```
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  "group": "ИУ5-62Б",
  "kernelspec": {
    "name": "python3",
    "display_name": "Python 3 (ipykernel)",
    "language": "python"
  },
  "language_info": {
    "name": "python",
    "version": "3.9.7",
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    "codemirror_mode": {
      "name": "ipython",
      "version": 3
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    "pygments_lexer": "ipython3",
    "nbconvert_exporter": "python",
    "file_extension": ".py"
  },
  "title": "РК№1"
  "Вариант": "1"
}
```

```python
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style="ticks")
data_url = "http://lib.stat.cmu.edu/datasets/boston"
raw_df = pd.read_csv(data_url, sep="\s+", skiprows=22, header=None)
data = np.hstack([raw_df.values[::2, :], raw_df.values[1::2, :2]])
target = raw_df.values[1::2, 2]
```

```python
raw_df.rename(columns={0: 'CRIM'}, inplace=True)
raw_df.rename(columns={1: 'ZN'}, inplace=True)
raw_df.rename(columns={2: 'INDUS'}, inplace=True)
raw_df.rename(columns={3: 'CHAS'}, inplace=True)
raw_df.rename(columns={4: 'NOX'}, inplace=True)
raw_df.rename(columns={5: 'RM'}, inplace=True)
raw_df.rename(columns={6: 'AGE'}, inplace=True)
raw_df.rename(columns={7: 'DIS'}, inplace=True)
raw_df.rename(columns={8: 'RAD'}, inplace=True)
raw_df.rename(columns={9: 'TAX'}, inplace=True)
raw_df.rename(columns={10: 'PTRATIO'}, inplace=True)
```

```
# Первые 5 строк датасета
raw_df.head()
```

```
        CRIM     ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD
TAX  \
0    0.00632  18.00   2.31   0.0  0.538  6.575  65.2  4.0900  1.0
296.0
1  396.90000   4.98  24.00   NaN    NaN    NaN   NaN     NaN  NaN
NaN
2    0.02731   0.00   7.07   0.0  0.469  6.421  78.9  4.9671  2.0
242.0
3  396.90000   9.14  21.60   NaN    NaN    NaN   NaN     NaN  NaN
NaN
4    0.02729   0.00   7.07   0.0  0.469  7.185  61.1  4.9671  2.0
242.0

   PTRATIO
0     15.3
1      NaN
2     17.8
3      NaN
4     17.8
```

```
# Размер датасета - 1012 строк, 11 колонок
raw_df.shape
```

```
(1012, 11)
```

```
total_count = raw_df.shape[0]
print('Всего строк: {}'.format(total_count))
```

```
Всего строк: 1012
```

```
# Список колонок
raw_df.columns
```

```
Index(['CRIM', 'ZN', 'INDUS', 'CHAS', 'NOX', 'RM', 'AGE', 'DIS',
'RAD', 'TAX',
       'PTRATIO'],
      dtype='object')
```

```
# Проверим наличие пустых значений
# Цикл по колонкам датасета
for col in raw_df.columns:
    # Количество пустых значений - все значения заполнены
    temp_null_count = raw_df[raw_df[col].isnull()].shape[0]
    print('{} - {}'.format(col, temp_null_count))
```

```
CRIM - 0
ZN - 0
INDUS - 0
CHAS - 506
```

```
NOX - 506
RM - 506
AGE - 506
DIS - 506
RAD - 506
TAX - 506
PTRATIO - 506
```

```
# Список колонок с типами данных
raw_df.dtypes
```

```
CRIM       float64
ZN         float64
INDUS      float64
CHAS       float64
NOX        float64
RM         float64
AGE        float64
DIS        float64
RAD        float64
TAX        float64
PTRATIO    float64
dtype: object
```

```
raw_df.describe()
```

```
              CRIM           ZN        INDUS        CHAS
NOX  \
count  1012.000000  1012.000000  1012.000000  506.000000  506.000000

mean    180.143778    12.008350    16.834792    0.069170    0.554695

std     188.132839    17.250728     9.912616    0.253994    0.115878

min       0.006320     0.000000     0.460000    0.000000    0.385000

25%       0.257830     0.000000     8.375000    0.000000    0.449000

50%      24.021000     7.240000    18.100000    0.000000    0.538000

75%     391.435000    16.780000    21.890000    0.000000    0.624000

max     396.900000   100.000000    50.000000    1.000000    0.871000


               RM         AGE         DIS         RAD         TAX
PTRATIO
count  506.000000  506.000000  506.000000  506.000000  506.000000
506.000000
mean     6.284634   68.574901    3.795043    9.549407  408.237154
```

```
18.455534
std      0.702617   28.148861    2.105710    8.707259  168.537116
2.164946
min      3.561000    2.900000    1.129600    1.000000  187.000000
12.600000
25%      5.885500   45.025000    2.100175    4.000000  279.000000
17.400000
50%      6.208500   77.500000    3.207450    5.000000  330.000000
19.050000
75%      6.623500   94.075000    5.188425   24.000000  666.000000
20.200000
max      8.780000  100.000000   12.126500   24.000000  711.000000
22.000000
```

```
# Определим уникальные значения для целевого признака
raw_df['TAX'].unique()
```

```
array([296.,  nan, 242., 222., 311., 307., 279., 252., 233., 243.,
469.,
       226., 313., 256., 284., 216., 337., 345., 305., 398., 281.,
247.,
       270., 276., 384., 432., 188., 437., 403., 193., 265., 255.,
329.,
       402., 348., 224., 277., 300., 330., 315., 244., 264., 223.,
254.,
       198., 285., 241., 293., 245., 289., 358., 304., 287., 430.,
422.,
       370., 352., 351., 280., 335., 411., 187., 334., 666., 711.,
391.,
       273.])
