1

In [46]:
```
import pandas as pd
```

In [47]:
```
import numpy as np
```

In [48]:
```
import matplotlib.pyplot as plt
```

In [49]:
```
import seaborn as sns
```

In [50]:
```
import statistics as stc
```

In [51]:
```
df=pd.read_csv("googleplaystore.csv")
```

In [52]:
```
df.head(5)
```

Out[52]:

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

In [54]:
```
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
```

In [55]:
```
df.shape
```

Out[55]:
```
(10841, 13)
```

2

In [56]:
```
df.isnull().any()
```

Out[56]:
```
App               False
Category          False
Rating             True
Reviews           False
Size              False
Installs          False
Type               True
Price             False
Content Rating     True
Genres            False
Last Updated      False
Current Ver        True
Android Ver        True
dtype: bool
```

In [57]:
```
df.isna().sum()
```

Out[57]:
```
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
```

3

In [58]:
```
df.dropna(inplace=True)
```

In [59]:
```
df.isnull().any()
```

Out[59]:
```
App               False
Category          False
Rating            False
Reviews           False
Size              False
Installs          False
Type              False
Price             False
Content Rating    False
Genres            False
Last Updated      False
Current Ver       False
Android Ver       False
dtype: bool
```

In [60]:
```
df.isna().sum()
```

Out[60]:
```
App               0
Category          0
Rating            0
Reviews           0
Size              0
Installs          0
Type              0
Price             0
Content Rating    0
Genres            0
Last Updated      0
Current Ver       0
Android Ver       0
dtype: int64
```

In [61]:
```
df.shape
```

Out[61]:
```
(9360, 13)
```

4(I)

In [62]:
```
df.columns
```

Out[62]:
```
Index(['App', 'Category', 'Rating', 'Reviews', 'Size', 'Installs', 'Type',
       'Price', 'Content Rating', 'Genres', 'Last Updated', 'Current Ver',
       'Android Ver'],
      dtype='object')
```

In [63]:
```
df["Size"].unique()
```

Out[63]:
```
array(['19M', '14M', '8.7M', '25M', '2.8M', '5.6M', '29M', '33M', '3.1M',
       '28M', '12M', '20M', '21M', '37M', '5.5M', '17M', '39M', '31M',
       '4.2M', '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', '2.7M', '2.5M', '7.0M', '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', '22M', '6.4M', '3.2M', '8.2M', '4.9M', '9.5M', '5.0M',
       '5.9M', '13M', '73M', '6.8M', '3.5M', '4.0M', '2.3M', '2.1M',
       '42M', '9.1M', '55M', '23k', '7.3M', '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',
       '3.7M', '118k', '44M', '695k', '1.6M', '6.2M', '53M', '1.4M',
       '3.0M', '7.2M', '5.8M', '3.8M', '9.6M', '45M', '63M', '49M', '77M',
       '4.4M', '70M', '9.3M', '8.1M', '36M', '6.9M', '7.4M', '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',
       '93M', '65M', '79M', '100M', '58M', '50M', '68M', '64M', '34M',
       '67M', '60M', '94M', '9.9M', '232k', '99M', '624k', '95M', '8.5k',
       '41k', '292k', '80M', '1.7M', '10.0M', '74M', '62M', '69M', '75M',
       '98M', '85M', '82M', '96M', '87M', '71M', '86M', '91M', '81M',
       '92M', '83M', '88M', '704k', '862k', '899k', '378k', '4.8M',
       '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', '818k', '81k', '939k', '169k',
       '45k', '965k', '90M', '545k', '61k', '283k', '655k', '714k', '93k',
       '872k', '121k', '322k', '976k', '206k', '954k', '444k', '717k',
       '210k', '609k', '308k', '306k', '175k', '350k', '383k', '454k',
       '1.0M', '70k', '812k', '442k', '842k', '417k', '412k', '459k',
       '478k', '335k', '782k', '721k', '430k', '429k', '192k', '460k',
       '728k', '496k', '816k', '414k', '506k', '887k', '613k', '778k',
       '683k', '592k', '186k', '840k', '647k', '373k', '437k', '598k',
       '716k', '585k', '982k', '219k', '55k', '323k', '691k', '511k',
       '951k', '963k', '25k', '554k', '351k', '27k', '82k', '208k',
       '551k', '29k', '103k', '116k', '153k', '209k', '499k', '173k',
       '597k', '809k', '122k', '411k', '400k', '801k', '787k', '50k',
       '643k', '986k', '516k', '837k', '780k', '20k', '498k', '600k',
       '656k', '221k', '228k', '176k', '34k', '259k', '164k', '458k',
       '629k', '28k', '288k', '775k', '785k', '636k', '916k', '994k',
       '309k', '485k', '914k', '903k', '608k', '500k', '54k', '562k',
       '847k', '948k', '811k', '270k', '48k', '523k', '784k', '280k',
       '24k', '892k', '154k', '18k', '33k', '860k', '364k', '387k',
       '626k', '161k', '879k', '39k', '170k', '141k', '160k', '144k',
       '143k', '190k', '376k', '193k', '473k', '246k', '73k', '253k',
       '957k', '420k', '72k', '404k', '470k', '226k', '240k', '89k',
```

```
       '234k', '257k', '861k', '467k', '676k', '552k', '582k', '619k'],
      dtype=object)
```

In [64]:
```
df["Size"] = [ float(i.split('M')[0]) if 'M' in i else float(0) for i in df["Size"]]
```

In [65]:
```
df.head(5)
```

Out[65]:

	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	10,000+	Free	0	Everyone
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500,000+	Free	0	Everyone
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8.7	5,000,000+	Free	0	Everyone
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50,000,000+	Free	0	Teen
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100,000+	Free	0	Everyone

In [66]:
```
df["Size"] = 1000 * df["Size"]
```

In [67]:
```
df.head(5)
```

Out[67]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Cont Rat
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19000.0	10,000+	Free	0	Every
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14000.0	500,000+	Free	0	Every

2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510	8700.0	5,000,000+	Free	0	Every
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25000.0	50,000,000+	Free	0	T
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2800.0	100,000+	Free	0	Every

4(II)

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

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 9360 entries, 0 to 10840
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   App             9360 non-null   object 
 1   Category        9360 non-null   object 
 2   Rating          9360 non-null   float64
 3   Reviews         9360 non-null   object 
 4   Size            9360 non-null   float64
 5   Installs        9360 non-null   object 
 6   Type            9360 non-null   object 
 7   Price           9360 non-null   object 
 8   Content Rating  9360 non-null   object 
 9   Genres          9360 non-null   object 
 10  Last Updated    9360 non-null   object 
 11  Current Ver     9360 non-null   object 
 12  Android Ver     9360 non-null   object 
dtypes: float64(2), object(11)
memory usage: 1023.8+ KB
```

In [69]:
```
df["Reviews"]=df["Reviews"].astype(float)
```

In [70]:
```
df.dtypes
```

Out[70]:
```
App              object
Category         object
Rating          float64
Reviews         float64
Size            float64
Installs         object
Type             object
```

