Московский государственный технический университет им. Н.Э. Баумана
Кафедра «Системы обработки информации и управления»

Лабораторная работа №1
по дисциплине
«Методы машинного обучения»
на тему
«Разведочный анализ данных. Исследование и визуализация данных»

Выполнил:
студент группы ИУ5-24М
Мельников К. И.

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1. Цель лабораторной работы

Изучение различных методов визуализация данных.

2. Задание

Выбрать набор данных (датасет).
Для лабораторных работ не рекомендуется выбирать датасеты большого размера.
Создать ноутбук, который содержит следующие разделы:

- Текстовое описание выбранного Вами набора данных.
- Основные характеристики датасета.
- Визуальное исследование датасета.
- Информация о корреляции признаков.

3. Ход работы

```
In [1]: import pandas as pd
        import seaborn as sn

In [2]: dt = pd.read_csv('StudentsPerformance.csv', header=0)

In [5]: dt
```

Out[5]:

	gender	race/ethnicity	parental level of education	lunch	\
0	female	group B	bachelor's degree	standard	
1	female	group C	some college	standard	
2	female	group B	master's degree	standard	
3	male	group A	associate's degree	free/reduced	
4	male	group C	some college	standard	
5	female	group B	associate's degree	standard	
6	female	group B	some college	standard	
7	male	group B	some college	free/reduced	
8	male	group D	high school	free/reduced	
9	female	group B	high school	free/reduced	
10	male	group C	associate's degree	standard	
11	male	group D	associate's degree	standard	
12	female	group B	high school	standard	
13	male	group A	some college	standard	
14	female	group A	master's degree	standard	
15	female	group C	some high school	standard	
16	male	group C	high school	standard	
17	female	group B	some high school	free/reduced	
18	male	group C	master's degree	free/reduced	
19	female	group C	associate's degree	free/reduced	
20	male	group D	high school	standard	
21	female	group B	some college	free/reduced	
22	male	group D	some college	standard	
23	female	group C	some high school	standard	
24	male	group D	bachelor's degree	free/reduced	

25	male	group A	master's degree	free/reduced	
26	male	group B	some college	standard	
27	female	group C	bachelor's degree	standard	
28	male	group C	high school	standard	
29	female	group D	master's degree	standard	
..	…	…	…	…	
970	female	group D	bachelor's degree	standard	
971	male	group C	some high school	standard	
972	female	group A	high school	free/reduced	
973	female	group D	some college	free/reduced	
974	female	group A	some college	standard	
975	female	group C	some college	standard	
976	male	group B	some college	free/reduced	
977	male	group C	associate's degree	standard	
978	male	group D	high school	standard	
979	female	group C	associate's degree	standard	
980	female	group B	high school	free/reduced	
981	male	group D	some high school	standard	
982	male	group B	some high school	standard	
983	female	group A	some college	standard	
984	female	group C	some high school	standard	
985	male	group A	high school	standard	
986	female	group C	associate's degree	standard	
987	male	group E	some high school	standard	
988	female	group A	some high school	free/reduced	
989	female	group D	some college	free/reduced	
990	male	group E	high school	free/reduced	
991	female	group B	some high school	standard	
992	female	group D	associate's degree	free/reduced	
993	female	group D	bachelor's degree	free/reduced	
994	male	group A	high school	standard	
995	female	group E	master's degree	standard	
996	male	group C	high school	free/reduced	
997	female	group C	high school	free/reduced	
998	female	group D	some college	standard	
999	female	group D	some college	free/reduced	

	test preparation course	math score	reading score	writing score
0	none	72	72	74
1	completed	69	90	88
2	none	90	95	93
3	none	47	57	44
4	none	76	78	75
5	none	71	83	78
6	completed	88	95	92
7	none	40	43	39
8	completed	64	64	67
9	none	38	60	50
10	none	58	54	52
11	none	40	52	43

