Exploratory Data Analysis of Google Play Store Apps

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1 About Me

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2 Project:Google Play Store Apps

[1]:
```
import pandas as pd
```

[2]:
```
raw_data = pd.read_csv("googleplaystore.csv")
df = raw_data.copy()
df.head()
```

[2]:

	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	19M	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	14M	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	8.7M	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	25M	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	2.8M	100,000+	Free	0	Everyone	Art & Design;Creativity	June 20, 2018	1.1	4.4 and up

```
1  4.0.3 and up
2  4.0.3 and up
3    4.2 and up
4    4.4 and up
```

[3]:
```
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
```

[4]:
```
df.describe().T
```

[4]:

	count	mean	std	min	25%	50%	75%	max
Rating	9367.0	4.193338	0.537431	1.0	4.0	4.3	4.5	19.0

[5]:
```
df.describe(include = 'object').T
```

[5]:

	count	unique	top	freq
App	10841	9660	ROBLOX	9
Category	10841	34	FAMILY	1972
Reviews	10841	6002	0	596
Size	10841	462	Varies with device	1695
Installs	10841	22	1,000,000+	1579
Type	10840	3	Free	10039
Price	10841	93	0	10040
Content Rating	10840	6	Everyone	8714
Genres	10841	120	Tools	842
Last Updated	10841	1378	August 3, 2018	326
Current Ver	10833	2832	Varies with device	1459
Android Ver	10838	33	4.1 and up	2451