```
Price              object
Content Rating     object
Genres             object
Last Updated       object
Current Ver        object
Android Ver        object
dtype: object
```

4(III).

In [71]:
```
df["Installs"] = [ float(i.replace('+','').replace(',', '')) if '+' in i or ',' in
```

In [72]:
```
df.head(5)
```

Out[72]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Conte Rati
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159.0	19000.0	10000.0	Free	0	Everyc
1	Coloring book moana	ART_AND_DESIGN	3.9	967.0	14000.0	500000.0	Free	0	Everyc
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510.0	8700.0	5000000.0	Free	0	Everyc
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644.0	25000.0	50000000.0	Free	0	Te
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967.0	2800.0	100000.0	Free	0	Everyc

In [74]:
```
df["Installs"]=df["Installs"].astype(int)
```

In [75]:
```
df.dtypes
```

Out[75]:
```
App                object
Category           object
Rating            float64
Reviews           float64
```

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

4(IV).

In [76]:
```
df['Price'] = [ float(i.split('$')[1]) if '$' in i else float(0) for i in df['Price
```

In [77]:
```
df.head()
```

Out[77]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Conter Ratin
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159.0	19000.0	10000	Free	0.0	Everyor
1	Coloring book moana	ART_AND_DESIGN	3.9	967.0	14000.0	500000	Free	0.0	Everyor
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510.0	8700.0	5000000	Free	0.0	Everyor
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644.0	25000.0	50000000	Free	0.0	Tee
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967.0	2800.0	100000	Free	0.0	Everyor

In [78]:
```
df['Price']=df['Price'].astype(int)
```

In [79]:
```
df.info()
```

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

