МОСКОВСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ
им. Н.Э. Баумана

Кафедра «Систем обработки информации и управления»

# ОТЧЕТ

**Лабораторная работа №__1__**
по курсу «Методы машинного обучения»

Тема: «Разведочный анализ данных.
Исследование и визуализация данных.»


ИСПОЛНИТЕЛЬ: Цитульский А.М.
ФИО

группа ИУ5-21М _____
подпись

"29"___03 ____2019 г.

ПРЕПОДАВАТЕЛЬ: ___Гапанюк Ю.Е.___
ФИО

_____
подпись

"__"_____2019 г.


Москва - 2019

# Текстовое описание данных

Набор данных: https://www.kaggle.com/spscientist/students-performance-in-exams (https://www.kaggle.com/spscientist/students-performance-in-exams)

Содержит следующие колонки:

- gender - пол (М = 1, Ж = 0)
- race/ethnicity - раса (5 групп)
- parental level of education - уровень образования родителей
- lunch - обед перед тестированием ( стандарный = 1, нет/уменьшенный = 0)
- test preparation course - подготовка к тесту (завершена = 0, незавершена = 1)
- math score - балл по математике
- reading score - балл по чтению
- writing score - балл по письму

# Импорт библиотек

In [0]:
```
import numpy as np
import pandas as pd
import os
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style="ticks")
```

In [4]:
```
from google.colab import drive
drive.mount('/content/drive', force_remount=True)

os.listdir('/content/drive/My Drive/Colab Notebooks/')

# Будем анализировать данные только на обучающей выборке
data = pd.read_csv('/content/drive/My Drive/Colab Notebooks/StudentsPerformance.csv', sep=",")
```

```
Mounted at /content/drive
```

# Основные характеристики датасета

In [23]:
```
data.head()
```

Out[23]:

| | gender | race/ethnicity | parental level of education | lunch | test preparation course | math score | reading score | writing score |
|---|---|---|---|---|---|---|---|---|
| **0** | 0 | 1 | bachelor's degree | 1 | 1 | 72 | 72 | 74 |
| **1** | 0 | 2 | some college | 1 | 0 | 69 | 90 | 88 |
| **2** | 0 | 1 | master's degree | 1 | 1 | 90 | 95 | 93 |
| **3** | 1 | 0 | associate's degree | 0 | 1 | 47 | 57 | 44 |
| **4** | 1 | 2 | some college | 1 | 1 | 76 | 78 | 75 |

In [6]:
```
data.shape
```

Out[6]:
```
(1000, 8)
```

In [8]:
```
data.columns
```

Out[8]:
```
Index(['gender', 'race/ethnicity', 'parental level of education', 'lunch',
       'test preparation course', 'math score', 'reading score',
       'writing score'],
      dtype='object')
```

In [22]:
```
data.dtypes
```

Out[22]:
```
gender                         int64
race/ethnicity                 int64
parental level of education    object
lunch                          int64
test preparation course        int64
math score                     int64
reading score                  int64
writing score                  int64
dtype: object
```

In [7]:
```
# Проверим наличие пустых значений
# Цикл по колонкам датасета
for col in data.columns:
    # Количество пустых значений - все значения заполнены
    temp_null_count = data[data[col].isnull()].shape[0]
    print('{} - {}'.format(col, temp_null_count))
```

```
gender - 0
race/ethnicity - 0
parental level of education - 0
lunch - 0
test preparation course - 0
math score - 0
reading score - 0
writing score - 0
```

In [21]:
```
data['test preparation course'].unique()
```

Out[21]:
```
array([1, 0])
```

In [0]:
```
from sklearn.preprocessing import LabelEncoder
labelencoder = LabelEncoder()
data['race/ethnicity'] = labelencoder.fit_transform(data['race/ethnicity'])
data['gender'] = labelencoder.fit_transform(data['gender'])
data['lunch'] = labelencoder.fit_transform(data['lunch'])
data['test preparation course'] = labelencoder.fit_transform(data['test preparati
on course'])
```

In [24]:
```
# Основные статистические характеристки набора данных
data.describe()
```