[6]:
```
df.shape
```

[6]:
```
(10841, 13)
```

2.1 Checking for the duplicates and removing duplicates if any

[7]:
```
df.duplicated().sum()
```

[7]:
```
483
```

[8]:
```
df.drop_duplicates(inplace = True)
df.duplicated().sum()
```

[8]:
```
0
```

[9]:
```
df.shape
```

[9]:
```
(10358, 13)
```

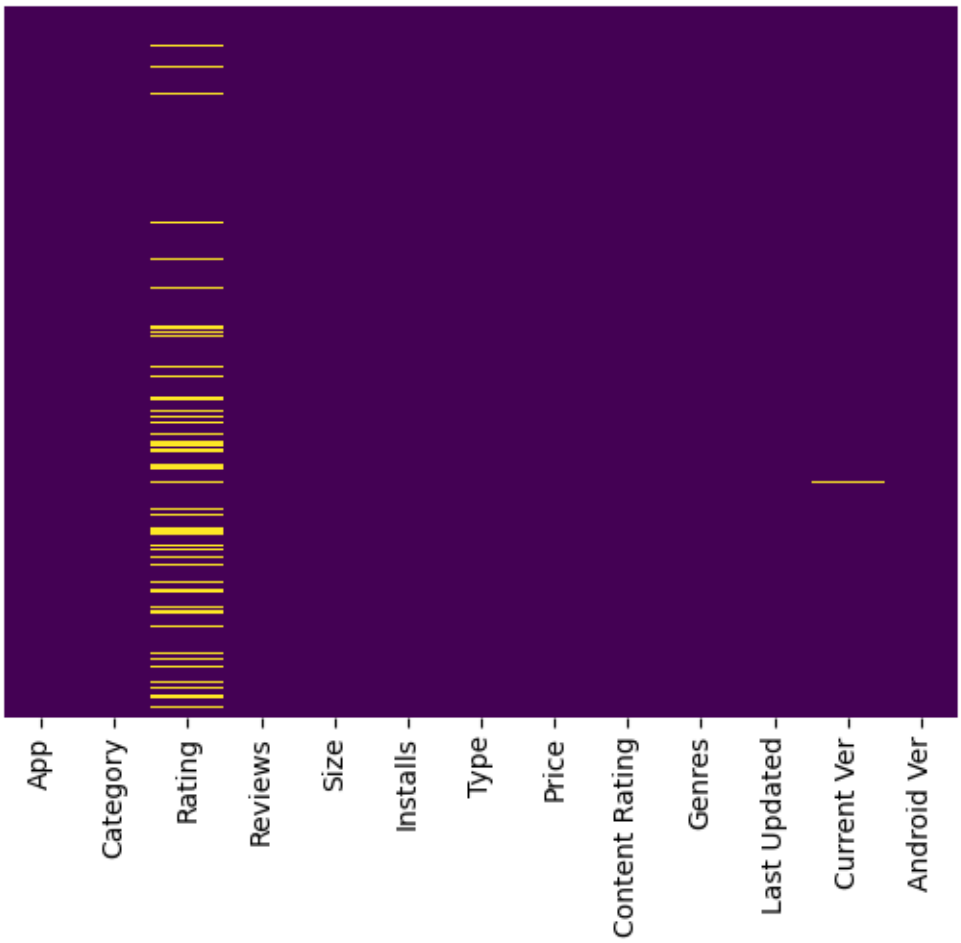
2.1.1 Missing values

[10]:
```
df.isnull().sum()
```

[10]:
```
App                0
Category           0
Rating          1465
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
```

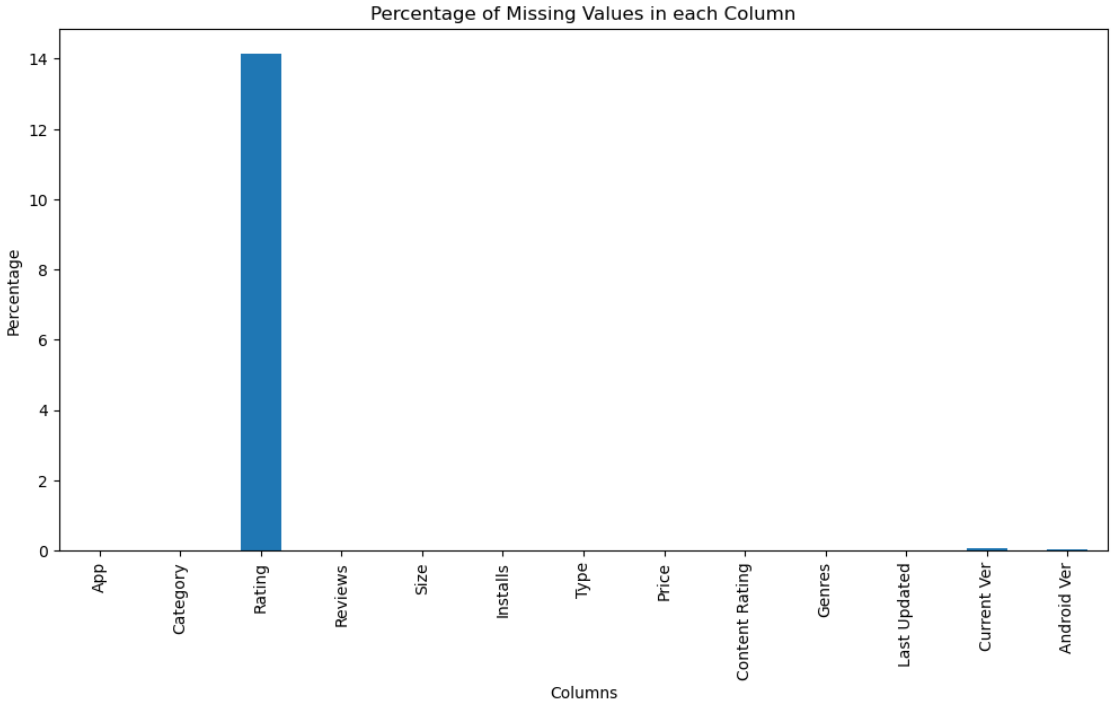
[11]:
```
### Plot Missing Values
import seaborn as sns
sns.heatmap(df.isnull(), yticklabels=False, cbar=False, cmap='viridis')
```

[11]:
```
<Axes: >
```



[13]:
```
import matplotlib.pyplot as plt
# make figure size
plt.figure(figsize=(12, 6))

# plot the null values by their percentage in each column
missing_percentage = df.isnull().sum()/len(df)*100
missing_percentage.plot(kind='bar')

# add the labels
plt.xlabel('Columns')
plt.ylabel('Percentage')
plt.title('Percentage of Missing Values in each Column')
```