```

```
# Удаление строк, содержащих пустые значения
raw_df_2 = raw_df.dropna(axis=0, how='any')
(raw_df.shape, raw_df_2.shape)
```

```
((1012, 11), (506, 11))
```

```
raw_df_2.head()
```

```
      CRIM    ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD    TAX
PTRATIO
0  0.00632  18.0   2.31   0.0  0.538  6.575  65.2  4.0900  1.0  296.0
15.3
2  0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671  2.0  242.0
17.8
4  0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671  2.0  242.0
17.8
6  0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622  3.0  222.0
18.7
8  0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622  3.0  222.0
18.7
```

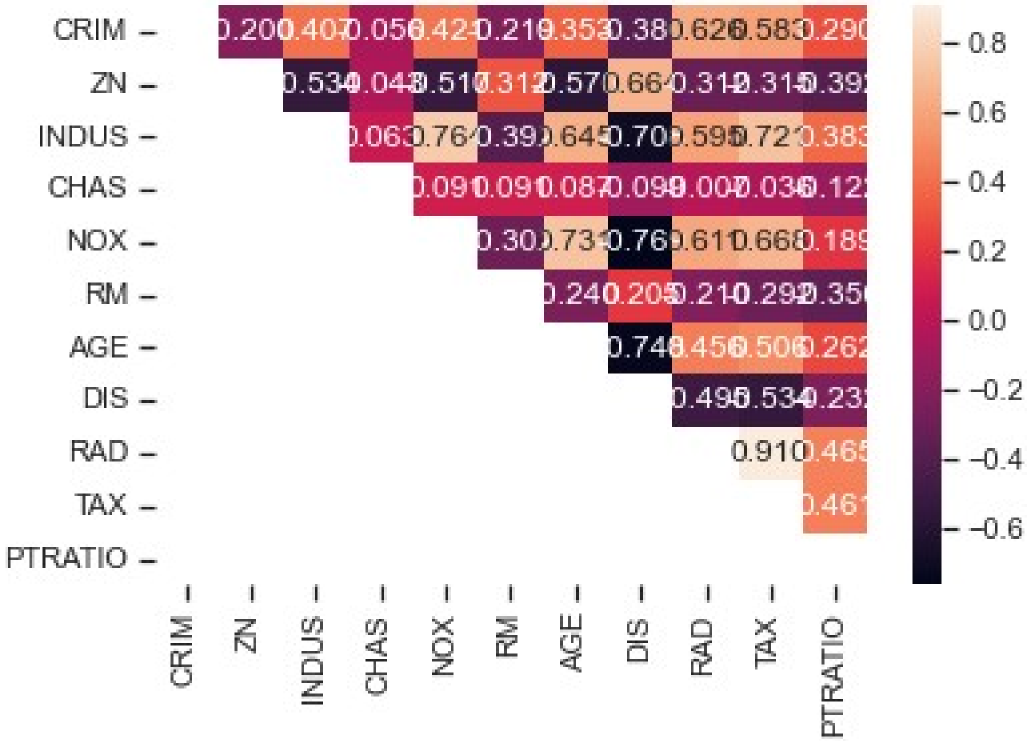
```python
# Проверим наличие пустых значений
# Цикл по колонкам датасета
for col in raw_df_2.columns:
    # Количество пустых значений - все значения заполнены
    temp_null_count = raw_df_2[raw_df_2[col].isnull()].shape[0]
    print('{} - {}'.format(col, temp_null_count))
```

```
CRIM - 0
ZN - 0
INDUS - 0
CHAS - 0
NOX - 0
RM - 0
AGE - 0
DIS - 0
RAD - 0
TAX - 0
PTRATIO - 0
```

```python
# Вывод значений в ячейках
mask = np.zeros_like(raw_df_2.corr(), dtype=np.bool)
mask[np.tril_indices_from(mask)] = True
sns.heatmap(raw_df_2.corr(), mask=mask, annot=True, fmt='.3f')
# Как мы можем видеть RAD и TAX имеют почти прямую зависимость,
поэтому можно сделать вывод, чем выше индекс доступности
# к радиальным магистралям, тем выше полная стоимость недвижимости.
```

```
C:\Users\7272~1\AppData\Local\Temp/ipykernel_18912/3416543911.py:2:
DeprecationWarning: `np.bool` 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 the
numpy scalar type, use `np.bool_` here.