```
Int64Index: 9360 entries, 0 to 10840
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   App             9360 non-null   object 
 1   Category        9360 non-null   object 
 2   Rating          9360 non-null   float64
 3   Reviews         9360 non-null   float64
 4   Size            9360 non-null   float64
 5   Installs        9360 non-null   int32  
 6   Type            9360 non-null   object 
 7   Price           9360 non-null   int32  
 8   Content Rating  9360 non-null   object 
 9   Genres          9360 non-null   object 
 10  Last Updated    9360 non-null   object 
 11  Current Ver     9360 non-null   object 
 12  Android Ver     9360 non-null   object 
dtypes: float64(3), int32(2), object(8)
memory usage: 950.6+ KB
```

4(V-A).

In [80]:
```
df.shape
```

Out[80]: (9360, 13)

In [81]:
```
df[(df['Rating']<=5) &(df['Rating']>=1)]
```

Out[81]:

	App	Category	Rating	Reviews	Size	Installs	Type	Pr
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159.0	19000.0	10000	Free	
1	Coloring book moana	ART_AND_DESIGN	3.9	967.0	14000.0	500000	Free	
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510.0	8700.0	5000000	Free	
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644.0	25000.0	50000000	Free	
4	Pixel Draw - Number Art	ART_AND_DESIGN	4.3	967.0	2800.0	100000	Free	

	Coloring Book						
...	...	...	...	...	...	...	...
10834	FR Calculator	FAMILY	4.0	7.0	2600.0	500	Free
10836	Sya9a Maroc - FR	FAMILY	4.5	38.0	53000.0	5000	Free
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4.0	3600.0	100	Free
10839	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	4.5	114.0	0.0	1000	Free
10840	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	4.5	398307.0	19000.0	10000000	Free

9360 rows × 13 columns

In [82]:
```
df.shape
```

Out[82]: (9360, 13)

4(V-B).

In [83]:
```
df.shape
```

Out[83]: (9360, 13)

In [84]:
```
df.drop(df.index[df['Reviews'] > df['Installs']],axis=0,inplace = True)
```

In [85]:
```
df.shape
```

Out[85]: (9353, 13)

4(V-C).

In [86]:
```
df.shape
```

Out[86]: (9353, 13)

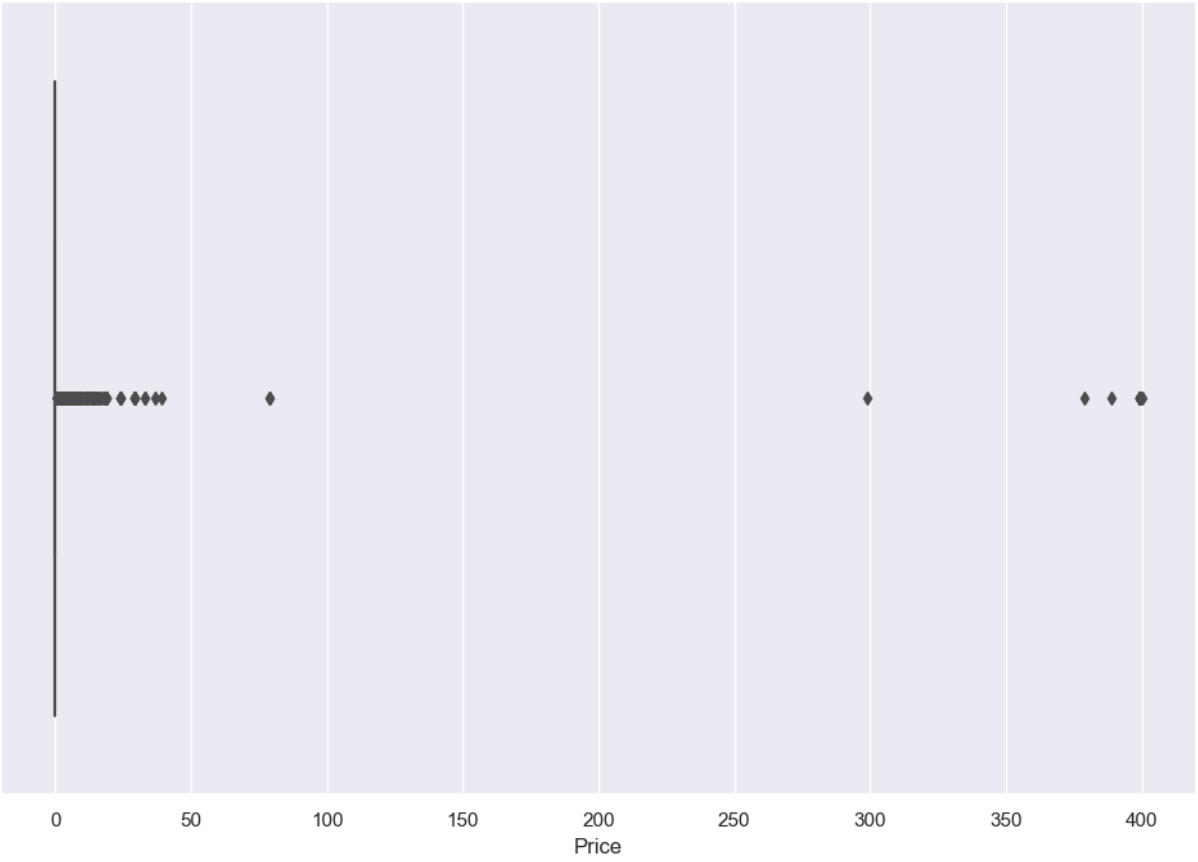
In [87]:
```
index_free_and_price_not_0=df.index[((df.Type=='Free')&(df.Price>0))]
len(index_free_and_price_not_0)
df.drop(index_free_and_price_not_0,axis=0,inplace=True)
```

In [88]:
```
df.shape
```

Out[88]:
```
(9353, 13)
```

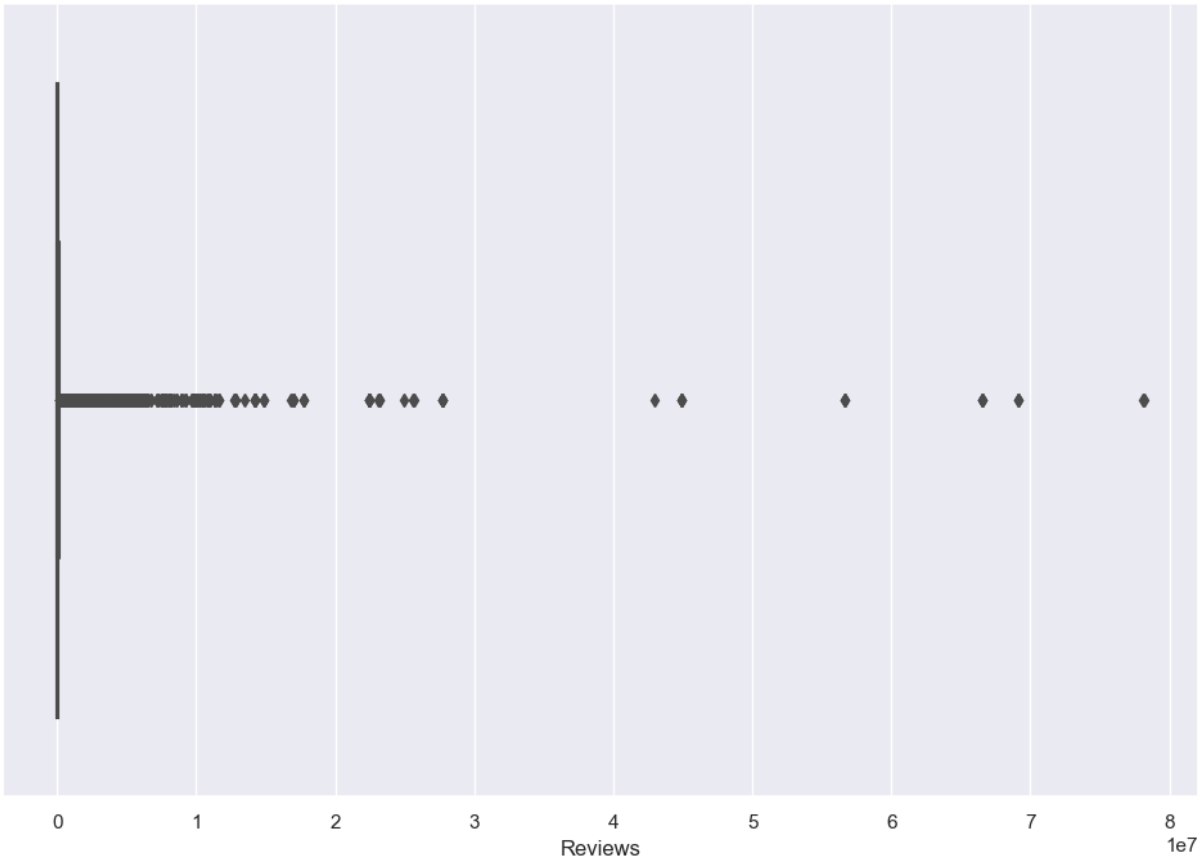
5(I)

In [92]:
```
bx_price = sns.boxplot(x='Price',data=df)
```



5(II).

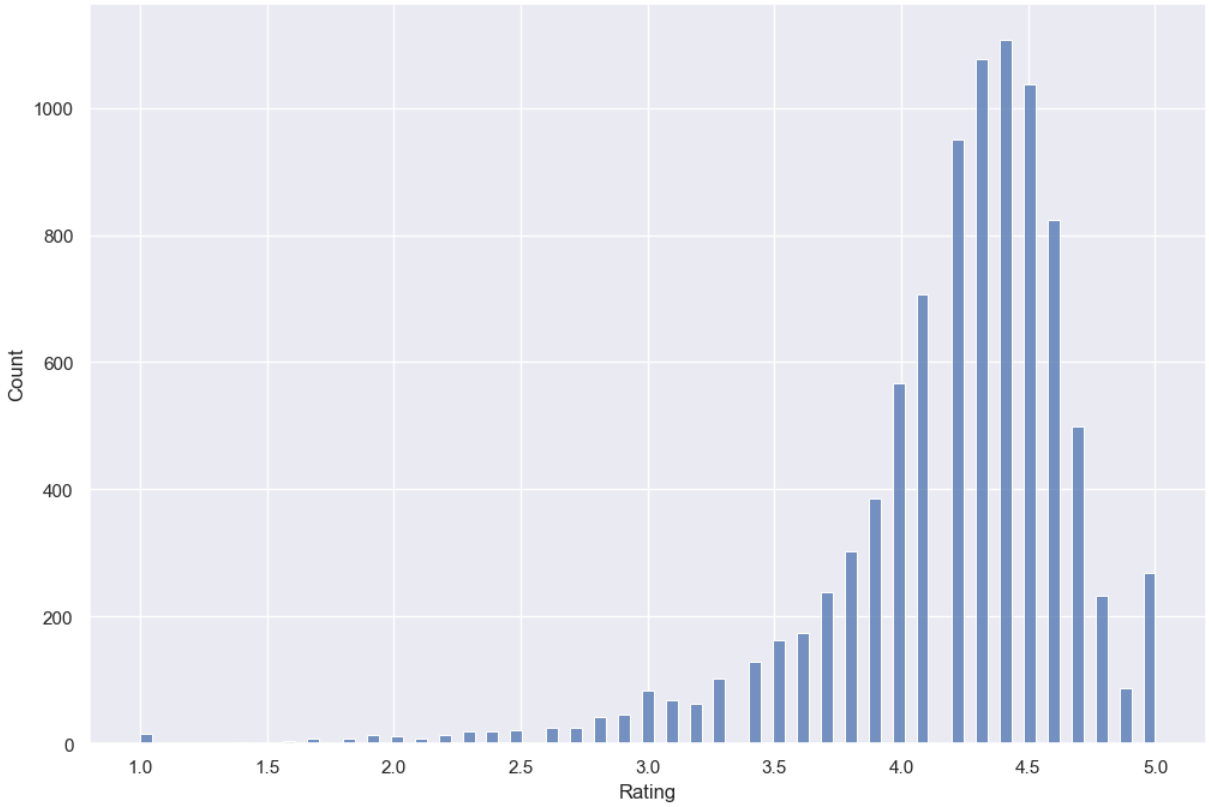
In [93]:
```
bx_review = sns.boxplot(x='Reviews',data=df)
```



5(III).

In [94]:
```
sns.histplot(df['Rating'])
```

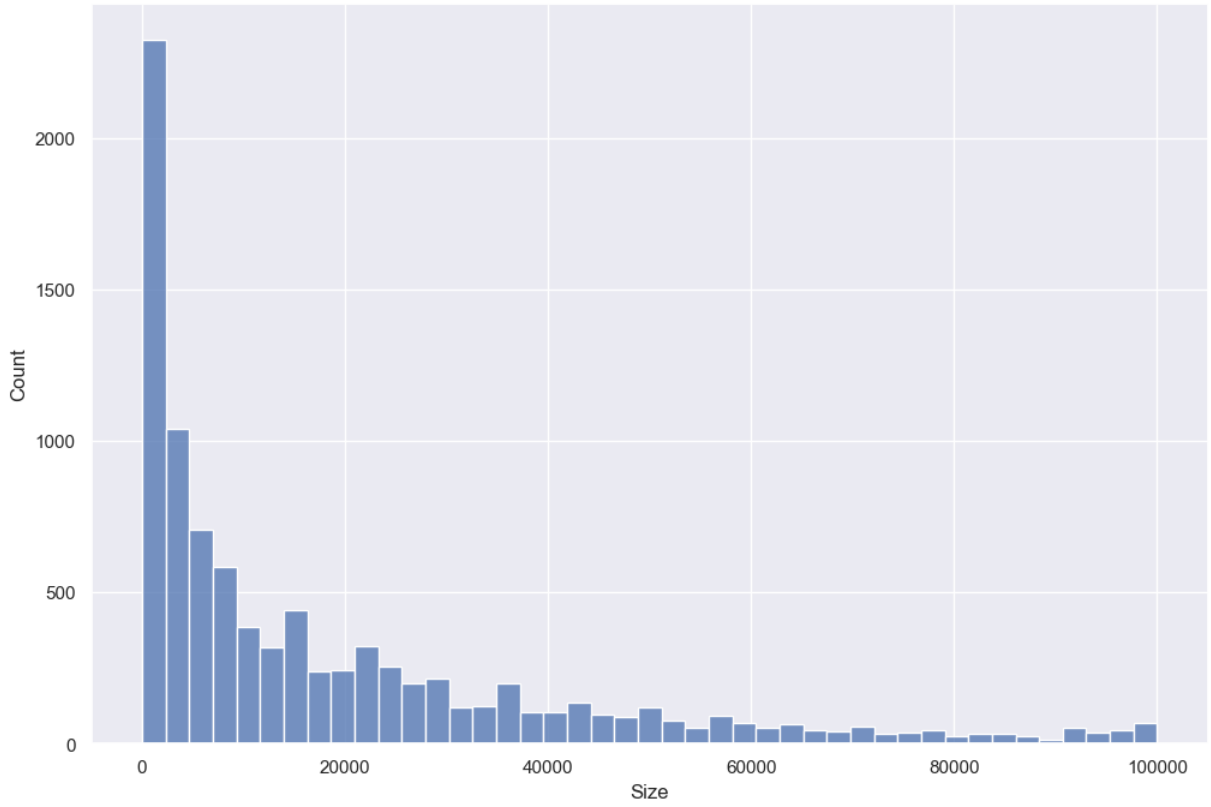
Out[94]:
```
<Axes: xlabel='Rating', ylabel='Count'>
```



5(IV).

In [95]:
```
sns.histplot(df['Size'])
```

Out[95]:
```
<Axes: xlabel='Size', ylabel='Count'>
```



6(I).

In [104…
```
more = df.apply(lambda x : True
            if x['Price'] > 200 else False, axis = 1)
```

In [105…
```
more_count = len(more[more == True].index)
```

In [106…
```
df.shape
```

Out[106]: (9338, 13)

In [107…
```
df.drop(df[df['Price'] > 200].index, inplace = True)
```

In [108…
```
df.shape
```

Out[108]: (9338, 13)

6(II).

In [111…
```
df.drop(df[df['Reviews'] > 2000000].index, inplace = True)
```

In [112…
```
df.shape
```

Out[112]: (8885, 13)

6(III).

In [113…
```
df.quantile([.1, .25, .5, .70, .90, .95, .99], axis = 0)
```