12	none	65	81	73
13	completed	78	72	70
14	none	50	53	58
15	none	69	75	78
16	none	88	89	86
17	none	18	32	28
18	completed	46	42	46
19	none	54	58	61
20	none	66	69	63
21	completed	65	75	70
22	none	44	54	53
23	none	69	73	73
24	completed	74	71	80
25	none	73	74	72
26	none	69	54	55
27	none	67	69	75
28	none	70	70	65
29	none	62	70	75
..	…	…	…	…
970	none	89	100	100
971	completed	78	72	69
972	completed	53	50	60
973	none	49	65	61
974	none	54	63	67
975	completed	64	82	77
976	completed	60	62	60
977	none	62	65	58
978	completed	55	41	48
979	none	91	95	94
980	none	8	24	23
981	none	81	78	78
982	completed	79	85	86
983	completed	78	87	91
984	none	74	75	82
985	none	57	51	54
986	none	40	59	51
987	completed	81	75	76
988	none	44	45	45
989	completed	67	86	83
990	completed	86	81	75
991	completed	65	82	78
992	none	55	76	76
993	none	62	72	74
994	none	63	63	62
995	completed	88	99	95
996	none	62	55	55
997	completed	59	71	65
998	completed	68	78	77
999	none	77	86	86

```
        [1000 rows x 8 columns]
```

```
In [52]: dt.shape
```

```
Out[52]: (1000, 13)
```

```
In [7]: dt.dtypes
```

```
Out[7]: gender                         object
        race/ethnicity                 object
        parental level of education    object
        lunch                          object
        test preparation course        object
        math score                      int64
        reading score                   int64
        writing score                   int64
        dtype: object
```

```
In [17]: dt.describe()
```

```
Out[17]:        math score  reading score  writing score   gender_cat
         count  1000.00000    1000.000000    1000.000000  1000.000000
         mean     66.08900      69.169000      68.054000     0.482000
         std      15.16308      14.600192      15.195657     0.499926
         min       0.00000      17.000000      10.000000     0.000000
         25%      57.00000      59.000000      57.750000     0.000000
         50%      66.00000      70.000000      69.000000     0.000000
         75%      77.00000      79.000000      79.000000     1.000000
         max     100.00000     100.000000     100.000000     1.000000
```

```
In [12]: dt['gender'] = dt['gender'].astype('category')
         dt['race/ethnicity'] = dt['race/ethnicity'].astype('category')
         dt['parental level of education'] = dt['parental level of education'].as
         dt['test preparation course'] = dt['test preparation course'].astype('ca
         dt['lunch'] = dt['lunch'].astype('category')
```

```
In [18]: dt['gender_cat'] = dt['gender'].cat.codes
         dt['race/ethnicity_cat'] = dt['race/ethnicity'].cat.codes
         dt['parental level of education_cat'] = dt['parental level of education'
         dt['test preparation course_cat'] = dt['test preparation course'].cat.co
         dt['lunch_cat'] = dt['lunch'].cat.codes
```

```
In [19]: dt.describe()
```

```
Out[19]:        math score  reading score  writing score   gender_cat  \
         count  1000.00000    1000.000000    1000.000000  1000.000000
         mean     66.08900      69.169000      68.054000     0.482000
         std      15.16308      14.600192      15.195657     0.499926
         min       0.00000      17.000000      10.000000     0.000000
         25%      57.00000      59.000000      57.750000     0.000000
         50%      66.00000      70.000000      69.000000     0.000000
         75%      77.00000      79.000000      79.000000     1.000000
```

```
max     100.00000     100.000000     100.000000     1.000000

       race/ethnicity_cat  parental level of education_cat  \
count         1000.000000                      1000.000000
mean             2.174000                         2.486000
std              1.157179                         1.829522
min              0.000000                         0.000000
25%              1.000000                         1.000000
50%              2.000000                         2.000000
75%              3.000000                         4.000000
max              4.000000                         5.000000

       test preparation course_cat    lunch_cat
count                  1000.000000  1000.000000
mean                      0.642000     0.645000
std                       0.479652     0.478753
min                       0.000000     0.000000
25%                       0.000000     0.000000
50%                       1.000000     1.000000
75%                       1.000000     1.000000
max                       1.000000     1.000000
```