Deprecated in NumPy 1.20; for more details and guidance:
https://numpy.org/devdocs/release/1.20.0-notes.html#deprecations
  mask = np.zeros_like(raw_df_2.corr(), dtype=np.bool)
```

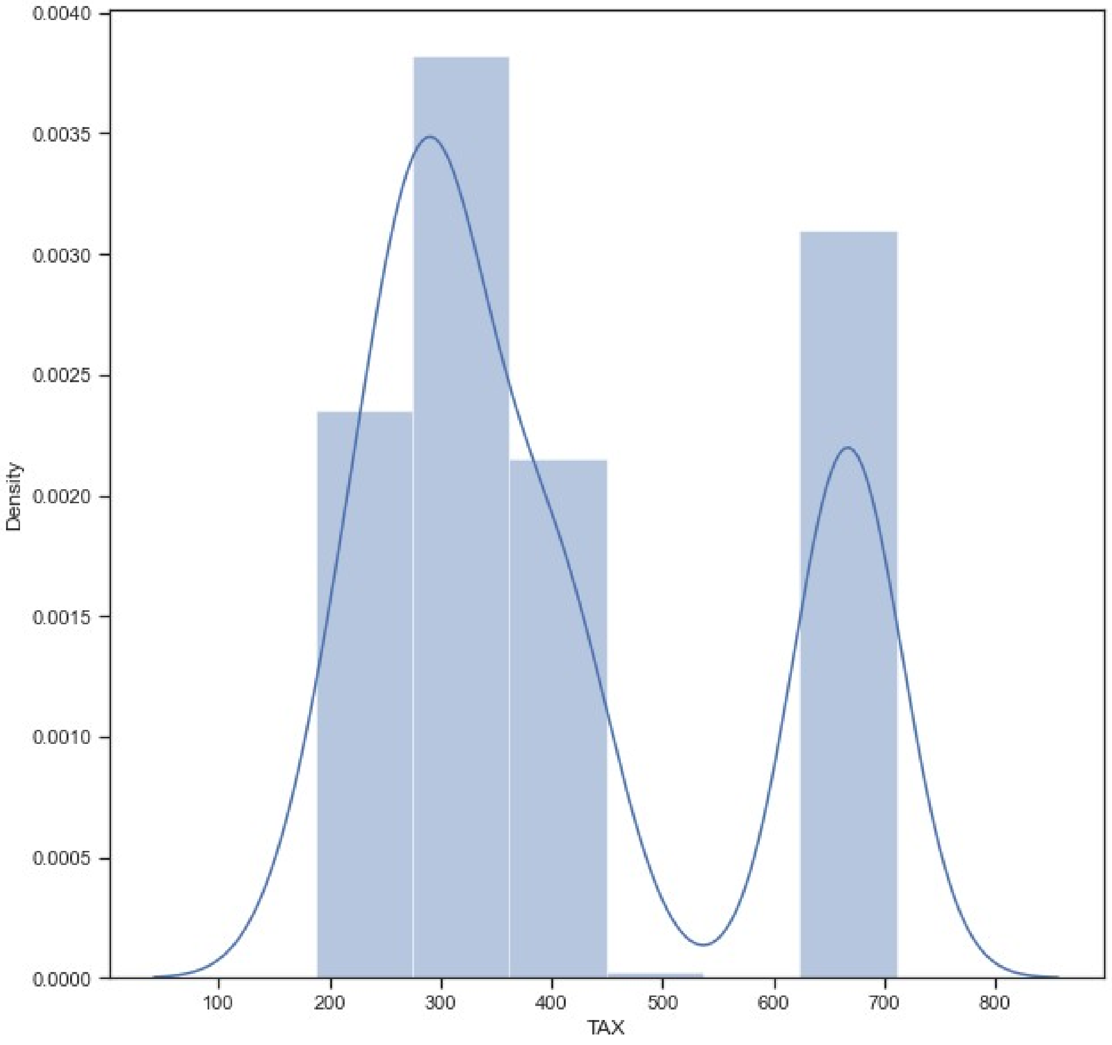
```
<AxesSubplot:>
```



```
# Гистограмма
fig, ax = plt.subplots(figsize=(10,10))
sns.distplot(raw_df['TAX'])
```

```
C:\Users\Админ\AppData\Local\Programs\Python\Python39\lib\site-packages\seaborn\distributions.py:2619: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)

<AxesSubplot:xlabel='TAX', ylabel='Density'>
```


0.0040
0.0035
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
Density
100
200
300
400
500
600
700
800
TAX