```
C:\Users\mahi3\AppData\Local\Temp\ipykernel_24232\2685684270.py:1: FutureWarning: The default value of numeric_only in DataFrame.quantile is deprecated. In a future version, it will default to False. Select only valid columns or specify the value of numeric_only to silence this warning.
  df.quantile([.1, .25, .5, .70, .90, .95, .99], axis = 0)
```

Out[113]:

	Rating	Reviews	Size	Installs	Price
0.10	3.5	18.00	0.0	1000.0	0.0
0.25	4.0	159.00	2600.0	10000.0	0.0
0.50	4.3	4290.00	9500.0	500000.0	0.0
0.70	4.5	35930.40	23000.0	1000000.0	0.0
0.90	4.7	296771.00	50000.0	10000000.0	0.0
0.95	4.8	637298.00	68000.0	10000000.0	1.0
0.99	5.0	1462800.88	95000.0	100000000.0	7.0

In [115…
```
# dropping more than 10000000 Installs value
df.drop(df[df['Installs'] > 10000000].index, inplace = True)
```

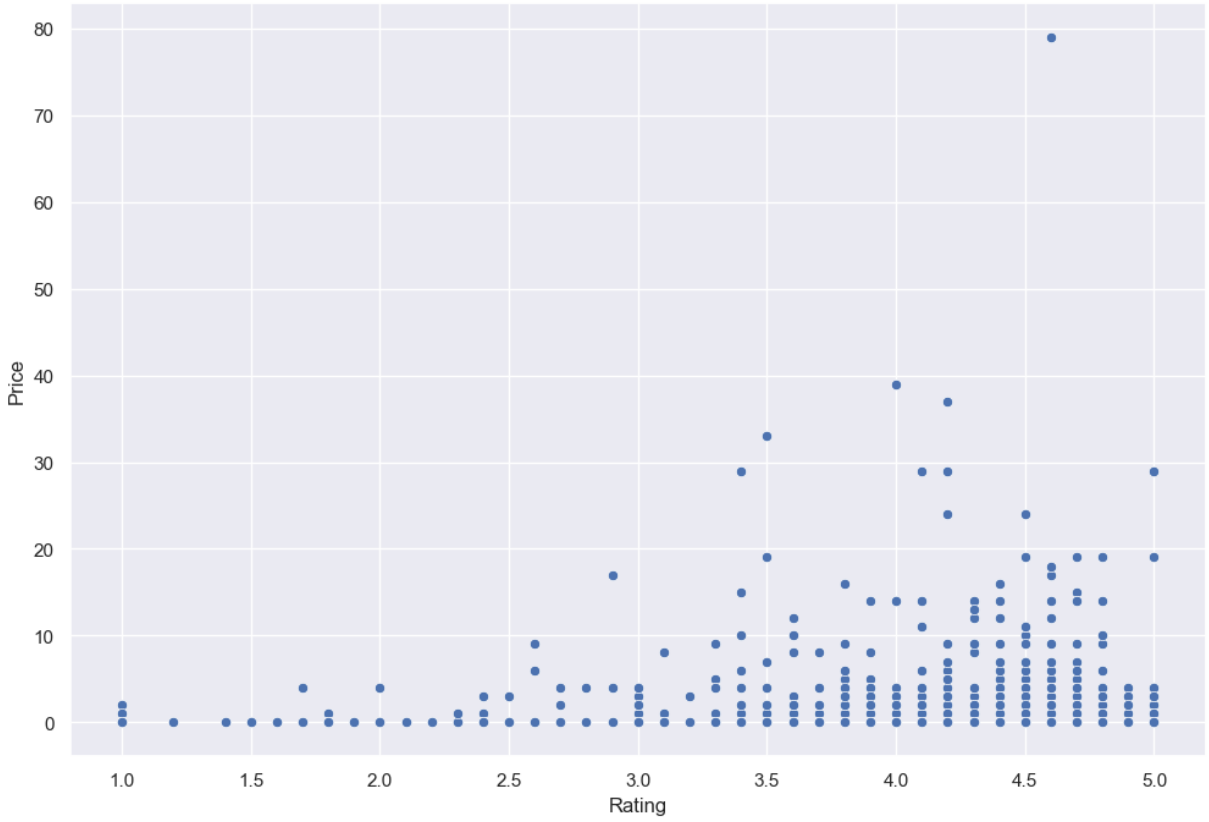
In [116…
```
df.shape
```

Out[116]:
```
(8496, 13)
```

7(I).

In [118…
```
sns.scatterplot(x='Rating',y='Price',data=df)
```

Out[118]:
```
<Axes: xlabel='Rating', ylabel='Price'>
```

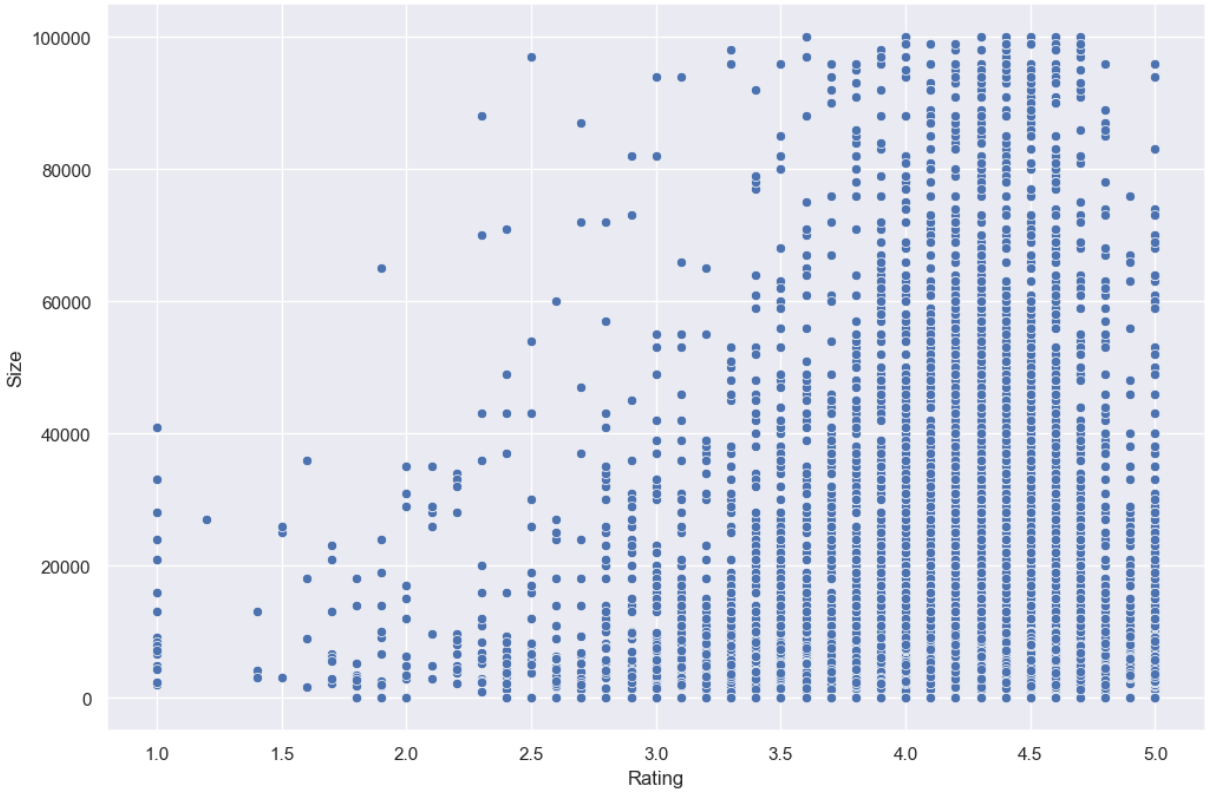


Yes, Paid apps are higher ratings compared to free apps.

7(II).

In [120…
```
sns.scatterplot(x='Rating',y='Size',data=df)
```

Out[120]:
```
<Axes: xlabel='Rating', ylabel='Size'>
```

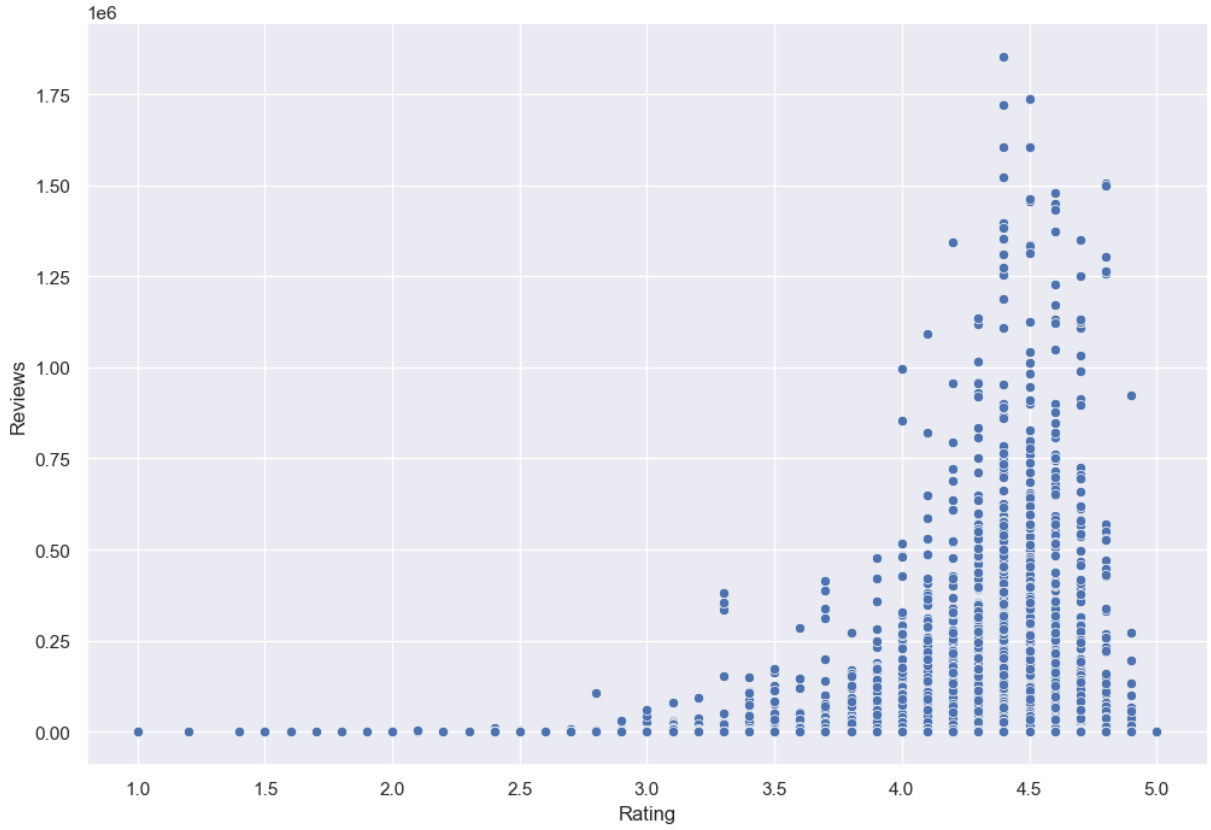


Yes it is clear that heavior apps are rated better.

7(III)