In [20]: dt

Out[20]:

	gender	race/ethnicity	parental level of education	lunch	\
0	female	group B	bachelor's degree	standard	
1	female	group C	some college	standard	
2	female	group B	master's degree	standard	
3	male	group A	associate's degree	free/reduced	
4	male	group C	some college	standard	
5	female	group B	associate's degree	standard	
6	female	group B	some college	standard	
7	male	group B	some college	free/reduced	
8	male	group D	high school	free/reduced	
9	female	group B	high school	free/reduced	
10	male	group C	associate's degree	standard	
11	male	group D	associate's degree	standard	
12	female	group B	high school	standard	
13	male	group A	some college	standard	
14	female	group A	master's degree	standard	
15	female	group C	some high school	standard	
16	male	group C	high school	standard	
17	female	group B	some high school	free/reduced	
18	male	group C	master's degree	free/reduced	
19	female	group C	associate's degree	free/reduced	
20	male	group D	high school	standard	
21	female	group B	some college	free/reduced	
22	male	group D	some college	standard	
23	female	group C	some high school	standard	
24	male	group D	bachelor's degree	free/reduced	
25	male	group A	master's degree	free/reduced	

```
26     male        group B           some college      standard
27   female        group C        bachelor's degree    standard
28     male        group C             high school     standard
29   female        group D          master's degree    standard
..      …            …                    …              …
970  female        group D        bachelor's degree    standard
971    male        group C         some high school    standard
972  female        group A             high school free/reduced
973  female        group D           some college free/reduced
974  female        group A           some college    standard
975  female        group C           some college    standard
976    male        group B           some college free/reduced
977    male        group C       associate's degree    standard
978    male        group D             high school     standard
979  female        group C       associate's degree    standard
980  female        group B             high school free/reduced
981    male        group D         some high school    standard
982    male        group B         some high school    standard
983  female        group A           some college    standard
984  female        group C         some high school    standard
985    male        group A             high school     standard
986  female        group C       associate's degree    standard
987    male        group E         some high school    standard
988  female        group A         some high school free/reduced
989  female        group D           some college free/reduced
990    male        group E             high school free/reduced
991  female        group B         some high school    standard
992  female        group D       associate's degree free/reduced
993  female        group D        bachelor's degree free/reduced
994    male        group A             high school     standard
995  female        group E          master's degree    standard
996    male        group C             high school free/reduced
997  female        group C             high school free/reduced
998  female        group D           some college    standard
999  female        group D           some college free/reduced

    test preparation course  math score  reading score  writing score  \
0                      none          72             72             74
1                 completed          69             90             88
2                      none          90             95             93
3                      none          47             57             44
4                      none          76             78             75
5                      none          71             83             78
6                 completed          88             95             92
7                      none          40             43             39
8                 completed          64             64             67
9                      none          38             60             50
10                     none          58             54             52
11                     none          40             52             43
12                     none          65             81             73
```

```
13                completed          78             72             70
14                     none          50             53             58
15                     none          69             75             78
16                     none          88             89             86
17                     none          18             32             28
18                completed          46             42             46
19                     none          54             58             61
20                     none          66             69             63
21                completed          65             75             70
22                     none          44             54             53
23                     none          69             73             73
24                completed          74             71             80
25                     none          73             74             72
26                     none          69             54             55
27                     none          67             69             75
28                     none          70             70             65
29                     none          62             70             75
..                      …             …              …              …
970                    none          89            100            100
971               completed          78             72             69
972               completed          53             50             60
973                    none          49             65             61
974                    none          54             63             67
975               completed          64             82             77
976               completed          60             62             60
977                    none          62             65             58
978               completed          55             41             48
979                    none          91             95             94
980                    none           8             24             23
981                    none          81             78             78
982               completed          79             85             86
983               completed          78             87             91
984                    none          74             75             82
985                    none          57             51             54
986                    none          40             59             51
987               completed          81             75             76
988                    none          44             45             45
989               completed          67             86             83
990               completed          86             81             75
991               completed          65             82             78
992                    none          55             76             76
993                    none          62             72             74
994                    none          63             63             62
995               completed          88             99             95
996                    none          62             55             55
997               completed          59             71             65
998               completed          68             78             77
999                    none          77             86             86

     gender_cat  race/ethnicity_cat  parental level of education_cat  \
```