[13]:
```
Text(0.5, 1.0, 'Percentage of Missing Values in each Column')
```



[14]:
```
#filling 'Rating column's' nan with mean of the columns 'Rating'
df['Rating'].fillna(df['Rating'].mean(),inplace = True)
df['Rating'].isnull().sum()
```

```
C:\Users\Mohammed Riad\AppData\Local\Temp\ipykernel_10916\1287123280.py:2:
FutureWarning: A value is trying to be set on a copy of a DataFrame or Series
through chained assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work
because the intermediate object on which we are setting values always behaves as
a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using
'df.method({col: value}, inplace=True)' or df[col] = df[col].method(value)
instead, to perform the operation inplace on the original object.


  df['Rating'].fillna(df['Rating'].mean(),inplace = True)
```

[14]: 0

[15]:
```
#dropping rest of the rows with missing values as the number of rows with␣
 ↪missing value is overall 12
df.dropna(inplace = True)
df.isnull().sum(),df.shape
```

[15]:
```
(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,
 (10346, 13))
```

2.1.2 Changing the data type of 'Reviews' column

[16]:
```
df['Reviews'] = df['Reviews'].astype(int)
df['Reviews'].dtype
```

[16]:
```
dtype('int32')
```

[17]:
```
df['Reviews']
```

[17]:
```
0           159
1           967
2         87510
3        215644
4           967
          …
10836        38
10837         4
10838         3
10839       114
10840    398307
Name: Reviews, Length: 10346, dtype: int32
```

[18]:
```
df['Last Updated'] = pd.to_datetime(df['Last Updated'])
df['Last Updated'].dtype
```

[18]:
```
dtype('<M8[ns]')
```

2.1.3 Changing the data type of 'Price' column

[19]:
```
import numpy as np
df['Price'] = df['Price'].str.replace('$',"",regex = False)
df['Price'] = df['Price'].astype(np.float64)
df['Price'].dtype
```

[19]:
```
dtype('float64')
```

2.1.4 Changing the data type of 'Installs' column

[20]:
```
df['Installs']= df['Installs'].str.replace('+','',regex = False).str.
 ↪replace(',','',regex = False)
df['Installs']= df['Installs'].astype(np.int32)
df['Installs'].dtype
```

[20]:
```
dtype('int32')
```

2.1.5 Changing the data type of 'Size' column

[21]:
```
df['Size']=df['Size'].str.replace('M','',regex = False)


#df['Size'].astype(np.float64)
```