In [121…
```
sns.scatterplot(x='Rating',y='Reviews',data=df)
```

Out[121]:
```
<Axes: xlabel='Rating', ylabel='Reviews'>
```

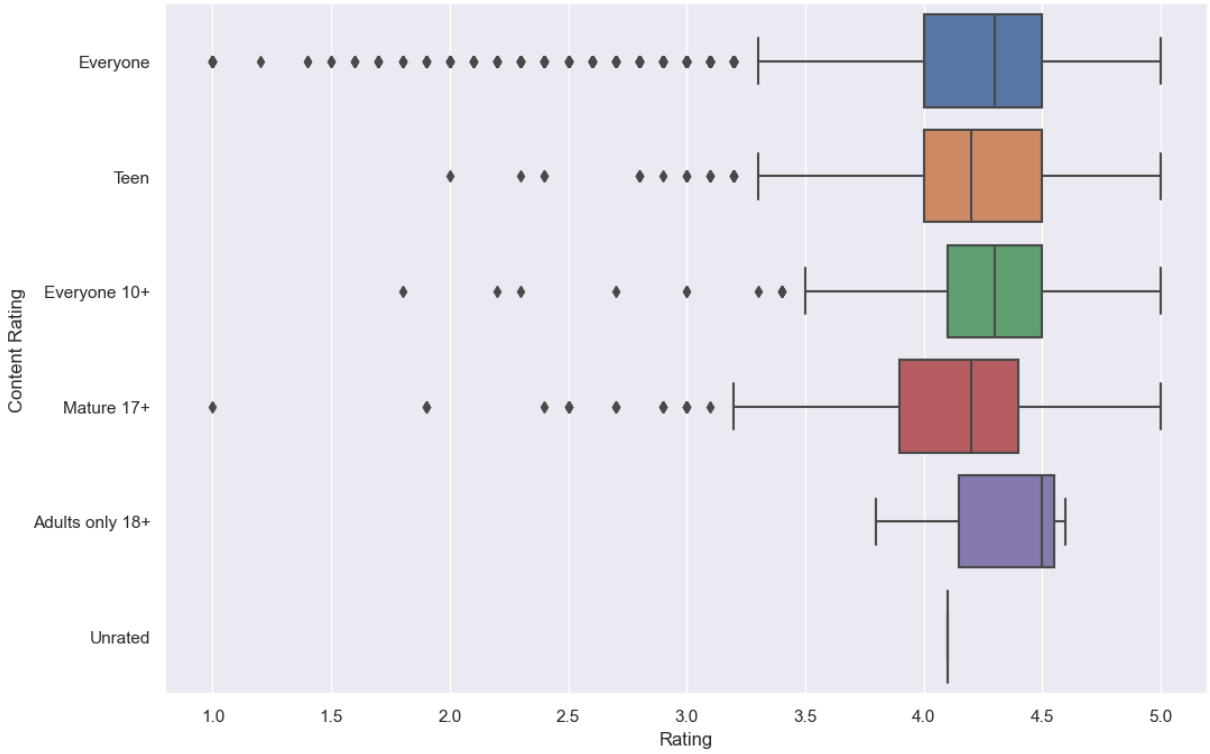


It is clear that more reviews makes app rating better.

7(IV).

In [122…
```
sns.boxplot(x="Rating", y="Content Rating", data=df)
```

Out[122]:
```
<Axes: xlabel='Rating', ylabel='Content Rating'>
```

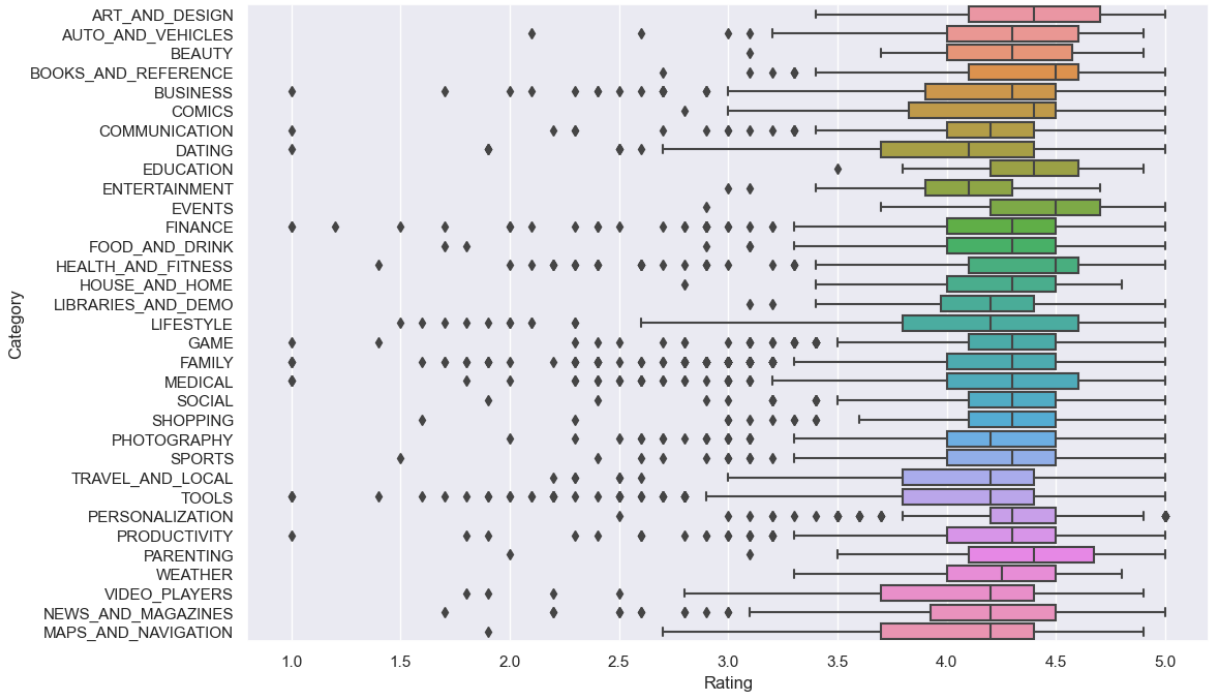


Apps which are for everyone has more bad ratings compare to other sections as it has so much outliers value, while 18+ apps have better ratings.

7(V).

In [123…
```
sns.boxplot(x="Rating", y="Category", data=df)
```

Out[123]:
```
<Axes: xlabel='Rating', ylabel='Category'>
```



Events category has best ratings compare to others.

8(I).

In [124…
```
inp1 = df
```

In [125…
```
inp1.head()
```

Out[125]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Conten Ratin
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159.0	19000.0	10000	Free	0	Everyon
1	Coloring book moana	ART_AND_DESIGN	3.9	967.0	14000.0	500000	Free	0	Everyon
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	87510.0	8700.0	5000000	Free	0	Everyon
4	Pixel Draw	ART_AND_DESIGN	4.3	967.0	2800.0	100000	Free	0	Everyon

	- Number Art Coloring Book								
5	Paper flowers instructions	ART_AND_DESIGN	4.4	167.0	5600.0	50000	Free	0	Everyon

In [126…
```
inp1.skew()
```