0	0	1	1
1	0	2	4
2	0	1	3
3	1	0	0
4	1	2	4
5	0	1	0
6	0	1	4
7	1	1	4
8	1	3	2
9	0	1	2
10	1	2	0
11	1	3	0
12	0	1	2
13	1	0	4
14	0	0	3
15	0	2	5
16	1	2	2
17	0	1	5
18	1	2	3
19	0	2	0
20	1	3	2
21	0	1	4
22	1	3	4
23	0	2	5
24	1	3	1
25	1	0	3
26	1	1	4
27	0	2	1
28	1	2	2
29	0	3	3
..	…	…	…
970	0	3	1
971	1	2	5
972	0	0	2
973	0	3	4
974	0	0	4
975	0	2	4
976	1	1	4
977	1	2	0
978	1	3	2
979	0	2	0
980	0	1	2
981	1	3	5
982	1	1	5
983	0	0	4
984	0	2	5
985	1	0	2
986	0	2	0
987	1	4	5
988	0	0	5

989	0	3	4
990	1	4	2
991	0	1	5
992	0	3	0
993	0	3	1
994	1	0	2
995	0	4	3
996	1	2	2
997	0	2	2
998	0	3	4
999	0	3	4

	test preparation	course_cat	lunch_cat
0		1	1
1		0	1
2		1	1
3		1	0
4		1	1
5		1	1
6		0	1
7		1	0
8		0	0
9		1	0
10		1	1
11		1	1
12		1	1
13		0	1
14		1	1
15		1	1
16		1	1
17		1	0
18		0	0
19		1	0
20		1	1
21		0	0
22		1	1
23		1	1
24		0	0
25		1	0
26		1	1
27		1	1
28		1	1
29		1	1
..		…	…
970		1	1
971		0	1
972		0	0
973		1	0
974		1	1
975		0	1

```
976                                 0          0
977                                 1          1
978                                 0          1
979                                 1          1
980                                 1          0
981                                 1          1
982                                 0          1
983                                 0          1
984                                 1          1
985                                 1          1
986                                 1          1
987                                 0          1
988                                 1          0
989                                 0          0
990                                 0          0
991                                 0          1
992                                 1          0
993                                 1          0
994                                 1          1
995                                 0          1
996                                 1          0
997                                 0          0
998                                 0          1
999                                 1          0

[1000 rows x 13 columns]
```

