1.

In [1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
```

In [2]:
```
data = pd.read_csv('googleplaystore.csv')
```

In [3]:
```
data.head()
```

Out[3]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	A
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19M	10,000+	Free	0	Everyone	Art & Design	January 7, 2018	1.0.0	
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0	
2	U Launcher Lite â€“ FREE Live Cool Themes, Hid...	ART_AND_DESIGN	4.7	87510	8.7M	5,000,000+	Free	0	Everyone	Art & Design	August 1, 2018	1.2.4	
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	Art & Design	June 8, 2018	Varies with device	
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8M	100,000+	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1	

In [4]:
```
data.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 [5]:
```
data.shape
```

Out[5]:
```
(10841, 13)
```

2.

In [6]:
```
data.isnull().any()
```

Out[6]:
```
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 [7]:
```
data.isnull().sum()
```

Out[7]:
```
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 [8]:
```
data = data.dropna()
```

In [9]:
```
data.isnull().any()
```

Out[9]:
```
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 [10]:
```
data.shape
```

Out[10]:
```
(9360, 13)
```

4(I).

In [11]:
```
data["Size"] = [ float(i.split('M')[0]) if 'M' in i else float(0) for i in data["Size"]  ]
```

In [12]:
```
data.head()
```

Out[12]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	A
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19.0	10,000+	Free	0	Everyone	Art & Design	January 7, 2018	1.0.0	
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14.0	500,000+	Free	0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0	
2	U Launcher Lite â€“ FREE Live Cool Themes, Hid...	ART_AND_DESIGN	4.7	87510	8.7	5,000,000+	Free	0	Everyone	Art & Design	August 1, 2018	1.2.4	
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25.0	50,000,000+	Free	0	Teen	Art & Design	June 8, 2018	Varies with device	
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2.8	100,000+	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1	

In [13]:
```
data["Size"] = 1000 * data["Size"]
```

In [14]:
```
data
```

Out[14]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	L Upda
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19000.0	10,000+	Free	0	Everyone	Art & Design	Janu 7, 2
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14000.0	500,000+	Free	0	Everyone	Art & Design;Pretend Play	Janu 15, 2
2	U Launcher Lite â€“ FREE Live Cool Themes, Hid...	ART_AND_DESIGN	4.7	87510	8700.0	5,000,000+	Free	0	Everyone	Art & Design	Aug 1, 2
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644	25000.0	50,000,000+	Free	0	Teen	Art & Design	Jun 2
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967	2800.0	100,000+	Free	0	Everyone	Art & Design;Creativity	June 2
...	...	...	...	...	...	...	...	...	...	...	
10834	FR Calculator	FAMILY	4.0	7	2600.0	500+	Free	0	Everyone	Education	June 2
10836	Sya9a Maroc - FR	FAMILY	4.5	38	53000.0	5,000+	Free	0	Everyone	Education	July 2
10837	Fr. Mike Schmitz Audio Teachings	FAMILY	5.0	4	3600.0	100+	Free	0	Everyone	Education	Jul 2
10839	The SCP Foundation DB fr nn5n	BOOKS_AND_REFERENCE	4.5	114	0.0	1,000+	Free	0	Mature 17+	Books & Reference	Janu 19, 2
10840	iHoroscope - 2018 Daily Horoscope & Astrology	LIFESTYLE	4.5	398307	19000.0	10,000,000+	Free	0	Everyone	Lifestyle	July 2

9360 rows × 13 columns

4(II).

In [15]:
```
data.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 [16]:
```
data["Reviews"] = data["Reviews"].astype(float)
```

In [17]:
```
data.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   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(3), object(10)
memory usage: 1023.8+ KB
```

4(III).

In [18]:
```
data["Installs"] = [ float(i.replace('+','').replace(',', '')) if '+' in i or ',' in i else float(0) for i in da
```

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

Out[19]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159.0	19000.0	10000.0	Free	0	Everyone	Art & Design	January 7, 2018	1.0.0
1	Coloring book moana	ART_AND_DESIGN	3.9	967.0	14000.0	500000.0	Free	0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0
2	U Launcher Lite â€“ FREE Live Cool Themes, Hid...	ART_AND_DESIGN	4.7	87510.0	8700.0	5000000.0	Free	0	Everyone	Art & Design	August 1, 2018	1.2.4
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644.0	25000.0	50000000.0	Free	0	Teen	Art & Design	June 8, 2018	Varies with device
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967.0	2800.0	100000.0	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1

In [20]:
```
data.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   float64
 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(4), object(9)
memory usage: 1023.8+ KB
```

In [21]:
```
data["Installs"] = data["Installs"].astype(int)
```

In [22]:
```
data.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   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(3), int32(1), object(9)
memory usage: 987.2+ KB
```

4(IV).