Out[24]:

| | gender | race/ethnicity | lunch | test preparation course | math score | reading score | writing score |
|---|---|---|---|---|---|---|---|
| **count** | 1000.000000 | 1000.000000 | 1000.000000 | 1000.000000 | 1000.00000 | 1000.000000 | 1000.000000 |
| **mean** | 0.482000 | 2.174000 | 0.645000 | 0.642000 | 66.08900 | 69.169000 | 68.054000 |
| **std** | 0.499926 | 1.157179 | 0.478753 | 0.479652 | 15.16308 | 14.600192 | 15.195657 |
| **min** | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.00000 | 17.000000 | 10.000000 |
| **25%** | 0.000000 | 1.000000 | 0.000000 | 0.000000 | 57.00000 | 59.000000 | 57.750000 |
| **50%** | 0.000000 | 2.000000 | 1.000000 | 1.000000 | 66.00000 | 70.000000 | 69.000000 |
| **75%** | 1.000000 | 3.000000 | 1.000000 | 1.000000 | 77.00000 | 79.000000 | 79.000000 |
| **max** | 1.000000 | 4.000000 | 1.000000 | 1.000000 | 100.00000 | 100.000000 | 100.000000 |

# Информация о корреляции признаков

In [25]:
```
data.corr()
```

Out[25]:

| | gender | race/ethnicity | lunch | test preparation course | math score | reading score | writing score |
|---|---|---|---|---|---|---|---|
| **gender** | 1.000000 | -0.001502 | 0.021372 | -0.006028 | 0.167982 | -0.244313 | -0.301225 |
| **race/ethnicity** | -0.001502 | 1.000000 | 0.046563 | -0.017508 | 0.216415 | 0.145253 | 0.165691 |
| **lunch** | 0.021372 | 0.046563 | 1.000000 | 0.017044 | 0.350877 | 0.229560 | 0.245769 |
| **test preparation course** | -0.006028 | -0.017508 | 0.017044 | 1.000000 | -0.177702 | -0.241780 | -0.312946 |
| **math score** | 0.167982 | 0.216415 | 0.350877 | -0.177702 | 1.000000 | 0.817580 | 0.802642 |
| **reading score** | -0.244313 | 0.145253 | 0.229560 | -0.241780 | 0.817580 | 1.000000 | 0.954598 |
| **writing score** | -0.301225 | 0.165691 | 0.245769 | -0.312946 | 0.802642 | 0.954598 | 1.000000 |