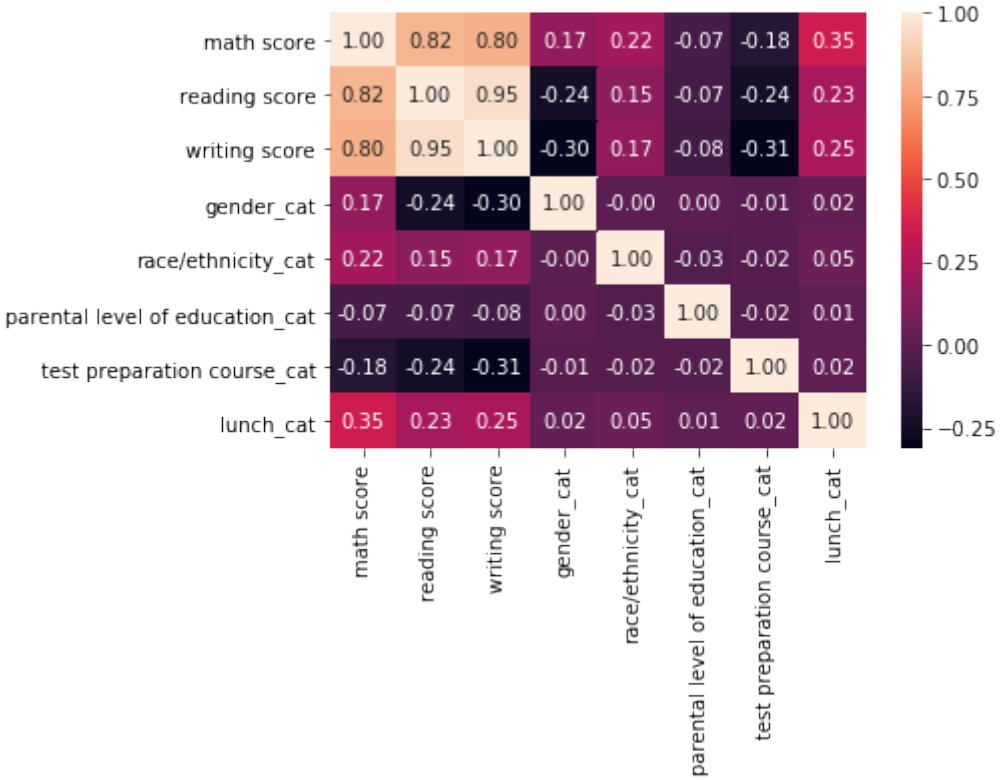
In [22]:
```
dt.corr()
```

Out[22]:
```
                                   math score  reading score  writing score
math score                           1.000000       0.817580       0.802642
reading score                        0.817580       1.000000       0.954598
writing score                        0.802642       0.954598       1.000000
gender_cat                           0.167982      -0.244313      -0.301225
race/ethnicity_cat                   0.216415       0.145253       0.165691
parental level of education_cat     -0.068279      -0.072444      -0.084299
test preparation course_cat         -0.177702      -0.241780      -0.312946
lunch_cat                            0.350877       0.229560       0.245769

                                   gender_cat  race/ethnicity_cat  \
math score                           0.167982            0.216415
reading score                       -0.244313            0.145253
writing score                       -0.301225            0.165691
gender_cat                           1.000000           -0.001502
race/ethnicity_cat                  -0.001502            1.000000