In [23]:
```
data['Price'] = [ float(i.split('$')[1]) if '$' in i else float(0) for i in data['Price'] ]
```

In [24]:
```
data.head()
```

Out[24]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159.0	19000.0	10000	Free	0.0	Everyone	Art & Design	January 7, 2018	1.0.0
1	Coloring book moana	ART_AND_DESIGN	3.9	967.0	14000.0	500000	Free	0.0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0
2	U Launcher Lite â€“ FREE Live Cool Themes, Hid...	ART_AND_DESIGN	4.7	87510.0	8700.0	5000000	Free	0.0	Everyone	Art & Design	August 1, 2018	1.2.4
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5	215644.0	25000.0	50000000	Free	0.0	Teen	Art & Design	June 8, 2018	Varies with device
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967.0	2800.0	100000	Free	0.0	Everyone	Art & Design;Creativity	June 20, 2018	1.1

In [25]:
```
data.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   float64
 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(4), int32(1), object(8)
memory usage: 987.2+ KB
```

In [26]:
```
data["Price"] = data["Price"].astype(int)
```

In [27]:
```
data.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 [28]:
```
data.shape
```

Out[28]: (9360, 13)

In [29]:
```
data.drop(data[(data['Reviews'] < 1) & (data['Reviews'] > 5 )].index, inplace = True)
```

In [30]:
```
data.shape
```

Out[30]: (9360, 13)

4(V-B).

In [31]:
```
data.shape
```

Out[31]: (9360, 13)

In [32]:
```
data.drop(data[data['Installs'] < data['Reviews'] ].index, inplace = True)
```

In [33]:
```
data.shape
```

Out[33]: (9353, 13)

4(V-C).

In [34]:
```
data.shape
```

Out[34]: (9353, 13)

In [35]:
```
data.drop(data[(data['Type'] =='Free') & (data['Price'] > 0 )].index, inplace = True)
```

In [36]:
```
data.shape
```

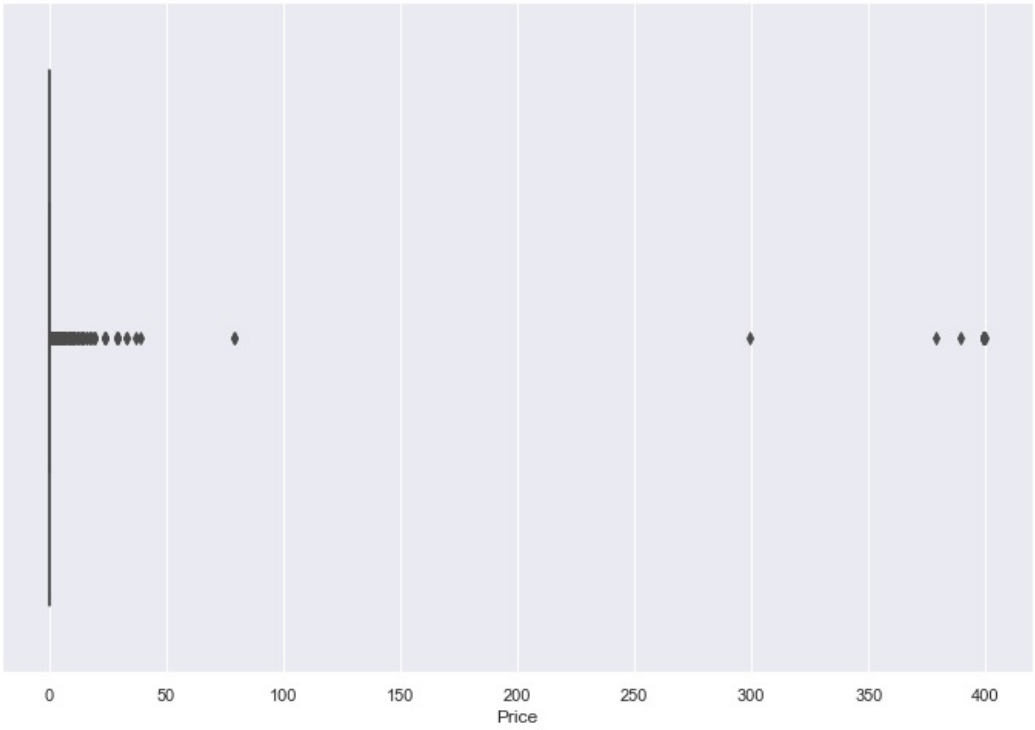
Out[36]: (9353, 13)

5(I).

In [37]:
```
sns.set(rc={'figure.figsize':(12,8)})
```

In [38]:
```
sns.boxplot(data['Price'])
```

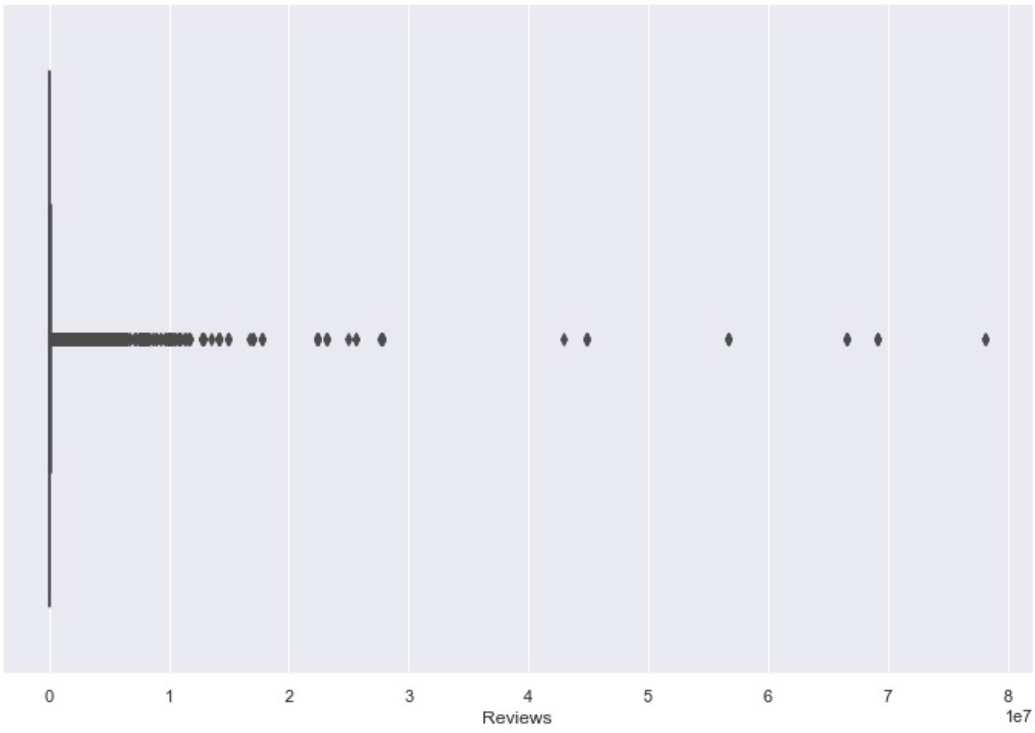
Out[38]: <matplotlib.axes._subplots.AxesSubplot at 0x26af7332408>



5(II).

In [39]:
```
sns.boxplot(data['Reviews'])
```

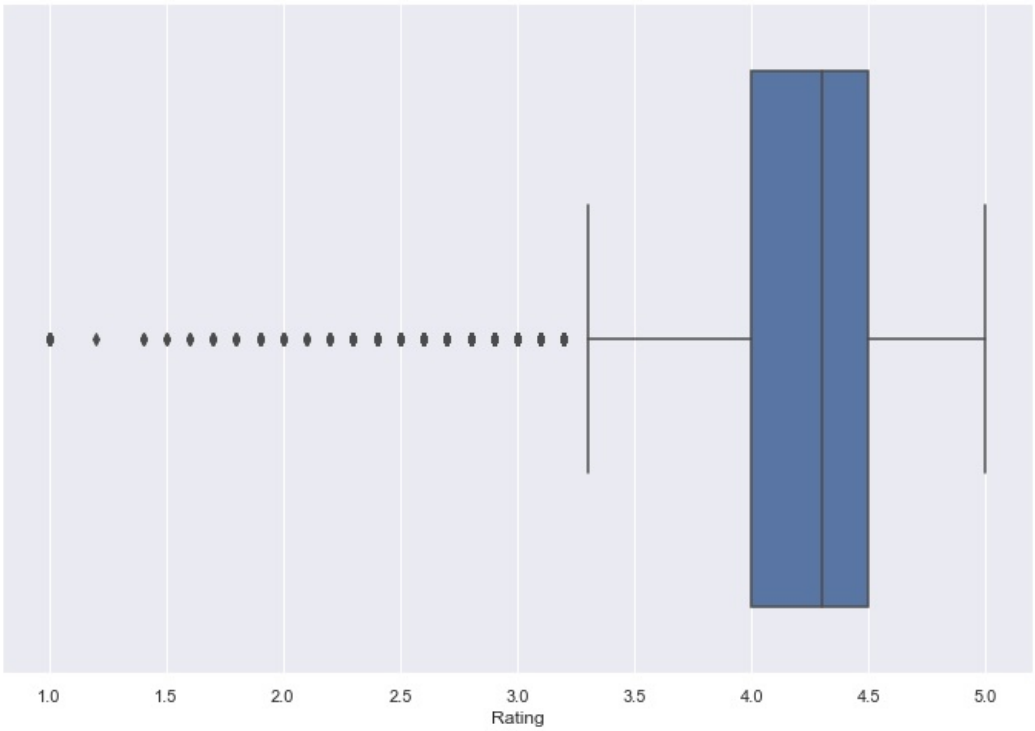
Out[39]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x26af7cc8148>
```



5(III).