# Визуальное исследование датасета

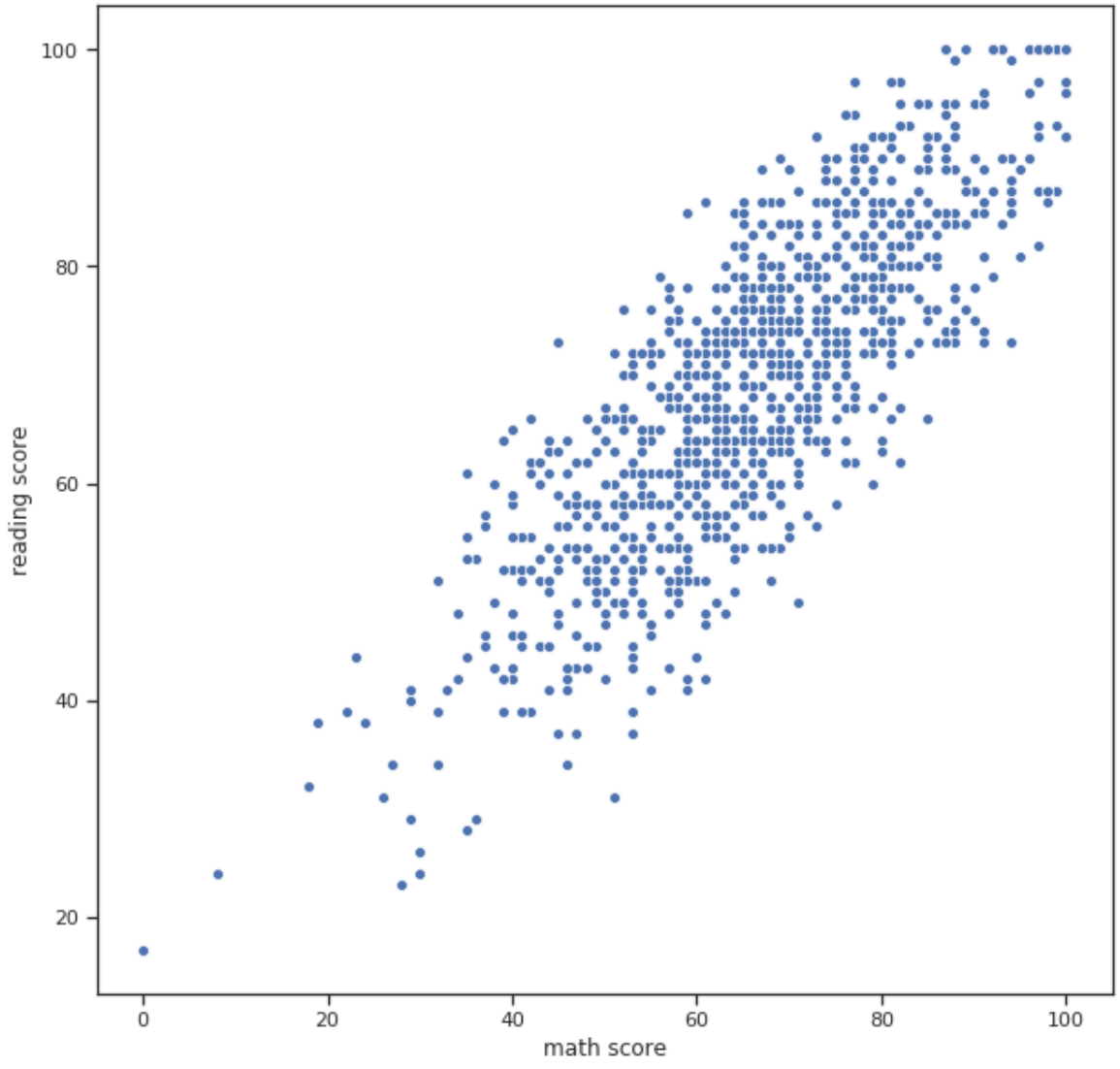
In [60]:
```
!ipython nbconvert –to pdf "/content/drive/My Drive/Colab Notebooks/LR1.ipynb"
```

```
[TerminalIPythonApp] WARNING | Subcommand `ipython nbconvert` is deprecated and
will be removed in future versions.
[TerminalIPythonApp] WARNING | You likely want to use `jupyter nbconvert` in the
future
[NbConvertApp] WARNING | pattern u'\u2014to' matched no files
[NbConvertApp] WARNING | pattern u'pdf' matched no files
[NbConvertApp] Converting notebook /content/drive/My Drive/Colab Notebooks/LR1.i
pynb to html
[NbConvertApp] Writing 1363390 bytes to /content/drive/My Drive/Colab Notebooks/
LR1.html
```