[22]:
```
df['Size'].unique()
```

[22]:
```
array(['19', '14', '8.7', '25', '2.8', '5.6', '29', '33', '3.1', '28',
       '12', '20', '21', '37', '5.5', '17', '39', '31', '4.2', '7.0',
       '23', '6.0', '6.1', '4.6', '9.2', '5.2', '11', '24',
       'Varies with device', '9.4', '15', '10', '1.2', '26', '8.0', '7.9',
       '56', '57', '35', '54', '201k', '3.6', '5.7', '8.6', '2.4', '27',
       '2.7', '2.5', '16', '3.4', '8.9', '3.9', '2.9', '38', '32', '5.4',
       '18', '1.1', '2.2', '4.5', '9.8', '52', '9.0', '6.7', '30', '2.6',
       '7.1', '3.7', '22', '7.4', '6.4', '3.2', '8.2', '9.9', '4.9',
       '9.5', '5.0', '5.9', '13', '73', '6.8', '3.5', '4.0', '2.3', '7.2',
       '2.1', '42', '7.3', '9.1', '55', '23k', '6.5', '1.5', '7.5', '51',
       '41', '48', '8.5', '46', '8.3', '4.3', '4.7', '3.3', '40', '7.8',
       '8.8', '6.6', '5.1', '61', '66', '79k', '8.4', '118k', '44',
       '695k', '1.6', '6.2', '18k', '53', '1.4', '3.0', '5.8', '3.8',
       '9.6', '45', '63', '49', '77', '4.4', '4.8', '70', '6.9', '9.3',
       '10.0', '8.1', '36', '84', '97', '2.0', '1.9', '1.8', '5.3', '47',
       '556k', '526k', '76', '7.6', '59', '9.7', '78', '72', '43', '7.7',
       '6.3', '334k', '34', '93', '65', '79', '100', '58', '50', '68',
       '64', '67', '60', '94', '232k', '99', '624k', '95', '8.5k', '41k',
       '292k', '80', '1.7', '74', '62', '69', '75', '98', '85', '82',
       '96', '87', '71', '86', '91', '81', '92', '83', '88', '704k',
       '862k', '899k', '378k', '266k', '375k', '1.3', '975k', '980k',
```

```
       '4.1', '89', '696k', '544k', '525k', '920k', '779k', '853k',
       '720k', '713k', '772k', '318k', '58k', '241k', '196k', '857k',
       '51k', '953k', '865k', '251k', '930k', '540k', '313k', '746k',
       '203k', '26k', '314k', '239k', '371k', '220k', '730k', '756k',
       '91k', '293k', '17k', '74k', '14k', '317k', '78k', '924k', '902k',
       '818k', '81k', '939k', '169k', '45k', '475k', '965k', '90', '545k',
       '61k', '283k', '655k', '714k', '93k', '872k', '121k', '322k',
       '1.0', '976k', '172k', '238k', '549k', '206k', '954k', '444k',
       '717k', '210k', '609k', '308k', '705k', '306k', '904k', '473k',
       '175k', '350k', '383k', '454k', '421k', '70k', '812k', '442k',
       '842k', '417k', '412k', '459k', '478k', '335k', '782k', '721k',
       '430k', '429k', '192k', '200k', '460k', '728k', '496k', '816k',
       '414k', '506k', '887k', '613k', '243k', '569k', '778k', '683k',
       '592k', '319k', '186k', '840k', '647k', '191k', '373k', '437k',
       '598k', '716k', '585k', '982k', '219k', '55k', '948k', '323k',
       '691k', '511k', '951k', '963k', '25k', '554k', '351k', '27k',
       '82k', '208k', '913k', '514k', '551k', '29k', '103k', '898k',
       '743k', '116k', '153k', '209k', '353k', '499k', '173k', '597k',
       '809k', '122k', '411k', '400k', '801k', '787k', '50k', '643k',
       '986k', '97k', '516k', '837k', '780k', '961k', '269k', '20k',
       '498k', '600k', '749k', '642k', '881k', '72k', '656k', '601k',
       '221k', '228k', '108k', '940k', '176k', '33k', '663k', '34k',
       '942k', '259k', '164k', '458k', '245k', '629k', '28k', '288k',
       '775k', '785k', '636k', '916k', '994k', '309k', '485k', '914k',
       '903k', '608k', '500k', '54k', '562k', '847k', '957k', '688k',
       '811k', '270k', '48k', '329k', '523k', '921k', '874k', '981k',
       '784k', '280k', '24k', '518k', '754k', '892k', '154k', '860k',
       '364k', '387k', '626k', '161k', '879k', '39k', '970k', '170k',
       '141k', '160k', '144k', '143k', '190k', '376k', '193k', '246k',
       '73k', '992k', '253k', '420k', '404k', '470k', '226k', '240k',
       '89k', '234k', '257k', '861k', '467k', '157k', '44k', '676k',
       '67k', '552k', '885k', '1020k', '582k', '619k'], dtype=object)
```

[23]:
```
df_cleaned = df.copy()
```

[24]:
```
df_cleaned.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 10346 entries, 0 to 10840
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype
---  ------          --------------  -----
 0   App             10346 non-null  object
 1   Category        10346 non-null  object
 2   Rating          10346 non-null  float64
 3   Reviews         10346 non-null  int32
 4   Size            10346 non-null  object
 5   Installs        10346 non-null  int32
```

```
 6   Type            10346 non-null  object
 7   Price           10346 non-null  float64
 8   Content Rating  10346 non-null  object
 9   Genres          10346 non-null  object
 10  Last Updated    10346 non-null  datetime64[ns]
 11  Current Ver     10346 non-null  object
 12  Android Ver     10346 non-null  object
dtypes: datetime64[ns](1), float64(2), int32(2), object(8)
memory usage: 1.0+ MB
```