```
C:\Users\mahi3\AppData\Local\Temp\ipykernel_24232\3545313420.py:1: FutureWarning: The default value of numeric_only in DataFrame.skew is deprecated. In a future version, it will default to False. In addition, specifying 'numeric_only=None' is deprecated. Select only valid columns or specify the value of numeric_only to silence this warning.
  inp1.skew()
```

Out[126]:
```
Rating      -1.749753
Reviews      4.576494
Size         1.655917
Installs     1.543697
Price       18.074542
dtype: float64
```

In [127…
```
reviewskew = np.log1p(inp1['Reviews'])
inp1['Reviews'] = reviewskew
```

In [128…
```
reviewskew.skew()
```

Out[128]:
```
-0.20039949659264134
```

In [129…
```
installsskew = np.log1p(inp1['Installs'])
inp1['Installs']
```

Out[129]:
```
0           10000
1          500000
2         5000000
4          100000
5           50000
           ...
10834         500
10836        5000
10837         100
10839        1000
10840    10000000
Name: Installs, Length: 8496, dtype: int32
```

In [130…
```
installsskew.skew()
```

Out[130]:
```
-0.5097286542754812
```

In [131…
```
inp1.head()
```

Out[131]:

App	Category	Rating	Reviews	Size	Installs	Type	Price	Conte

										Rati
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	5.075174	19000.0	10000	Free	0	Everyc
1	Coloring book moana	ART_AND_DESIGN	3.9	6.875232	14000.0	500000	Free	0	Everyc
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	ART_AND_DESIGN	4.7	11.379520	8700.0	5000000	Free	0	Everyc
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	6.875232	2800.0	100000	Free	0	Everyc
5	Paper flowers instructions	ART_AND_DESIGN	4.4	5.123964	5600.0	50000	Free	0	Everyc

8(II).

In [132…
```
inp1.drop(["Last Updated","Current Ver","Android Ver","App","Type"],axis=1,inplace=
```

In [133…
```
inp1.head()
```

Out[133]:

	Category	Rating	Reviews	Size	Installs	Price	Content Rating	Genres
0	ART_AND_DESIGN	4.1	5.075174	19000.0	10000	0	Everyone	Art & Design
1	ART_AND_DESIGN	3.9	6.875232	14000.0	500000	0	Everyone	Art & Design;Pretend Play
2	ART_AND_DESIGN	4.7	11.379520	8700.0	5000000	0	Everyone	Art & Design
4	ART_AND_DESIGN	4.3	6.875232	2800.0	100000	0	Everyone	Art & Design;Creativity
5	ART_AND_DESIGN	4.4	5.123964	5600.0	50000	0	Everyone	Art & Design

In [134…
```
inp1.shape
```

Out[134]:
```
(8496, 8)
```

8(III).

In [135…
```
inp2=inp1
```

In [136…
```
inp2.head()
```

Out[136]:

	Category	Rating	Reviews	Size	Installs	Price	Content Rating	Genres
0	ART_AND_DESIGN	4.1	5.075174	19000.0	10000	0	Everyone	Art & Design
1	ART_AND_DESIGN	3.9	6.875232	14000.0	500000	0	Everyone	Art & Design;Pretend Play
2	ART_AND_DESIGN	4.7	11.379520	8700.0	5000000	0	Everyone	Art & Design
4	ART_AND_DESIGN	4.3	6.875232	2800.0	100000	0	Everyone	Art & Design;Creativity
5	ART_AND_DESIGN	4.4	5.123964	5600.0	50000	0	Everyone	Art & Design

Let's apply Dummy EnCoding on Column "Category"

In [137…
```
inp2.Category.unique()
```

Out[137]:
```
array(['ART_AND_DESIGN', 'AUTO_AND_VEHICLES', 'BEAUTY',
       'BOOKS_AND_REFERENCE', 'BUSINESS', 'COMICS', 'COMMUNICATION',
       'DATING', 'EDUCATION', 'ENTERTAINMENT', 'EVENTS', 'FINANCE',
       'FOOD_AND_DRINK', 'HEALTH_AND_FITNESS', 'HOUSE_AND_HOME',
       'LIBRARIES_AND_DEMO', 'LIFESTYLE', 'GAME', 'FAMILY', 'MEDICAL',
       'SOCIAL', 'SHOPPING', 'PHOTOGRAPHY', 'SPORTS', 'TRAVEL_AND_LOCAL',
       'TOOLS', 'PERSONALIZATION', 'PRODUCTIVITY', 'PARENTING', 'WEATHER',
       'VIDEO_PLAYERS', 'NEWS_AND_MAGAZINES', 'MAPS_AND_NAVIGATION'],
      dtype=object)
```

In [138…
```
inp2.Category = pd.Categorical(inp2.Category)