parental level of education_cat      0.001913           -0.031946
test preparation course_cat         -0.006028           -0.017508
lunch_cat                            0.021372            0.046563

                                   parental level of education_cat  \
math score                                               -0.068279
```

```
reading score                                -0.072444
writing score                                -0.084299
gender_cat                                    0.001913
race/ethnicity_cat                           -0.031946
parental level of education_cat               1.000000
test preparation course_cat                  -0.023968
lunch_cat                                     0.006320
```

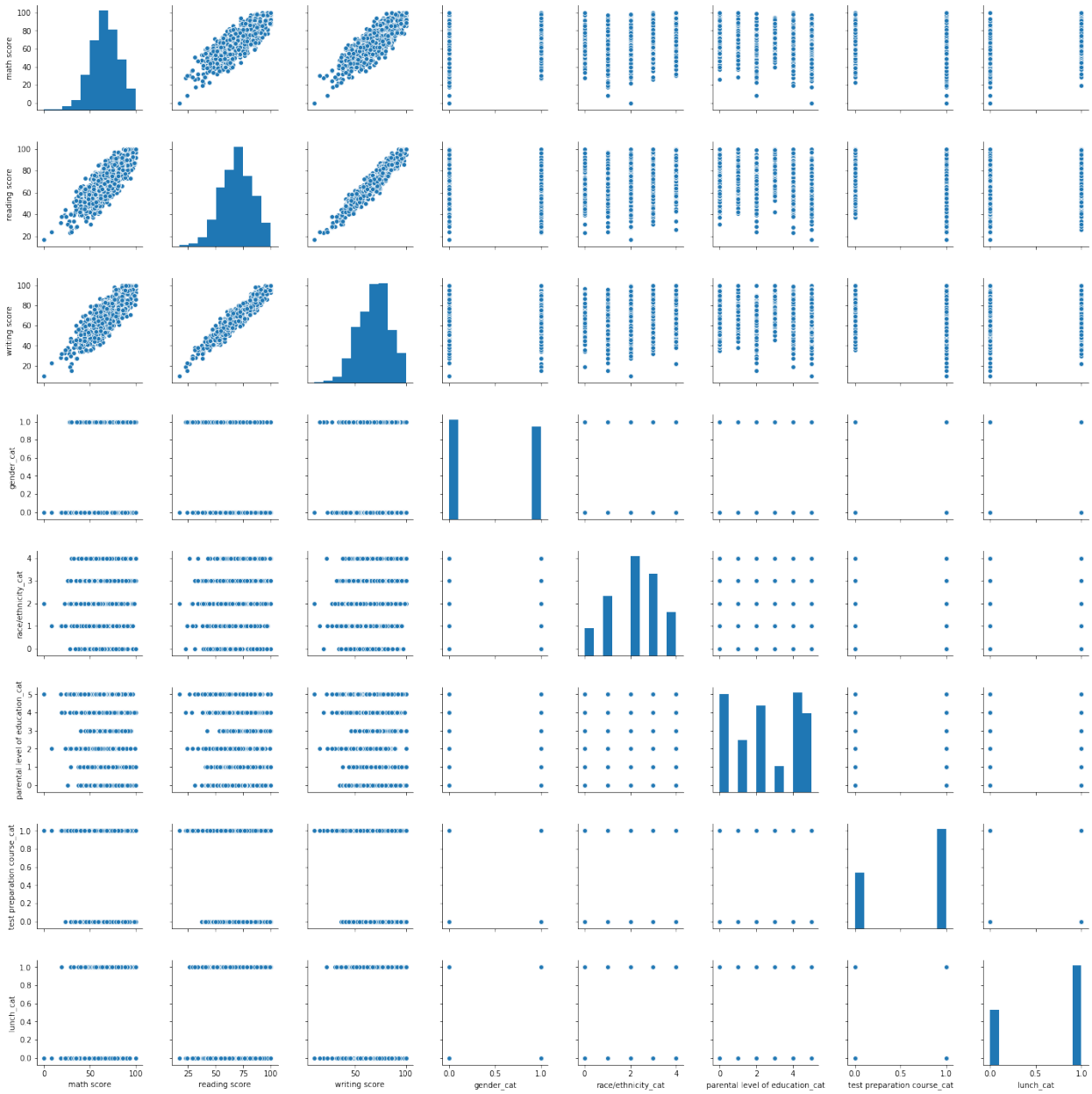
	test preparation course_cat	lunch_cat
math score	-0.177702	0.350877
reading score	-0.241780	0.229560
writing score	-0.312946	0.245769
gender_cat	-0.006028	0.021372
race/ethnicity_cat	-0.017508	0.046563
parental level of education_cat	-0.023968	0.006320
test preparation course_cat	1.000000	0.017044
lunch_cat	0.017044	1.000000