In [40]:
```
sns.boxplot(data['Rating'])
```

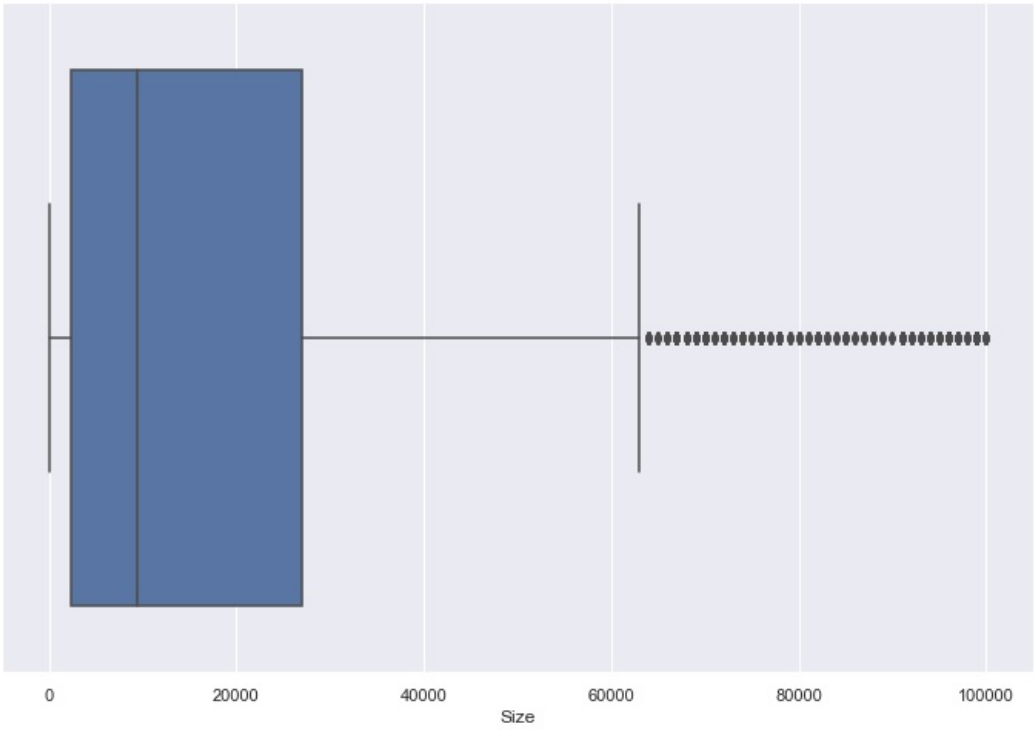
Out[40]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x26af7aa9cc8>
```



5(IV).

In [41]:
```
sns.boxplot(data['Size'])
```

Out[41]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x26af7acaa08>
```



6(I).

In [42]:
```
more = data.apply(lambda x : True
            if x['Price'] > 200 else False, axis = 1)
```

In [43]:
```
more_count = len(more[more == True].index)
```

In [44]:
```
data.shape
```

Out[44]: (9353, 13)

In [45]:
```
data.drop(data[data['Price'] > 200].index, inplace = True)
```

In [46]:
```
data.shape
```

Out[46]: (9338, 13)

6(II).

In [47]:
```
data.drop(data[data['Reviews'] > 2000000].index, inplace = True)
```

In [48]:
```
data.shape
```

Out[48]: (8885, 13)

6(III).

In [49]:
```
data.quantile([.1, .25, .5, .70, .90, .95, .99], axis = 0)
```

Out[49]:

	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 [50]:
```
# dropping more than 10000000 Installs value
data.drop(data[data['Installs'] > 10000000].index, inplace = True)
```