x = inp2[['Category']]
del inp2['Category']

dummies = pd.get_dummies(x, prefix = 'Category')
inp2 = pd.concat([inp2,dummies], axis=1)
inp2.head()
```

Out[138]:

	Rating	Reviews	Size	Installs	Price	Content Rating	Genres	Category_ART_A
0	4.1	5.075174	19000.0	10000	0	Everyone	Art & Design	
1	3.9	6.875232	14000.0	500000	0	Everyone	Art &	

							Design;Pretend Play	
2	4.7	11.379520	8700.0	5000000	0	Everyone	Art & Design	
4	4.3	6.875232	2800.0	100000	0	Everyone	Art & Design;Creativity	
5	4.4	5.123964	5600.0	50000	0	Everyone	Art & Design	

5 rows × 40 columns

In [139…
```
inp2.shape
```

Out[139]:
```
(8496, 40)
```

Let's apply Dummy EnCoding on Column "Genres"

In [140…
```
inp2["Genres"].unique()
```

Out[140]:
```
array(['Art & Design', 'Art & Design;Pretend Play',
       'Art & Design;Creativity', 'Auto & Vehicles', 'Beauty',
       'Books & Reference', 'Business', 'Comics', 'Comics;Creativity',
       'Communication', 'Dating', 'Education', 'Education;Creativity',
       'Education;Education', 'Education;Music & Video',
       'Education;Action & Adventure', 'Education;Pretend Play',
       'Education;Brain Games', 'Entertainment',
       'Entertainment;Brain Games', 'Entertainment;Creativity',
       'Entertainment;Music & Video', 'Events', 'Finance', 'Food & Drink',
       'Health & Fitness', 'House & Home', 'Libraries & Demo',
       'Lifestyle', 'Lifestyle;Pretend Play', 'Card', 'Casual', 'Puzzle',
       'Action', 'Arcade', 'Word', 'Racing', 'Casual;Creativity',
       'Sports', 'Board', 'Simulation', 'Role Playing', 'Adventure',
       'Strategy', 'Simulation;Education', 'Action;Action & Adventure',
       'Trivia', 'Casual;Brain Games', 'Simulation;Action & Adventure',
       'Educational;Creativity', 'Puzzle;Brain Games',
       'Educational;Education', 'Card;Brain Games',
       'Educational;Brain Games', 'Educational;Pretend Play',
       'Casual;Action & Adventure', 'Entertainment;Education',
       'Casual;Education', 'Casual;Pretend Play', 'Music;Music & Video',
       'Racing;Action & Adventure', 'Arcade;Pretend Play',
       'Adventure;Action & Adventure', 'Role Playing;Action & Adventure',
       'Simulation;Pretend Play', 'Puzzle;Creativity',
       'Sports;Action & Adventure', 'Educational;Action & Adventure',
       'Arcade;Action & Adventure', 'Entertainment;Action & Adventure',
       'Puzzle;Action & Adventure', 'Strategy;Action & Adventure',
       'Music & Audio;Music & Video', 'Health & Fitness;Education',
       'Adventure;Education', 'Board;Brain Games',
       'Board;Action & Adventure', 'Board;Pretend Play',
       'Casual;Music & Video', 'Role Playing;Pretend Play',
       'Entertainment;Pretend Play', 'Video Players & Editors;Creativity',
       'Card;Action & Adventure', 'Medical', 'Social', 'Shopping',
```