In [25]:
```
sn.heatmap(data=dt.corr(), annot=True, fmt='.2f');
```



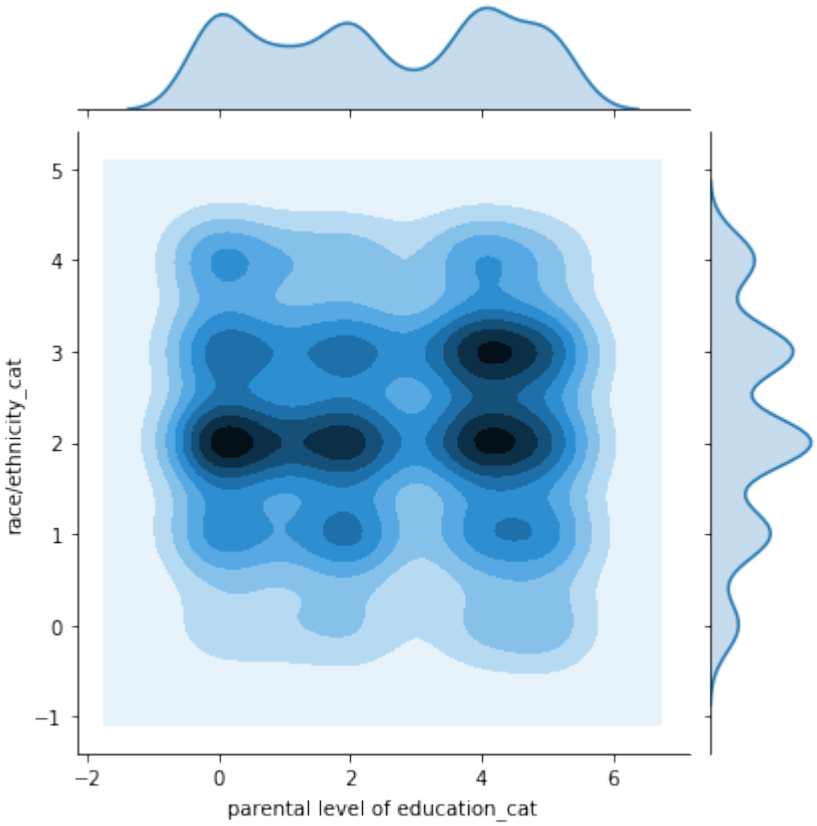
In [27]:
```
sn.pairplot(dt)
```

Out[27]: <seaborn.axisgrid.PairGrid at 0x7f012746ea20>



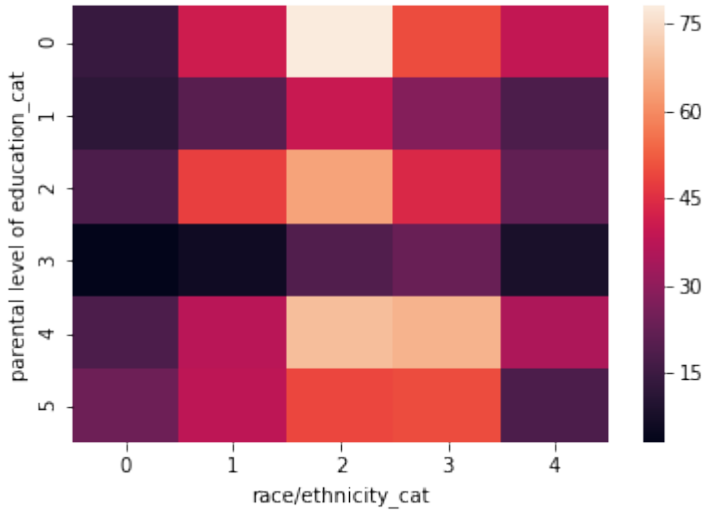
In [32]: sn.jointplot(data=dt, x='parental level of education_cat', y='race/ethnic

Out[32]: <seaborn.axisgrid.JointGrid at 0x7f01242c69e8>



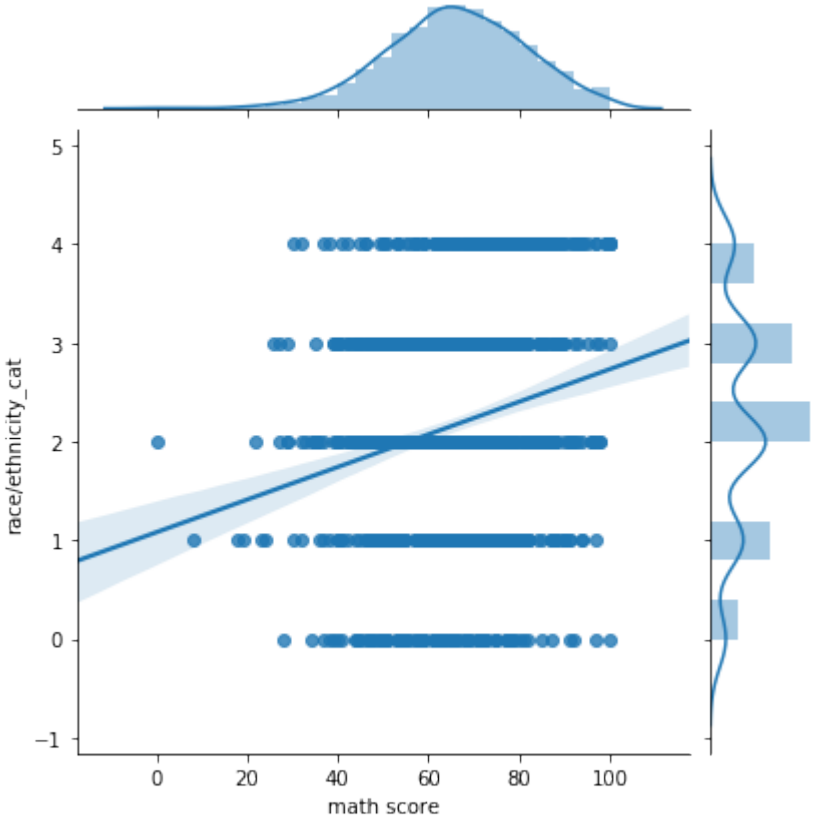
In [34]: sn.heatmap(pd.crosstab(dt['parental level of education_cat'], dt['race/et

Out[34]: <matplotlib.axes._subplots.AxesSubplot at 0x7f01241a4c50>



In [49]: sn.jointplot(data=dt, x='math score', y='race/ethnicity_cat', kind='reg'

Out[49]: <seaborn.axisgrid.JointGrid at 0x7f011c6f12e8>



In [51]: sn.lmplot(data=dt, x='math score', y='test preparation course_cat', hue=

Out[51]: <seaborn.axisgrid.FacetGrid at 0x7f011c4884a8>