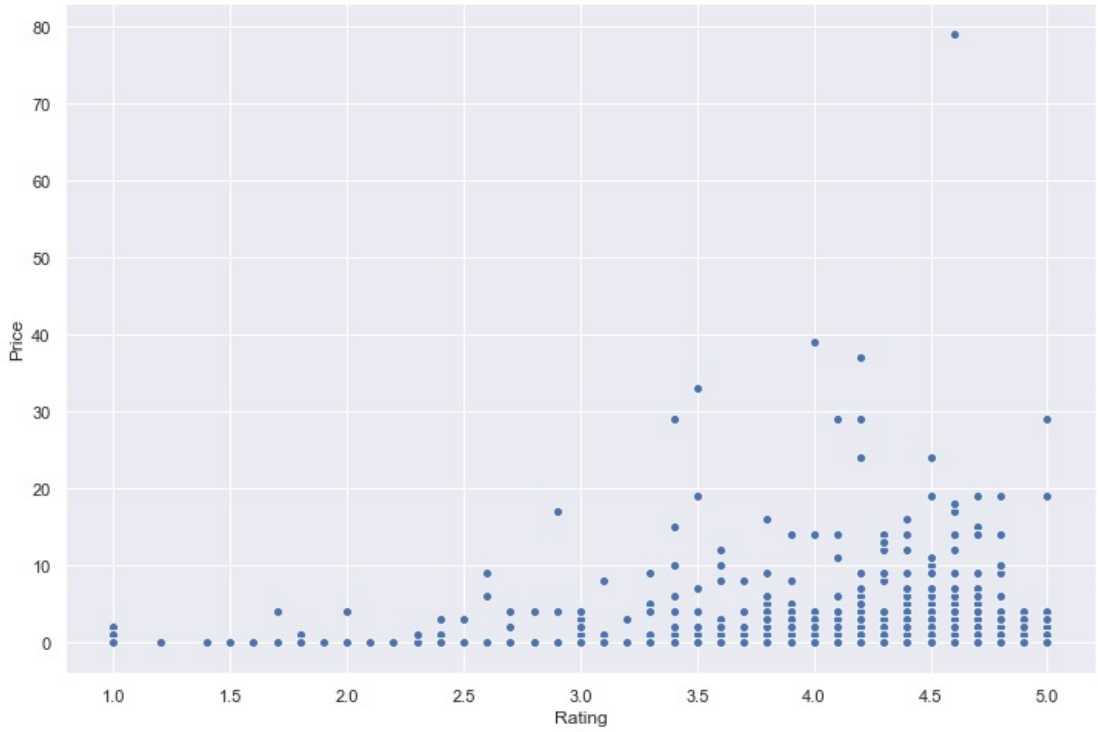
In [51]:
```
data.shape
```

Out[51]: (8496, 13)

7(I).

In [52]:
```
sns.scatterplot(x='Rating',y='Price',data=data)
```

Out[52]: <matplotlib.axes._subplots.AxesSubplot at 0x26af5bba188>

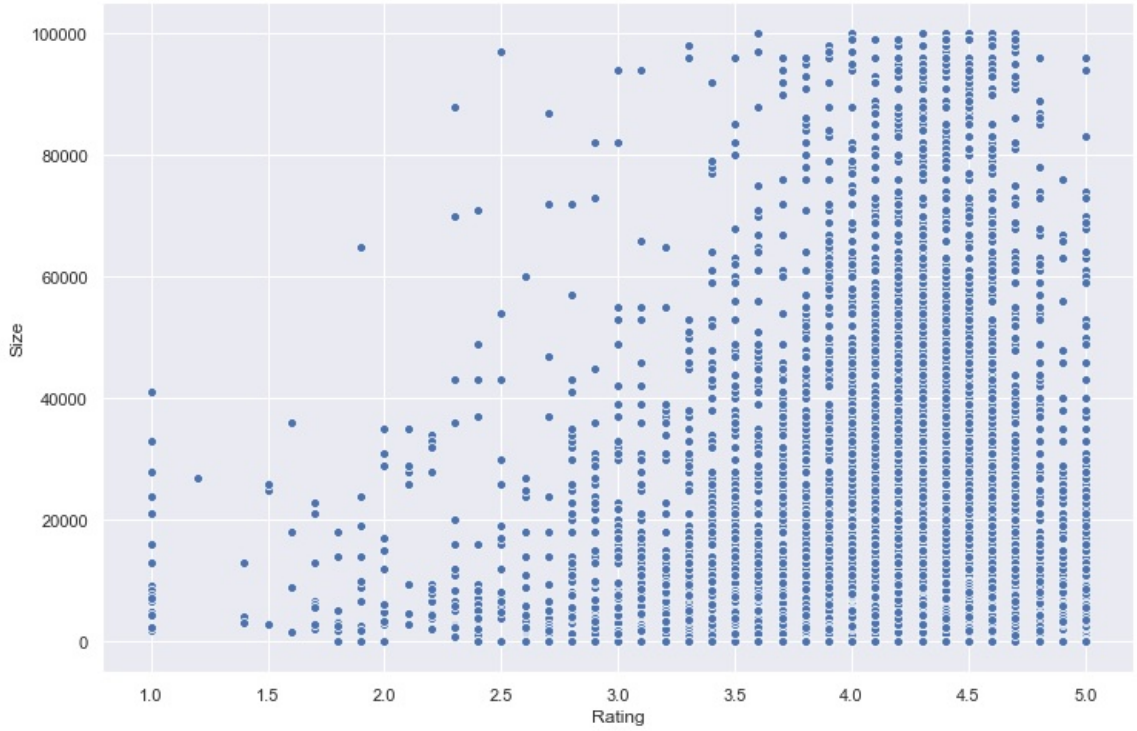


Yes, Paid apps are higher ratings comapre to free apps.

