.1
MED	NaN	3.9	4.16	3.50	3.90	NaN
HIGH	3.8	4.0	4.00	4.00	4.00	NaN
VERY HIGH	4.5	3.9	4.10	4.00	4.00	NaN

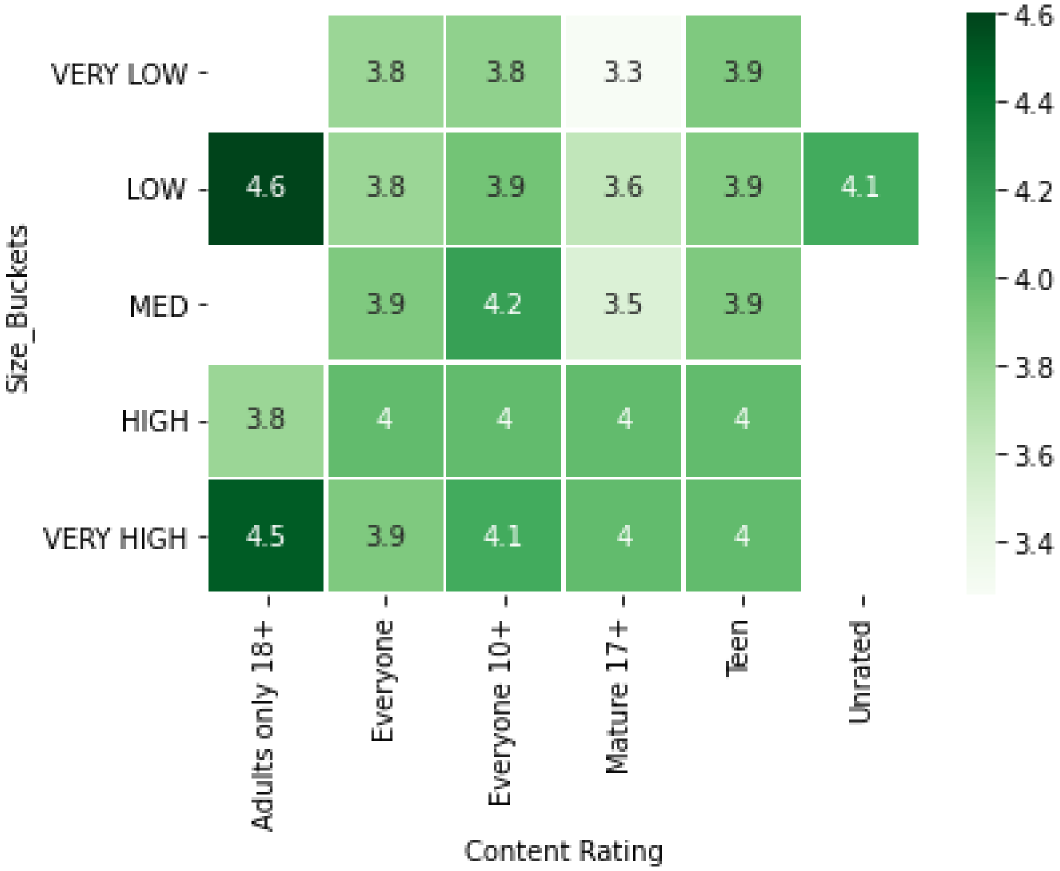
In [178]:

```
sns.heatmap(Size_Buckets, annot = True,linewidth=0.5)
plt.show()
```



In [179]:

```
sns.heatmap(Size_Buckets, annot=True,linewidth=0.5, cmap='Greens')
plt.show()
```



d. What's your inference? Are lighter apps preferred in all categories? Heavier? Some?

As we can see last two rows have 4 and more ratings except two spots and first two rows have 4 and below ratings except two spots therefore we can say that Heavier apps preferred in all categories.