2.2 EDA

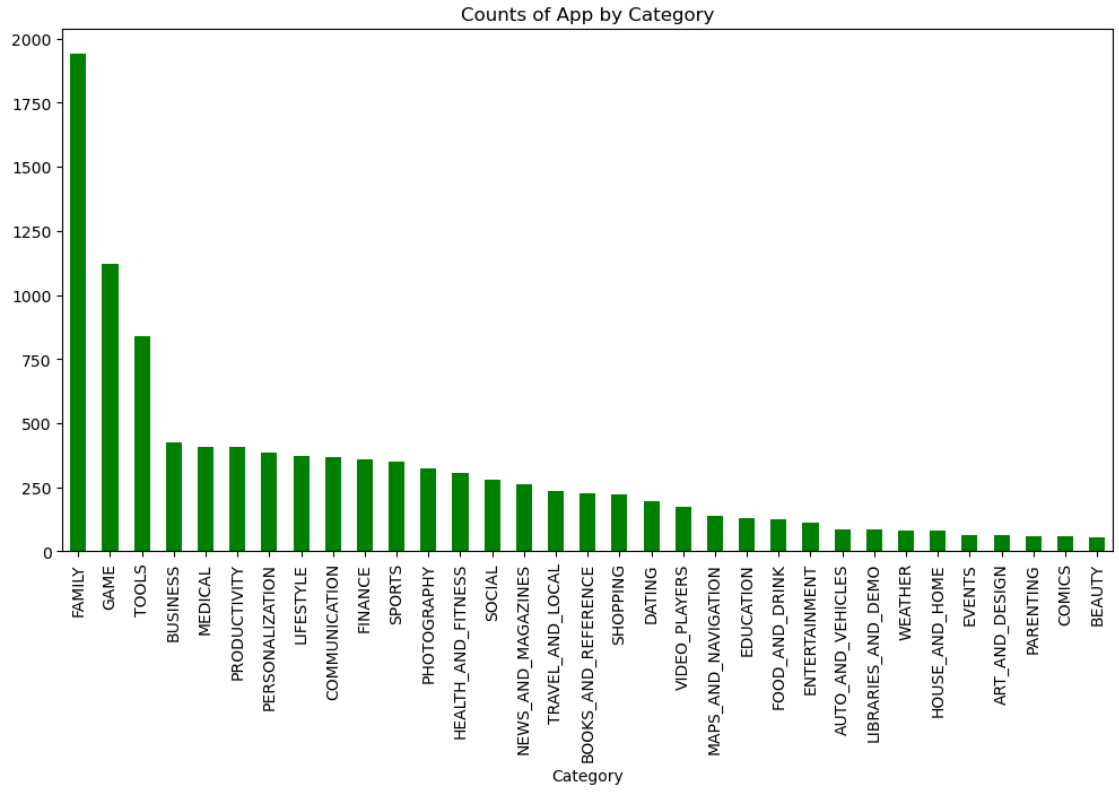
2.2.1 Counts of App by Category

[26]:
```
df_cleaned['Category'].unique().size
```

[26]: 33

[27]:
```
df_cleaned.groupby('Category')['App'].count().sort_values(ascending = False).
↪plot(kind = 'bar',figsize=(12,6),color = 'green',title ='Counts of App by␣
↪Category')
```

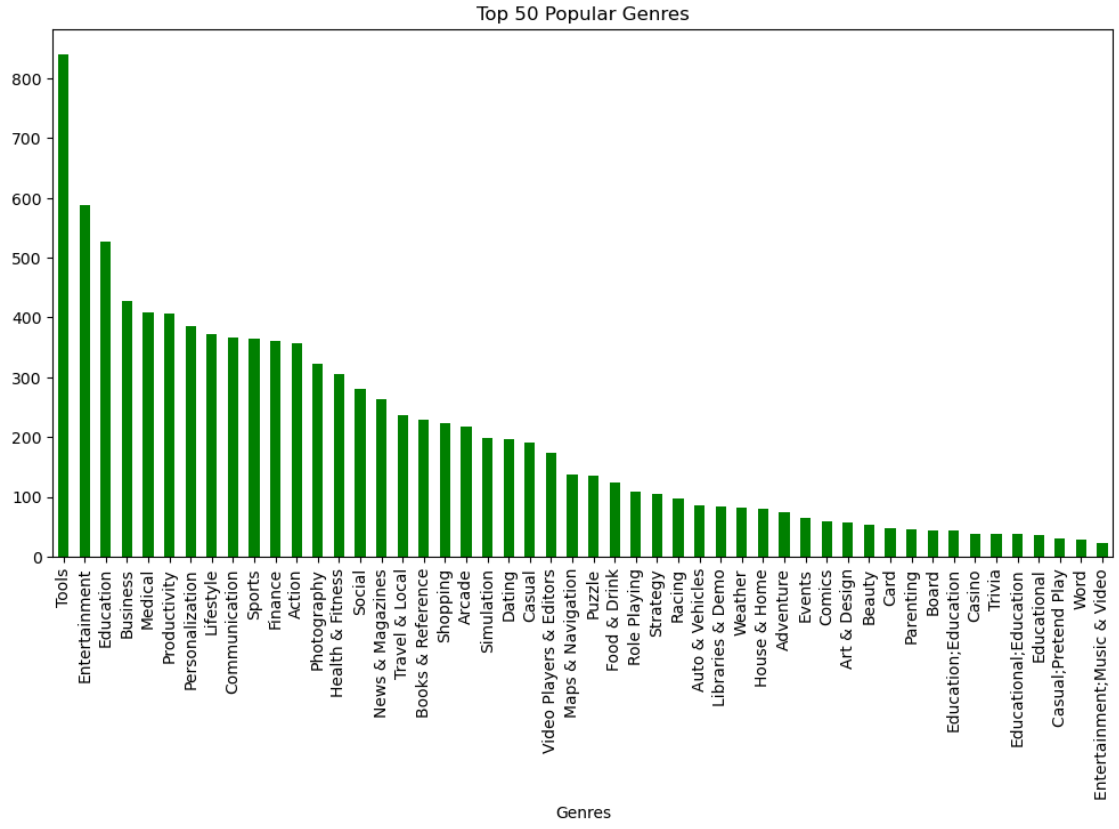
[27]: <Axes: title={'center': 'Counts of App by Category'}, xlabel='Category'>