7(II).

In [53]:
```
sns.scatterplot(x='Rating',y='Size',data=data)
```

Out[53]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x26af8200e88>
```

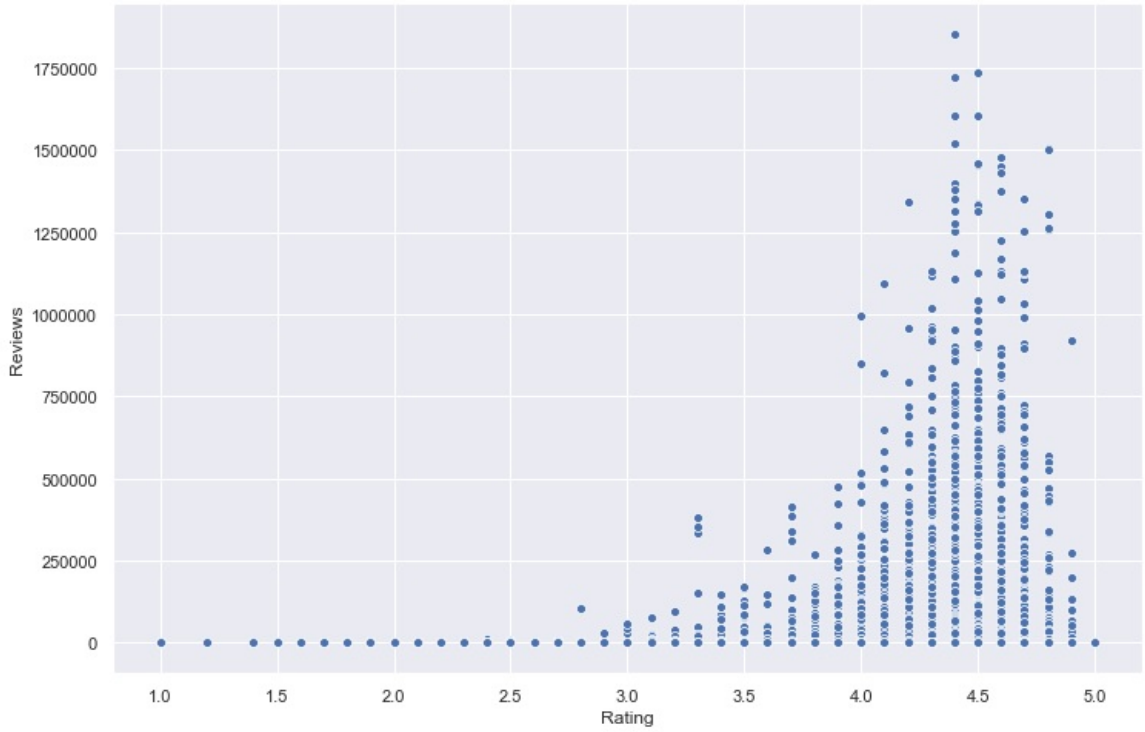


Yes it is clear that heavior apps are rated better.

7(III).

In [54]:
```
sns.scatterplot(x='Rating',y='Reviews',data=data)
```

Out[54]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x26af824df88>
```

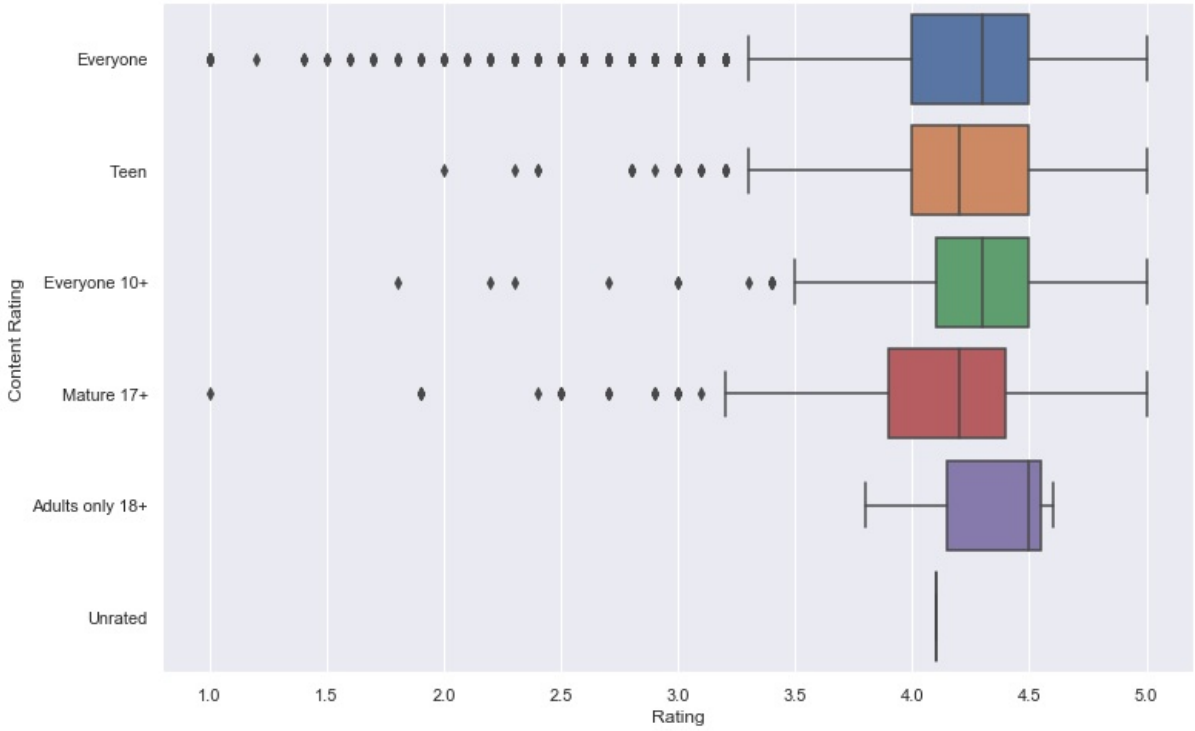


It is cristal clear that more reviews makes app rating better.

7(IV).

In [55]:
```
sns.boxplot(x="Rating", y="Content Rating", data=data)
```

Out[55]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x26af8342488>
```

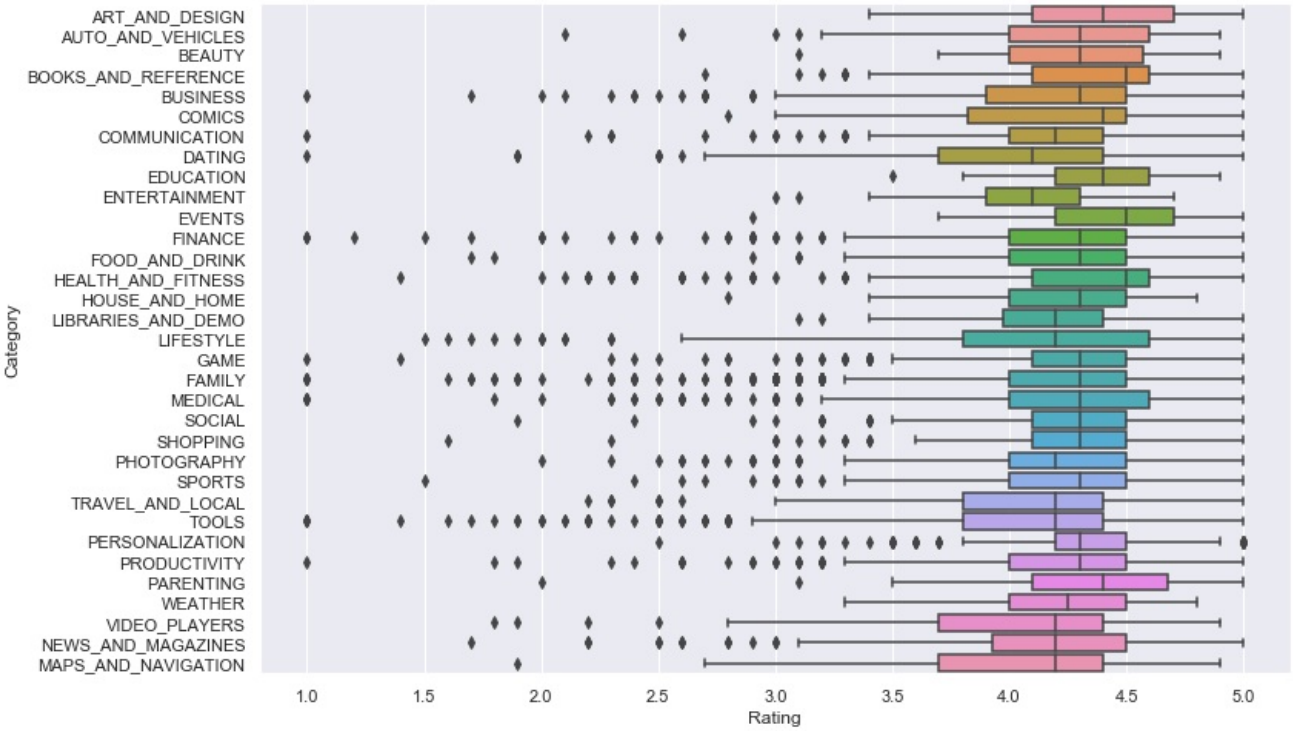


Apps which are for everyone has more bad ratings compare to other sections as it has so much outliers value, while 18+ apps have better ratings.

7(V).

In [56]:
```
sns.boxplot(x="Rating", y="Category", data=data)
```

Out[56]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x26af84e62c8>
```



Events category has best ratings compare to others.