```
       'Photography', 'Travel & Local',
       'Travel & Local;Action & Adventure', 'Tools', 'Tools;Education',
       'Personalization', 'Productivity', 'Parenting',
       'Parenting;Music & Video', 'Parenting;Brain Games',
       'Parenting;Education', 'Weather', 'Video Players & Editors',
       'Video Players & Editors;Music & Video', 'News & Magazines',
       'Maps & Navigation', 'Health & Fitness;Action & Adventure',
       'Music', 'Educational', 'Casino', 'Adventure;Brain Games',
       'Lifestyle;Education', 'Books & Reference;Education',
       'Puzzle;Education', 'Role Playing;Brain Games',
       'Strategy;Education', 'Racing;Pretend Play',
       'Communication;Creativity', 'Strategy;Creativity'], dtype=object)
```

Since, There are too many categories under Genres. Hence, we will try to reduce some categories which have very few samples under them and put them under one new common category i.e. "Other".

In [141…
```
lists = []
for i in inp2.Genres.value_counts().index:
    if inp2.Genres.value_counts()[i]<20:
        lists.append(i)
inp2.Genres = ['Other' if i in lists else i for i in inp2.Genres]
```

In [142…
```
inp2["Genres"].unique()
```

Out[142]:
```
array(['Art & Design', 'Other', 'Auto & Vehicles', 'Beauty',
       'Books & Reference', 'Business', 'Comics', 'Communication',
       'Dating', 'Education', 'Education;Education',
       'Education;Pretend Play', 'Entertainment',
       'Entertainment;Music & Video', 'Events', 'Finance', 'Food & Drink',
       'Health & Fitness', 'House & Home', 'Libraries & Demo',
       'Lifestyle', 'Card', 'Casual', 'Puzzle', 'Action', 'Arcade',
       'Word', 'Racing', 'Sports', 'Board', 'Simulation', 'Role Playing',
       'Adventure', 'Strategy', 'Trivia', 'Educational;Education',
       'Casual;Pretend Play', 'Medical', 'Social', 'Shopping',
       'Photography', 'Travel & Local', 'Tools', 'Personalization',
       'Productivity', 'Parenting', 'Weather', 'Video Players & Editors',
       'News & Magazines', 'Maps & Navigation', 'Educational', 'Casino'],
      dtype=object)
```

In [143…
```
inp2.Genres = pd.Categorical(inp2['Genres'])
x = inp2[["Genres"]]
del inp2['Genres']
dummies = pd.get_dummies(x, prefix = 'Genres')
inp2 = pd.concat([inp2,dummies], axis=1)
```

In [144…
```
inp2.head()
```

Out[144]:

	Rating	Reviews	Size	Installs	Price	Content	Category_ART_AND_DESIGN	Cate

						Rating	
0	4.1	5.075174	19000.0	10000	0	Everyone	1
1	3.9	6.875232	14000.0	500000	0	Everyone	1
2	4.7	11.379520	8700.0	5000000	0	Everyone	1
4	4.3	6.875232	2800.0	100000	0	Everyone	1
5	4.4	5.123964	5600.0	50000	0	Everyone	1

5 rows × 91 columns

In [145…
```
inp2.shape
```

Out[145]:
```
(8496, 91)
```

Let's apply Dummy EnCoding on Column "Content Rating"

In [146…
```
#get unique values in Column "Content Rating"
inp2["Content Rating"].unique()
```

Out[146]:
```
array(['Everyone', 'Teen', 'Everyone 10+', 'Mature 17+',
       'Adults only 18+', 'Unrated'], dtype=object)
```

In [147…
```
inp2['Content Rating'] = pd.Categorical(inp2['Content Rating'])

x = inp2[['Content Rating']]
del inp2['Content Rating']

dummies = pd.get_dummies(x, prefix = 'Content Rating')
inp2 = pd.concat([inp2,dummies], axis=1)
inp2.head()
```

Out[147]:

	Rating	Reviews	Size	Installs	Price	Category_ART_AND_DESIGN	Category_AUTO
0	4.1	5.075174	19000.0	10000	0	1	
1	3.9	6.875232	14000.0	500000	0	1	
2	4.7	11.379520	8700.0	5000000	0	1	
4	4.3	6.875232	2800.0	100000	0	1	
5	4.4	5.123964	5600.0	50000	0	1	

5 rows × 96 columns

In [148…
```
inp2.shape
```

Out[148]: (8496, 96)

9. and 10.

In [149…
```
from sklearn.model_selection import train_test_split as tts
from sklearn.linear_model import LinearRegression as LR
from sklearn.metrics import mean_squared_error as mse
```

In [150…
```
d1 = inp2
X = d1.drop('Rating',axis=1)
y = d1['Rating']

Xtrain, Xtest, ytrain, ytest = tts(X,y, test_size=0.3, random_state=5)
```

11.

In [151…
```
reg_all = LR()
reg_all.fit(Xtrain,ytrain)
```

Out[151]:
```
LinearRegression()
```

In [154…
```
R2_train = round(reg_all.score(Xtrain,ytrain),3)
print("The R2 value of the Training Set is : {}".format(R2_train))
```

```
The R2 value of the Training Set is : 0.074
```

12

In [153…
```
R2_test = round(reg_all.score(Xtest,ytest),3)
print("The R2 value of the Testing Set is : {}".format(R2_test))
```

```
The R2 value of the Testing Set is : 0.063
```