2.2.2 Top 50 Popular Genres

[33]:
```
df_cleaned['Genres'].value_counts().sort_values(ascending = False).head(50).
↪plot(kind= 'bar',figsize= (12,6),color = 'green',title ='Top 50 Popular␣
↪Genres')
```

[33]:
```
<Axes: title={'center': 'Top 50 Popular Genres'}, xlabel='Genres'>
```



[29]:
```
df_cleaned.head()
```

[29]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating
0	Photo Editor & Candy Camera & Grid & ScrapBook	ART_AND_DESIGN	4.1	159	19	10000	Free	0.0	Everyone
1	Coloring book moana	ART_AND_DESIGN	3.9	967	14	500000	Free	0.0	Everyone
2	U Launcher Lite - FREE Live Cool Themes, Hide …	ART_AND_DESIGN	4.7	87510	8.7	5000000	Free	0.0	Everyone
3	Sketch - Draw & Paint	ART_AND_DESIGN	4.5						
4	Pixel Draw - Number Art Coloring Book	ART_AND_DESIGN	4.3						

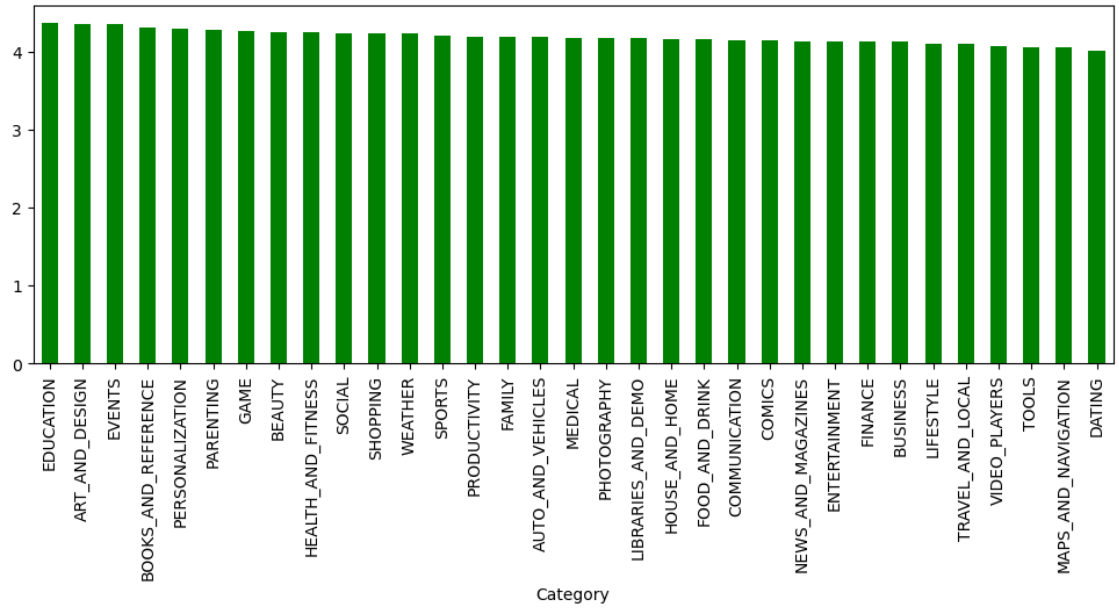
```
3   215644   25  50000000  Free    0.0           Teen
4      967  2.8    100000  Free    0.0       Everyone

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

[30]:
```
import matplotlib.pyplot as plt
import seaborn as sns
```

2.2.3 Average Rating by Category

[31]:
```
df_cleaned.groupby('Category')['Rating'].mean().sort_values(ascending=False).
↪plot(kind = 'bar',figsize = (12,4),color = 'green')
```

[31]: <Axes: xlabel='Category'>



2.3 10 Most popular apps

[54]:
```
df_cleaned[['App','Installs']].sort_values(by='Installs',ascending = False).
↪head(10)
```

[54]:

	App	Installs
336	WhatsApp Messenger	1000000000
2554	Google+	1000000000
3127	Google Street View	1000000000
3816	Google News	1000000000
3223	Maps - Navigate & Explore	1000000000
2545	Instagram	1000000000
2544	Facebook	1000000000
865	Google Play Games	1000000000
3234	Google	1000000000
3736	Google News	1000000000

2.4 List of apps that had installed in the highest number

[48]:
```
df_cleaned[['App','Installs']][df_cleaned['Installs']>= 1000000000]
```

[48]:

	App	Installs
152	Google Play Books	1000000000
335	Messenger - Text and Video Chat for Free	1000000000
336	WhatsApp Messenger	1000000000
338	Google Chrome: Fast & Secure	1000000000
340	Gmail	1000000000
341	Hangouts	1000000000
382	Messenger - Text and Video Chat for Free	1000000000
386	Hangouts	1000000000
391	Skype - free IM & video calls	1000000000
411	Google Chrome: Fast & Secure	1000000000
451	Gmail	1000000000
464	Hangouts	1000000000
865	Google Play Games	1000000000
1654	Subway Surfers	1000000000