8(I).

In [57]:
```
inp1 = data
```

In [58]:
```
inp1.head()
```

Out[58]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	A
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159.0	19000.0	10000	Free	0	Everyone	Art & Design	January 7, 2018	1.0.0	
1	Coloring book moana	ART_AND_DESIGN	3.9	967.0	14000.0	500000	Free	0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0	
2	U Launcher Lite â€“ FREE Live Cool Themes, Hid...	ART_AND_DESIGN	4.7	87510.0	8700.0	5000000	Free	0	Everyone	Art & Design	August 1, 2018	1.2.4	
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	967.0	2800.0	100000	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1	
5	Paper flowers instructions	ART_AND_DESIGN	4.4	167.0	5600.0	50000	Free	0	Everyone	Art & Design	March 26, 2017	1	

In [59]:
```
inp1.skew()
```

Out[59]:
```
Rating      -1.749753
Reviews      4.576494
Size         1.655917
Installs     1.543697
Price       18.074542
dtype: float64
```

In [60]:
```
reviewskew = np.log1p(inp1['Reviews'])
inp1['Reviews'] = reviewskew
```

In [61]:
```
reviewskew.skew()
```

Out[61]:
```
-0.20039949659264134
```

In [62]:
```
installsskew = np.log1p(inp1['Installs'])
inp1['Installs']
```

Out[62]:
```
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 [63]:
```
installsskew.skew()
```

Out[63]:
```
-0.5097286542754812
```

In [64]:
```
inp1.head()
```

Out[64]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	5.075174	19000.0	10000	Free	0	Everyone	Art & Design	January 7, 2018	1.0.0
1	Coloring book moana	ART_AND_DESIGN	3.9	6.875232	14000.0	500000	Free	0	Everyone	Art & Design;Pretend Play	January 15, 2018	2.0.0
2	U Launcher Lite â€“ FREE Live Cool Themes, Hid...	ART_AND_DESIGN	4.7	11.379520	8700.0	5000000	Free	0	Everyone	Art & Design	August 1, 2018	1.2.4
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3	6.875232	2800.0	100000	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1
5	Paper flowers instructions	ART_AND_DESIGN	4.4	5.123964	5600.0	50000	Free	0	Everyone	Art & Design	March 26, 2017	1

8(II)

In [65]:
```
inp1.drop(["Last Updated","Current Ver","Android Ver","App","Type"],axis=1,inplace=True)
```

In [66]:
```
inp1.head()
```

Out[66]:

	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 [67]:
```
inp1.shape
```

Out[67]:
```
(8496, 8)
```

8(III)

In [68]:
```
inp2 = inp1
```

In [69]:
```
inp2.head()
```

Out[69]:

	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 [70]:
```
#get unique values in Column "Category"
inp2.Category.unique()
```

Out[70]:
```
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 [71]:
```
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[71]:

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

5 rows × 40 columns

In [72]:
```
inp2.shape
```

Out[72]:
```
(8496, 40)
```

Let's apply Dummy EnCoding on Column "Genres"

In [73]:
```
#get unique values in Column "Genres"
inp2["Genres"].unique()
```

Out[73]:
```
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 [74]:
```
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 [75]:
```
inp2["Genres"].unique()
```

Out[75]:
```
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 [76]:
```
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 [77]:
```
inp2.head()
```

Out[77]:

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

5 rows × 91 columns

In [78]:
```
inp2.shape
```

Out[78]:
```
(8496, 91)
```

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

In [80]:
```
#get unique values in Column "Content Rating"
inp2["Content Rating"].unique()
```

Out[80]:
```
array(['Everyone', 'Teen', 'Everyone 10+', 'Mature 17+',
       'Adults only 18+', 'Unrated'], dtype=object)
```

In [81]:
```
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[81]:

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

5 rows × 96 columns

In [82]:
```
inp2.shape
```

Out[82]:
```
(8496, 96)
```

9. and 10.

In [85]:
```
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 [88]:
```
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 [89]:
```
reg_all = LR()
reg_all.fit(Xtrain,ytrain)
```

In [91]:
```
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 [92]:
```
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
```