ИУ5-62Б Дума Эмилия Михайловна РК1 ТМО

Технологии разведочного анализа и обработки данных.

Вариант 8

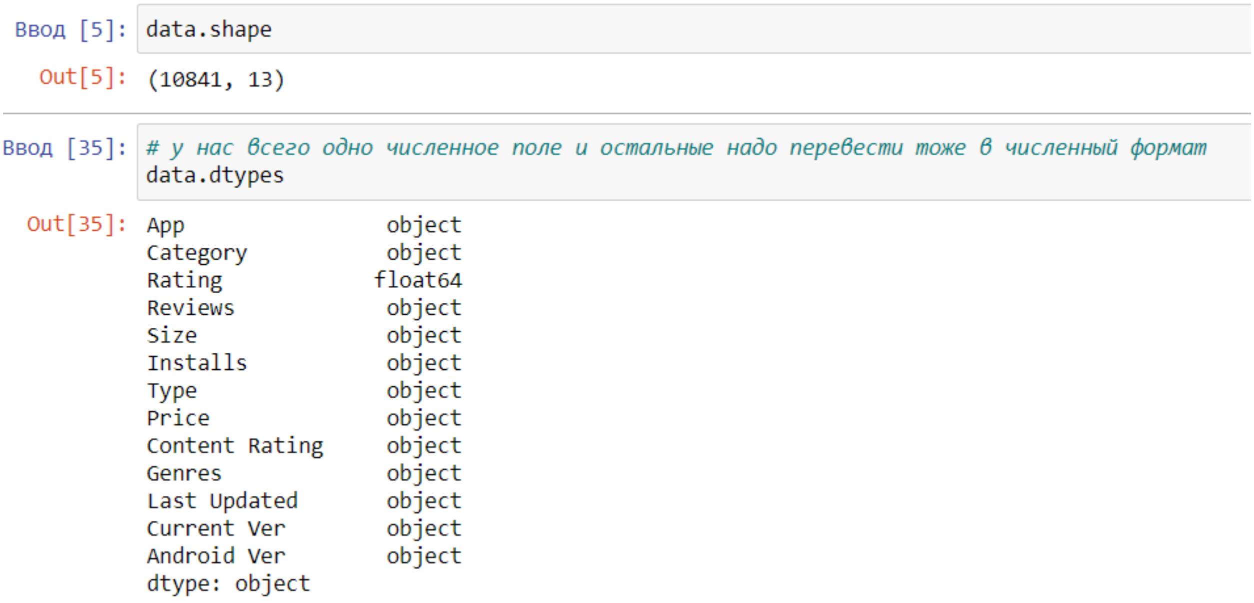
Задача 1, датасет 8.

Для заданного набора данных проведите корреляционный анализ. В случае наличия пропусков в данных удалите строки или колонки, содержащие пропуски. Сделайте выводы о возможности построения моделей машинного обучения и о возможном вкладе признаков в модель.

Датасет https://www.kaggle.com/lava18/google-play-store-apps

Задание для студентов групп ИУ5-62Б, ИУ5Ц-82Б - для произвольной колонки данных построить гистограмму.

```
#!/usr/bin/env python

# coding: utf-8


# In[2]:


# ИУ5-62Б Дума РК1

import numpy as np

import pandas as pd

import seaborn as sns

import matplotlib.pyplot as plt

get_ipython().run_line_magic('matplotlib', 'inline')

sns.set(style="ticks")


# In[4]:


data = pd.read_csv('googleplaystore.csv', sep=",")
```



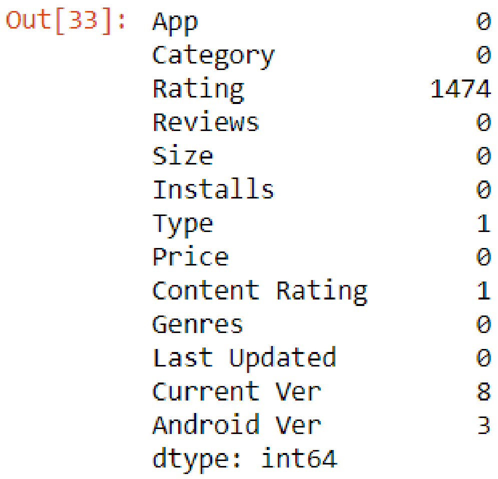
```
Ввод [5]: data.shape
 Out[5]: (10841, 13)
```

```
Ввод [35]: # у нас всего одно численное поле и остальные надо перевести тоже в численный формат
           data.dtypes

Out[35]: App                object
         Category           object
         Rating            float64
         Reviews            object
         Size               object
         Installs           object
         Type               object
         Price              object
         Content Rating     object
         Genres             object
         Last Updated       object
         Current Ver        object
         Android Ver        object
         dtype: object
```

# In[33]:

#видно пропуски -> датасет непригоден

data.isnull().sum()



```
Out[33]: 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
```

# In[8]:

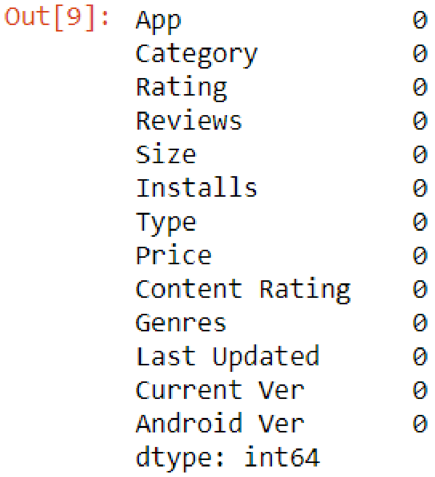
# удаляем пропуски

data_new = data.dropna(axis=0, how='any')

print(f"{data.shape[0]-data_new.shape[0]} rows were deleted")

# In[9]:

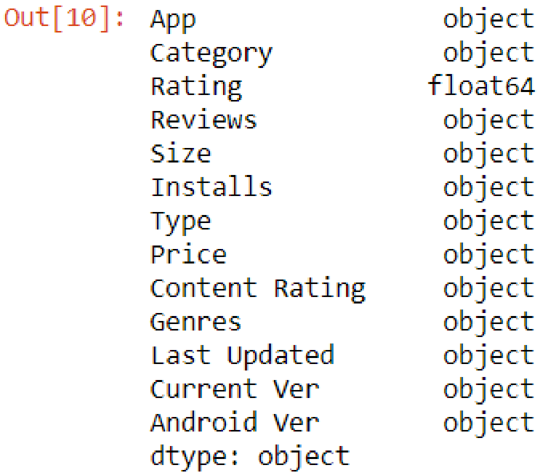
data_new.isnull().sum()



```
Out[9]: 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[10]:

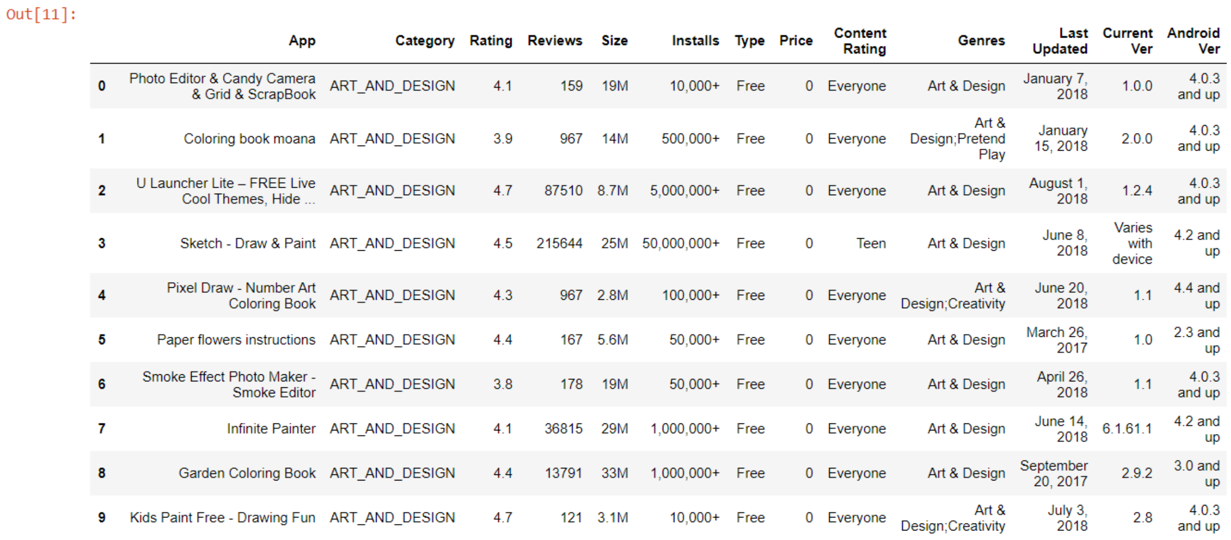
data_new.dtypes



```
Out[10]: App                object
         Category           object
         Rating            float64
         Reviews            object
         Size               object
         Installs           object
         Type               object
         Price              object
         Content Rating     object
         Genres             object
         Last Updated       object
         Current Ver        object
         Android Ver        object
         dtype: object
```

# In[11]:

data_new.head(10)



Out[11]:

	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
5	Paper flowers instructions	ART_AND_DESIGN	4.4	167	5.6M	50,000+	Free	0	Everyone	Art & Design	March 26, 2017	1.0	2.3 and up
6	Smoke Effect Photo Maker - Smoke Editor	ART_AND_DESIGN	3.8	178	19M	50,000+	Free	0	Everyone	Art & Design	April 26, 2018	1.1	4.0.3 and up
7	Infinite Painter	ART_AND_DESIGN	4.1	36815	29M	1,000,000+	Free	0	Everyone	Art & Design	June 14, 2018	6.1.61.1	4.2 and up
8	Garden Coloring Book	ART_AND_DESIGN	4.4	13791	33M	1,000,000+	Free	0	Everyone	Art & Design	September 20, 2017	2.9.2	3.0 and up
9	Kids Paint Free - Drawing Fun	ART_AND_DESIGN	4.7	121	3.1M	10,000+	Free	0	Everyone	Art & Design;Creativity	July 3, 2018	2.8	4.0.3 and up

```
# In[12]:


pd.options.mode.chained_assignment = None


# In[13]:


data_new.loc[:, 'Reviews']=pd.to_numeric(data_new.loc[:, 'Reviews'])


# In[14]:


data_new.loc[:, 'Installs'] = data_new.loc[:, 'Installs'].str.replace(',','')
data_new.loc[:, 'Installs'] = data_new.loc[:, 'Installs'].map(lambda x: str(x).rstrip('+'))
data_new.loc[:, 'Installs'] = pd.to_numeric(data_new.loc[:, 'Installs'], errors='coerce', downcast='float')


# In[15]:


data_new.loc[:, 'Price'] = data_new.loc[:, 'Price'].map(lambda x: str(x).lstrip('$'))
data_new.loc[:, 'Price'] = pd.to_numeric(data_new.loc[:, 'Price'], errors='coerce', downcast='float')


# In[16]:


data_new.loc[:, 'Size'] = data_new.loc[:, 'Size'].str.replace(',','')
data_new.loc[:, 'Size'] = data_new.loc[:, 'Size'].map(lambda x: str(x).rstrip('M'))


# In[18]:


from sklearn.impute import SimpleImputer
from sklearn.impute import MissingIndicator


# In[19]:


data_new.loc[:, 'Size'] = pd.to_numeric(data_new.loc[:, 'Size'], errors='coerce', downcast='float')
```

```
temp_data = data_new[['Size']]

indicator = MissingIndicator()

mask_missing_values_only = indicator.fit_transform(temp_data)

imp_num = SimpleImputer(strategy='mean')

data_num_imp = imp_num.fit_transform(temp_data)

filled_data = data_num_imp[mask_missing_values_only]

data_new = data_new.replace(np.nan, filled_data[0])


# In[20]:


from sklearn.preprocessing import LabelEncoder, OneHotEncoder

le = LabelEncoder()

cat_enc_le = le.fit_transform(data_new.loc[:, 'Category'])

print(le.inverse_transform(np.unique(cat_enc_le)))

data_new.loc[:, 'Category'] = cat_enc_le
```

```
['ART_AND_DESIGN' 'AUTO_AND_VEHICLES' 'BEAUTY' 'BOOKS_AND_REFERENCE'
 'BUSINESS' 'COMICS' 'COMMUNICATION' 'DATING' 'EDUCATION' 'ENTERTAINMENT'
 'EVENTS' 'FAMILY' 'FINANCE' 'FOOD_AND_DRINK' 'GAME' 'HEALTH_AND_FITNESS'
 'HOUSE_AND_HOME' 'LIBRARIES_AND_DEMO' 'LIFESTYLE' 'MAPS_AND_NAVIGATION'
 'MEDICAL' 'NEWS_AND_MAGAZINES' 'PARENTING' 'PERSONALIZATION'
 'PHOTOGRAPHY' 'PRODUCTIVITY' 'SHOPPING' 'SOCIAL' 'SPORTS' 'TOOLS'
 'TRAVEL_AND_LOCAL' 'VIDEO_PLAYERS' 'WEATHER']
```

```
# In[21]:


cat_enc_le = le.fit_transform(data_new.loc[:, 'Content Rating'])

print(le.inverse_transform(np.unique(cat_enc_le)))

data_new.loc[:, 'Content Rating'] = cat_enc_le
```

```
['Adults only 18+' 'Everyone' 'Everyone 10+' 'Mature 17+' 'Teen' 'Unrated'
]
```

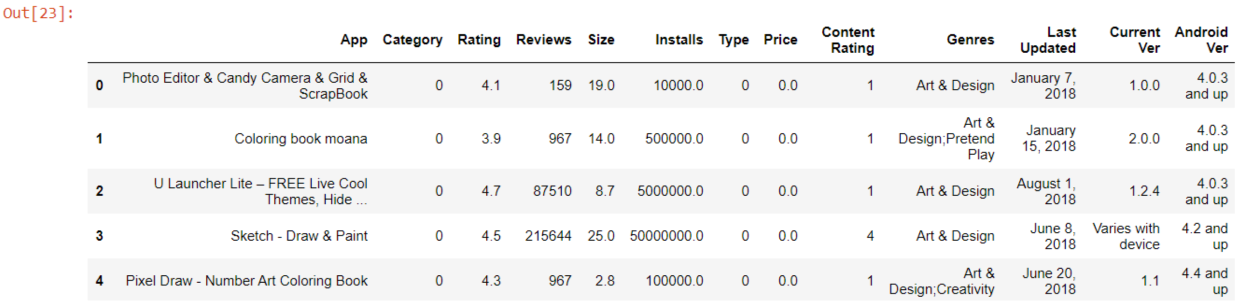
```
# In[22]:


cat_enc_le = le.fit_transform(data_new.loc[:, 'Type'])

print(le.inverse_transform(np.unique(cat_enc_le)))
```

data_new.loc[:, 'Type'] = cat_enc_le