1700	Subway Surfers	1000000000
1750	Subway Surfers	1000000000
1872	Subway Surfers	1000000000
2544	Facebook	1000000000
2545	Instagram	1000000000
2554	Google+	1000000000
2604	Instagram	1000000000
2808	Google Photos	1000000000
2853	Google Photos	1000000000
2884	Google Photos	1000000000
3117	Maps - Navigate & Explore	1000000000
3127	Google Street View	1000000000
3223	Maps - Navigate & Explore	1000000000
3232	Google Street View	1000000000
3234	Google	1000000000
3454	Google Drive	1000000000

```
3523                              Google Drive  1000000000
3665                                   YouTube  1000000000
3687                    Google Play Movies & TV  1000000000
3736                                 Google News  1000000000
3816                                 Google News  1000000000
3896                               Subway Surfers  1000000000
3904                          WhatsApp Messenger  1000000000
3909                                   Instagram  1000000000
3928                                   YouTube  1000000000
3943                                  Facebook  1000000000
3996              Google Chrome: Fast & Secure  1000000000
4098                 Maps - Navigate & Explore  1000000000
4144                                   Google+  1000000000
4150                                    Google  1000000000
4153                                  Hangouts  1000000000
4170                              Google Drive  1000000000
5395                             Google Photos  1000000000
5856                           Google Play Games  1000000000
9844                                 Google News  1000000000
```

[35]:
```
df_cleaned.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 10346 entries, 0 to 10840
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype
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 3   Reviews         10346 non-null  int32
 4   Size            10346 non-null  object
 5   Installs        10346 non-null  int32
 6   Type            10346 non-null  object
 7   Price           10346 non-null  float64
 8   Content Rating  10346 non-null  object
 9   Genres          10346 non-null  object
 10  Last Updated    10346 non-null  datetime64[ns]
 11  Current Ver     10346 non-null  object
 12  Android Ver     10346 non-null  object
dtypes: datetime64[ns](1), float64(2), int32(2), object(8)
memory usage: 1.0+ MB
```

[ ]:

[ ]:

[ ]: