Рубежный контроль №1

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Задача №1.

Для заданного набора данных **(googleplaystore.csv)** 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.

Для студентов группы ИУ5-64Б, ИУ5Ц-84Б - для произвольной колонки данных построить график "Скрипичная диаграмма **(violin plot)**".

Загрузка библиотек:

In [147]:

```
import pandas as pd
from sklearn.preprocessing import LabelEncoder
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

Загрузка датасета:

In [148]:

```
data = pd.read_csv("/content/drive/MyDrive/Colab Notebooks/googleplaystore.csv")
```

In [149]:

```
data.head()
```

Out[149]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Cu
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	**Coloring book moana**	ART_AND_DESIGN	3.9	967	14M	500,000+	Free	0	Everyone	Art & Design;Pretend Play	January 15, 2018	
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	
3	**Sketch - Draw & Paint**	ART_AND_DESIGN	4.5	215644	25M	50,000,000+	Free	0	Teen	Art & Design	June 8, 2018	Va de
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	

Количество строк/столбцов:

In [150]:

```
data.shape
```

Out[150]:

```
(10841, 13)
```

Проверка на наличие пропусков:

In [151]:

```
data.isnull().sum()
```

Out[151]:

```
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
```

Т.к. пропусков не много, а нам нужен чистый датасет, то удалим нулевые строки:

In [152]:

```
data = data.dropna(axis=0)
data.shape
```

Out[152]:

```
(9360, 13)
```

In [153]:

```
data.isnull().sum()
```

Out[153]:

```
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
```

Определим типы столбцов:

In [154]:

```
data.dtypes
```

Out[154]:

```
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
```

Будем использовать в качестве целевого признака переменную **Rating**

Приведем некоторые категориальные признаки к числовому формату:

In [155]:

```
#Преобразование Reviews
arr_before = []
arr_after = []
for i in range(data.shape[0]):
    arr_before.append(data["Reviews"].iloc[i])
    data["Reviews"].iloc[i] = int(data["Reviews"].iloc[i])
    arr_after.append(data["Reviews"].iloc[i])
print("До кодирования:")
print(arr_before[:50])
print("После кодирования:")
print(arr_after[:50])

data = data.astype({"Reviews": "int64"})
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/indexing.py:1732: SettingWithCopyWarni
ng:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_g
uide/indexing.html#returning-a-view-versus-a-copy
  self._setitem_single_block(indexer, value, name)
```

```
До кодирования:
['159', '967', '87510', '215644', '967', '167', '178', '36815', '13791', '121', '13880',
'8788', '44829', '4326', '1518', '3632', '27', '194216', '224399', '450', '654', '7699',
'118', '192', '20260', '203', '136', '223', '1120', '227', '5035', '1015', '353', '564',
'8145', '36639', '158', '591', '117', '176', '295221', '2206', '26', '174531', '1070', '8
5', '845', '367', '1598', '284']
После кодирования:
[159, 967, 87510, 215644, 967, 167, 178, 36815, 13791, 121, 13880, 8788, 44829, 4326, 151
8, 3632, 27, 194216, 224399, 450, 654, 7699, 118, 192, 20260, 203, 136, 223, 1120, 227, 5
035, 1015, 353, 564, 8145, 36639, 158, 591, 117, 176, 295221, 2206, 26, 174531, 1070, 85,
845, 367, 1598, 284]
```

In [156]:

```
#Преобразование Installs
arr_before = []
arr_after = []
for i in range(data.shape[0]):
    str = data["Installs"].iloc[i][:-1]
    arr_before.append(str)
    data["Installs"].iloc[i] = int(str.replace(",", ""))
    arr_after.append(data["Installs"].iloc[i])
print("До кодирования:")
print(arr_before[:50])
print("После кодирования:")
print(arr_after[:50])
data = data.astype({"Installs": "int64"})
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/indexing.py:1732: SettingWithCopyWarni
ng:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_g
uide/indexing.html#returning-a-view-versus-a-copy
  self._setitem_single_block(indexer, value, name)
```

```
До кодирования:
['10,000', '500,000', '5,000,000', '50,000,000', '100,000', '50,000', '50,000', '1,000,00
0', '1,000,000', '10,000', '1,000,000', '1,000,000', '10,000,000', '100,000', '100,000',
'500,000', '10,000', '5,000,000', '10,000,000', '100,000', '100,000', '500,000', '50,000'
, '10,000', '500,000', '100,000', '10,000', '100,000', '100,000', '50,000', '100,000', '1
00,000', '10,000', '100,000', '500,000', '5,000,000', '10,000', '500,000', '10,000', '100
,000', '10,000,000', '100,000', '10,000', '10,000,000', '100,000', '100,000', '100,000',
'100,000', '1,000,000', '100,000']
После кодирования:
[10000, 500000, 5000000, 50000000, 100000, 50000, 50000, 1000000, 1000000, 10000, 1000000
, 1000000, 10000000, 100000, 100000, 500000, 10000, 5000000, 10000000, 100000, 100000, 50
0000, 50000, 10000, 500000, 100000, 10000, 100000, 100000, 50000, 100000, 100000, 10000,
100000, 500000, 5000000, 10000, 500000, 10000, 100000, 10000000, 100000, 10000, 10000000,
100000, 100000, 100000, 100000, 1000000, 100000]
```

In [157]:

```
#Преобразование Type
arr_before = []
arr_after = []
for i in range(data.shape[0]):
  arr_before.append(data["Type"].iloc[i])
arr = []
leType = LabelEncoder()
le_arr = leType.fit_transform(data["Type"])
data["Type"] = le_arr
for i in range(data.shape[0]):
  arr_after.append(data["Type"].iloc[i])
print("До кодирования:")
print(arr_before[:50])
print("После кодирования:")
print(arr_after[:50])
data = data.astype({"Type":"int64"})
```

```
До кодирования:
['Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', '
Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Fr
ee', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free
', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free', 'Free',
'Free', 'Free', 'Free', 'Free', 'Free']
После кодирования:
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
```

In [158]:

```
#Преобразование Price
arr_before = []
arr_after = []
for i in range(data.shape[0]):
    arr_before.append(data["Price"].iloc[i])
    if data["Price"].iloc[i] != "0":
        data["Price"].iloc[i] = data["Price"].iloc[i][1:]
        data["Price"].iloc[i] = float(data["Price"].iloc[i])
    else:
        data["Price"].iloc[i] = 0
    arr_after.append(data["Price"].iloc[i])
print("До кодирования:")
print(arr_before[:50])
print("После кодирования:")
print(arr_after[:50])
data = data.astype({"Price":"float64"})
```

```
/usr/local/lib/python3.7/dist-packages/pandas/core/indexing.py:1732: SettingWithCopyWarni
ng:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_g
uide/indexing.html#returning-a-view-versus-a-copy
  self._setitem_single_block(indexer, value, name)
```

```
До кодирования:
['0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0'
, '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0
', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0']
После кодирования:
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]
```

In [159]:

```
#Преобразование Content Rating
arr_before = []
arr_after = []
for i in range(data.shape[0]):
  arr_before.append(data["Content Rating"].iloc[i])
leContent = LabelEncoder()
le_arr = leContent.fit_transform(data["Content Rating"])
data["Content Rating"] = le_arr
data["Content Rating"].unique()
for i in range(data.shape[0]):
  arr_after.append(data["Content Rating"].iloc[i])
print("До кодирования:")
print(arr_before[:50])
print("После кодирования:")
print(arr_after[:50])
data = data.astype({"Content Rating":"int64"})
```

```
До кодирования:
['Everyone', 'Everyone', 'Everyone', 'Teen', 'Everyone', 'Everyone', 'Everyone', 'Everyon
e', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Teen', 'Everyone', 'Everyone', 'Ever
yone', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone 10+', 'Every
one', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone',
'Everyone', 'Everyone', 'Teen', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone
', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'Everyone', 'E
veryone', 'Everyone', 'Everyone', 'Everyone', 'Everyone']
После кодирования:
[1, 1, 1, 4, 1, 1, 1, 1, 1, 1, 1, 1, 4, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 4, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1]
```

In [160]:

```
#Преобразование Category
arr_before = []
arr_after = []
for i in range(data.shape[0]):
  arr_before.append(data["Category"].iloc[i])
leCategory = LabelEncoder()
le_arr = leCategory.fit_transform(data["Category"])
data["Category"] = le_arr
data["Category"].unique()
for i in range(data.shape[0]):
  arr_after.append(data["Category"].iloc[i])
print("До кодирования:")
print(arr_before[:50])
print("После кодирования:")
print(arr_after[:50])
data = data.astype({"Category":"int64"})
```

```
До кодирования:
['ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN'
, 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN
, 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN
', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIG
N', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESI
GN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DES
IGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DE
SIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_D
ESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_
DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'ART_AND
_DESIGN', 'ART_AND_DESIGN', 'ART_AND_DESIGN', 'AUTO_AND_VEHICLES', 'AUTO_AND_VEHICLES', '
AUTO_AND_VEHICLES']
После кодирования:
[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1]
```

In [161]:

```
#Результаты преобразования
data.dtypes
```

Out[161]:

```
App                object
Category            int64
Rating            float64
Reviews             int64
Size               object
Installs            int64
Type                int64
Price             float64
Content Rating      int64
Genres             object
Last Updated       object
Current Ver        object
Android Ver        object
dtype: object
```

In [162]:

```
data.head()
```

Out[162]:

	App	Category	Rating	Reviews	Size	Installs	Type	Price	Content Rating	Genres	Last Updated	Current Ver	Androi Ve
0	Photo Editor & Candy Camera & Grid & ScrapBook	0	4.1	159	19M	10000	0	0.0	1	Art & Design	January 7, 2018	1.0.0	4.0. and u
1	Coloring book moana	0	3.9	967	14M	500000	0	0.0	1	Art & Design;Pretend Play	January 15, 2018	2.0.0	4.0. and u
2	U Launcher Lite – FREE Live Cool Themes, Hide ...	0	4.7	87510	8.7M	5000000	0	0.0	1	Art & Design	August 1, 2018	1.2.4	4.0. and u
3	Sketch - Draw & Paint	0	4.5	215644	25M	50000000	0	0.0	4	Art & Design	June 8, 2018	Varies with device	4.2 an u
4	Pixel Draw - Number Art Coloring Book	0	4.3	967	2.8M	100000	0	0.0	1	Art & Design;Creativity	June 20, 2018	1.1	4.4 an u

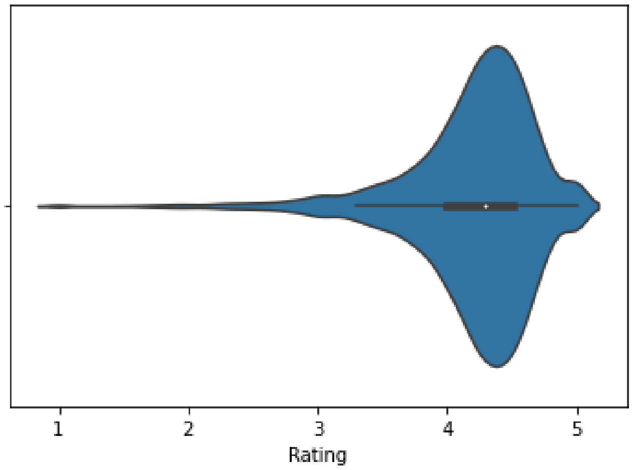
Выведем скрипичную диаграмму в соответствии с вариантом:

In [163]:

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

Out[163]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7efcb886d790>
```