```
['Free' 'Paid']
```

# In[23]:

data_new.head()



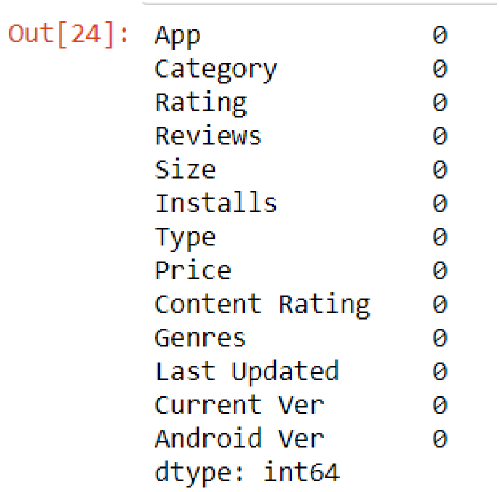
Out[23]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Android Ver
0	Photo Editor & Candy Camera & Grid & ScrapBook	0	4.1	159	19.0	10000.0	0	0.0	1	Art & Design	January 7, 2018	1.0.0	4.0.3 and up
1	Coloring book moana	0	3.9	967	14.0	500000.0	0	0.0	1	Art & Design;Pretend Play	January 15, 2018	2.0.0	4.0.3 and up
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	0	4.7	87510	8.7	5000000.0	0	0.0	1	Art & Design	August 1, 2018	1.2.4	4.0.3 and up
3	Sketch - Draw & Paint	0	4.5	215644	25.0	50000000.0	0	0.0	4	Art & Design	June 8, 2018	Varies with device	4.2 and up
4	Pixel Draw - Number Art Coloring Book	0	4.3	967	2.8	100000.0	0	0.0	1	Art & Design;Creativity	June 20, 2018	1.1	4.4 and up

# In[24]:

# теперь все строки без пропусков и в численном формате

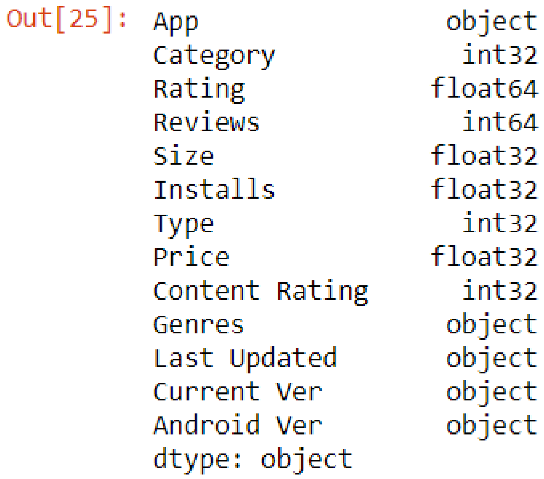
data_new.isnull().sum()



```
Out[24]: 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[25]:

data_new.dtypes

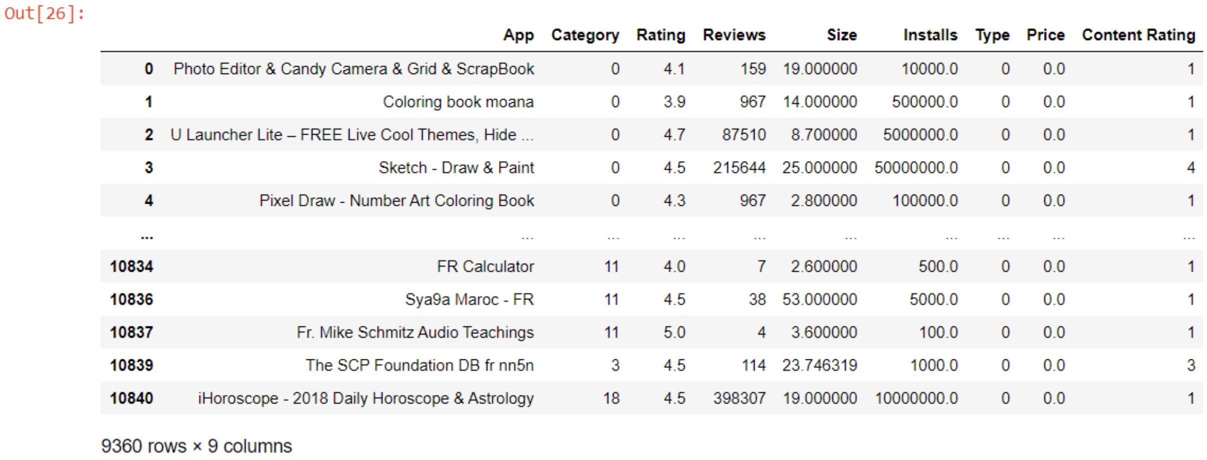


```
Out[25]: App                 object
         Category             int32
         Rating             float64
         Reviews              int64
         Size               float32
         Installs           float32
         Type                 int32
         Price              float32
         Content Rating       int32
         Genres              object
         Last Updated        object
         Current Ver         object
         Android Ver         object
         dtype: object
```

# In[26]:

# уберём колонки (см. в квадратных скобках) т.к. они не имеют особого значения, жанры - колонка с множеством значений

data_new.drop(columns=['Genres', 'Last Updated', 'Current Ver', 'Android Ver'])



Out[26]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating
0	Photo Editor & Candy Camera & Grid & ScrapBook	0	4.1	159	19.000000	10000.0	0	0.0	1
1	Coloring book moana	0	3.9	967	14.000000	500000.0	0	0.0	1
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	0	4.7	87510	8.700000	5000000.0	0	0.0	1
3	Sketch - Draw & Paint	0	4.5	215644	25.000000	50000000.0	0	0.0	4
4	Pixel Draw - Number Art Coloring Book	0	4.3	967	2.800000	100000.0	0	0.0	1
...	...	...	...	...	...	...	...	...	...
10834	FR Calculator	11	4.0	7	2.600000	500.0	0	0.0	1
10836	Sya9a Maroc - FR	11	4.5	38	53.000000	5000.0	0	0.0	1
10837	Fr. Mike Schmitz Audio Teachings	11	5.0	4	3.600000	100.0	0	0.0	1
10839	The SCP Foundation DB fr nn5n	3	4.5	114	23.746319	1000.0	0	0.0	3
10840	iHoroscope - 2018 Daily Horoscope & Astrology	18	4.5	398307	19.000000	10000000.0	0	0.0	1