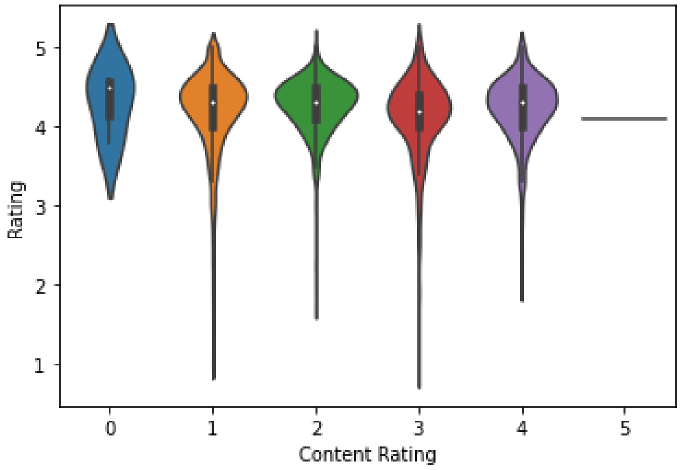


In [164]:

```
sns.violinplot(x='Content Rating', y='Rating', data=data)
```

Out[164]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7efcb86b0090>
```



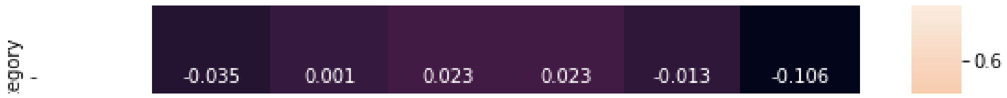
In [165]:

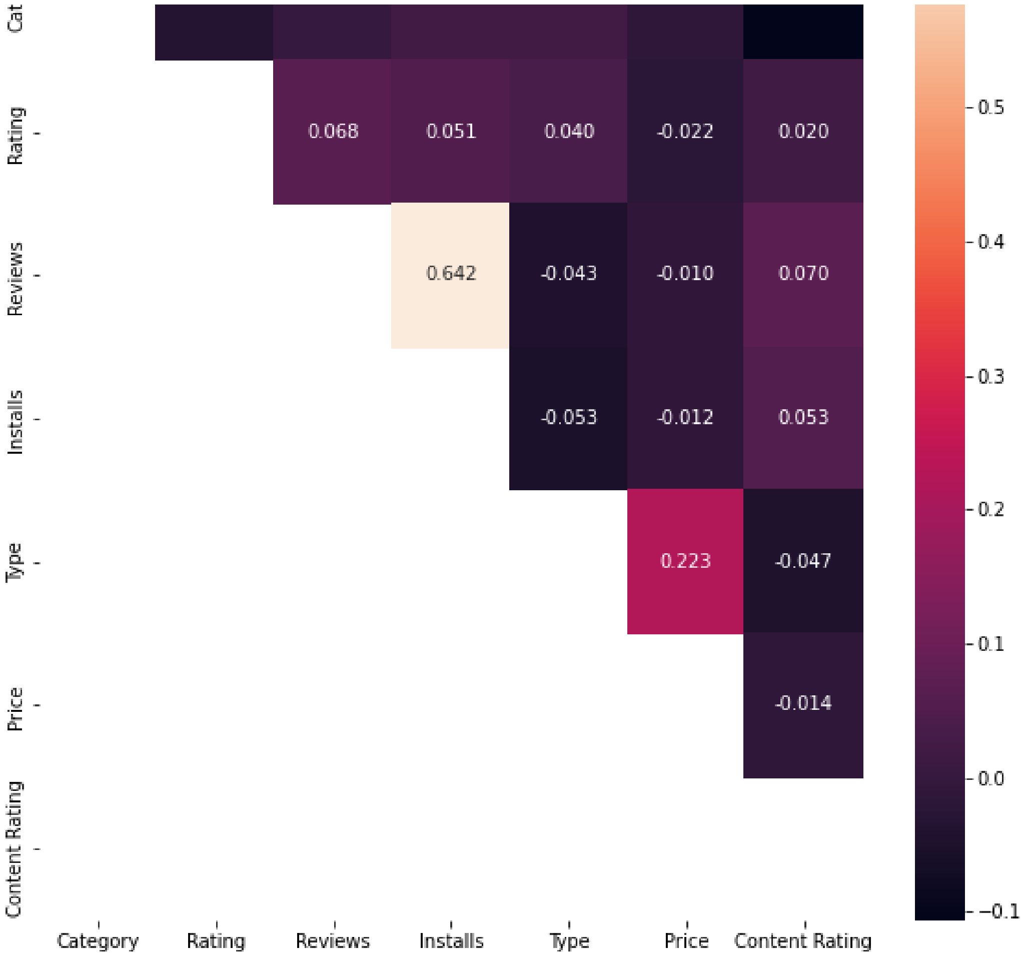
```
fig, ax = plt.subplots(1, 1, sharex='col', sharey='row', figsize=(10,10))
mask = np.zeros_like(data.corr(), dtype=np.bool)
mask[np.tril_indices_from(mask)] = True
sns.heatmap(data.corr(), mask=mask, annot=True, fmt='.3f')
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: DeprecationWarning: `np.b
ool` is a deprecated alias for the builtin `bool`. To silence this warning, use `bool` by
itself. Doing this will not modify any behavior and is safe. If you specifically wanted t
he numpy scalar type, use `np.bool_` here.
Deprecated in NumPy 1.20; for more details and guidance: https://numpy.org/devdocs/releas
e/1.20.0-notes.html#deprecations
```

Out[165]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7efcb85d0d50>
```





Вывод: В соответствии с корреляционной матрицей, можно сделать вывод, что с целевым признаком **Rating** остальные признаки слабо коррелируют. Из-за слабой связанности признаков между собой данный датасет мало пригоден к обучению модели.

Нецелевые признаки **Reviews** и **Installs** сильно коррелируют между собой, поэтому можно оставить только один **- Installs**