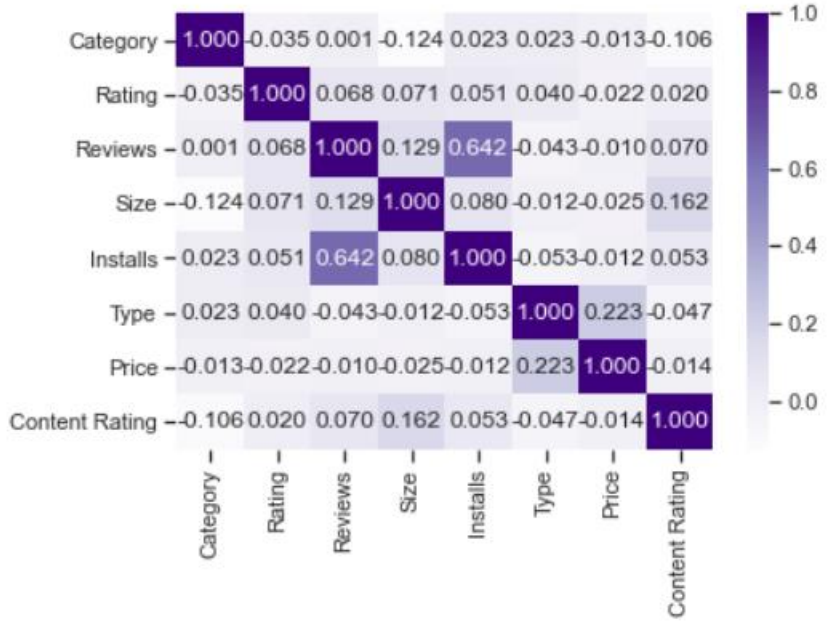
9360 rows × 9 columns

# In[34]:

# проведём корреляционный анализ

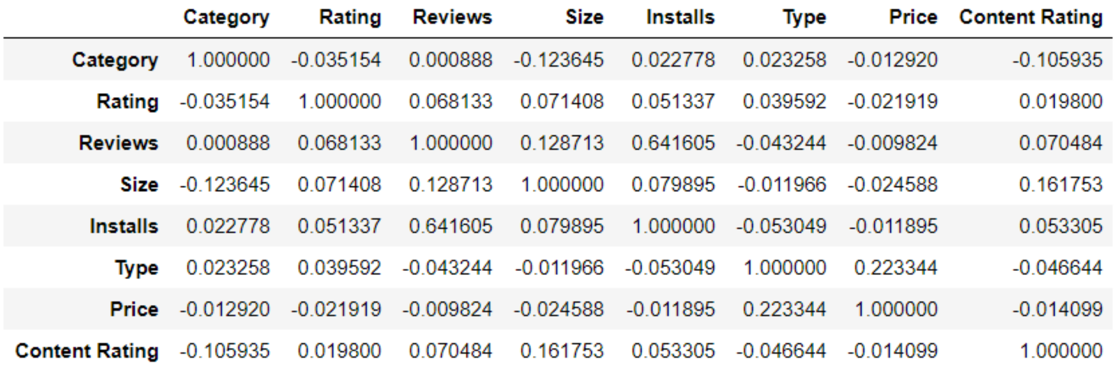
sns.heatmap(data_new.corr(), cmap='Purples', annot=True, fmt='.3f')

```
Out[34]: <AxesSubplot:>
```



```
# In[28]:


data_new.corr()
```

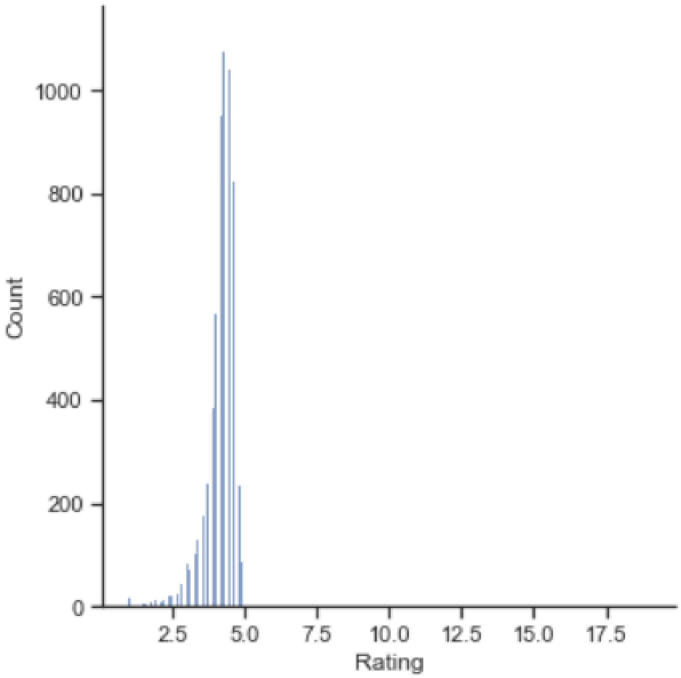
```
Out[28]:
```



	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating
Category	1.000000	-0.035154	0.000888	-0.123645	0.022778	0.023258	-0.012920	-0.105935
Rating	-0.035154	1.000000	0.068133	0.071408	0.051337	0.039592	-0.021919	0.019800
Reviews	0.000888	0.068133	1.000000	0.128713	0.641605	-0.043244	-0.009824	0.070484
Size	-0.123645	0.071408	0.128713	1.000000	0.079895	-0.011966	-0.024588	0.161753
Installs	0.022778	0.051337	0.641605	0.079895	1.000000	-0.053049	-0.011895	0.053305
Type	0.023258	0.039592	-0.043244	-0.011966	-0.053049	1.000000	0.223344	-0.046644
Price	-0.012920	-0.021919	-0.009824	-0.024588	-0.011895	0.223344	1.000000	-0.014099
Content Rating	-0.105935	0.019800	0.070484	0.161753	0.053305	-0.046644	-0.014099	1.000000

```
# In[32]:


# построим гистограмму по столбцу Rating

sns.displot(x=data['Rating'])
```

```
Out[32]: <seaborn.axisgrid.FacetGrid at 0x1c1e6628>
```



По результатам кореляционного анализа и гистограмме можно сделать выводы:

1 Средняя оценка приложения ~ 4.6

2 Параметр Size слабо связан с параметрами Category и Reviews - это видно и на диаграммах, и по значению в районе 0.1

3 Параметр Type слабо корелирует с параметром Price (очевидно)

Вывод: в модели данных существует всего одна сильная кореляция, для Installations-Reviews. Построить хорошую модель будет сложно, т.к. большинство параметров не корелирует между собой