# Диаграмма рассеяния

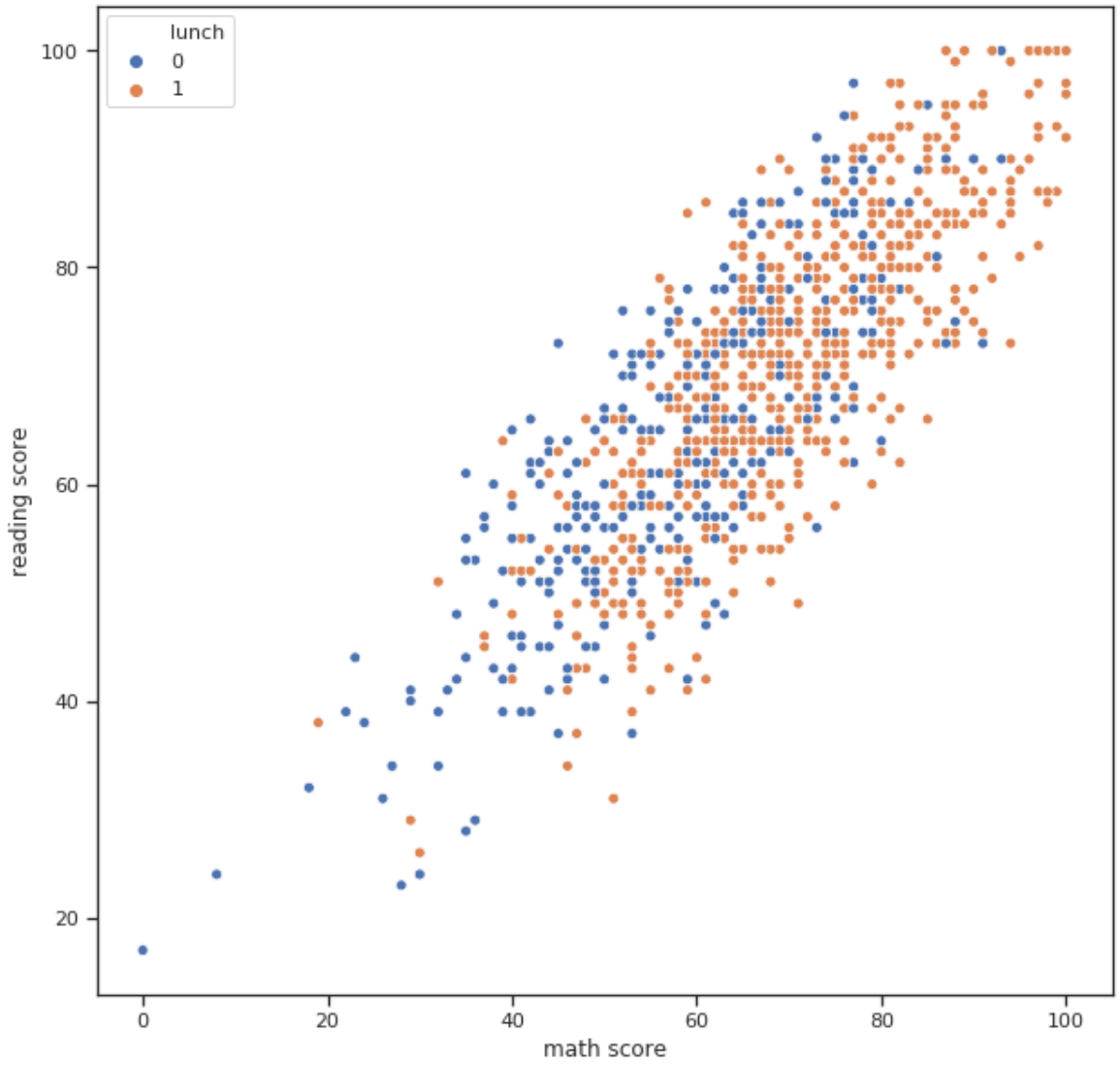
In [26]:
```
fig, ax = plt.subplots(figsize=(10,10))
sns.scatterplot(ax=ax, x='math score', y='reading score', data=data)
```

Out[26]: <matplotlib.axes._subplots.AxesSubplot at 0x7f791bcba470>



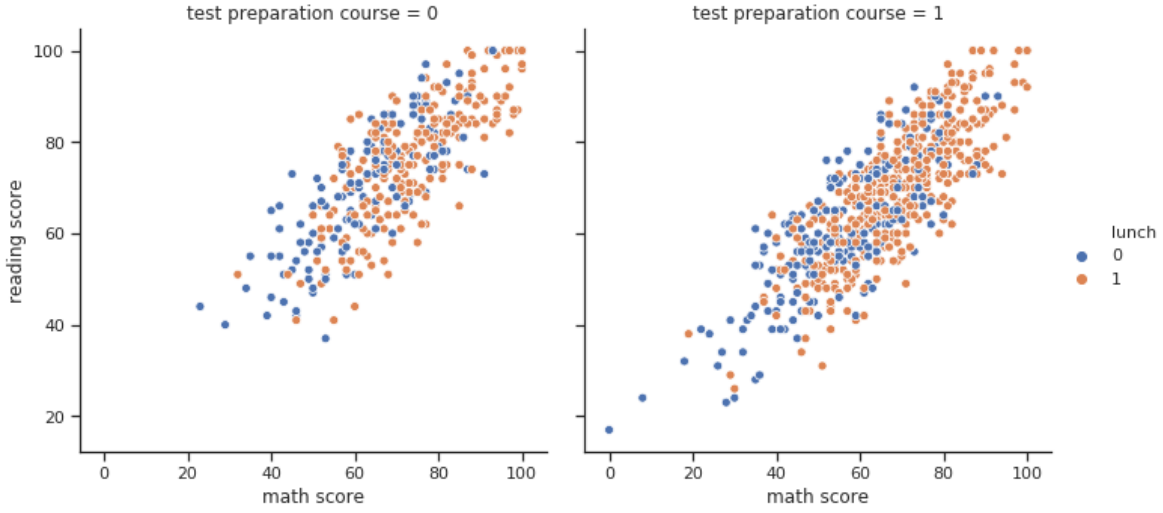
In [28]:
```
fig, ax = plt.subplots(figsize=(10,10))
sns.scatterplot(ax=ax, x='math score', y='reading score', data=data, hue = 'lunch')
```

Out[28]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7918d60fd0>
```



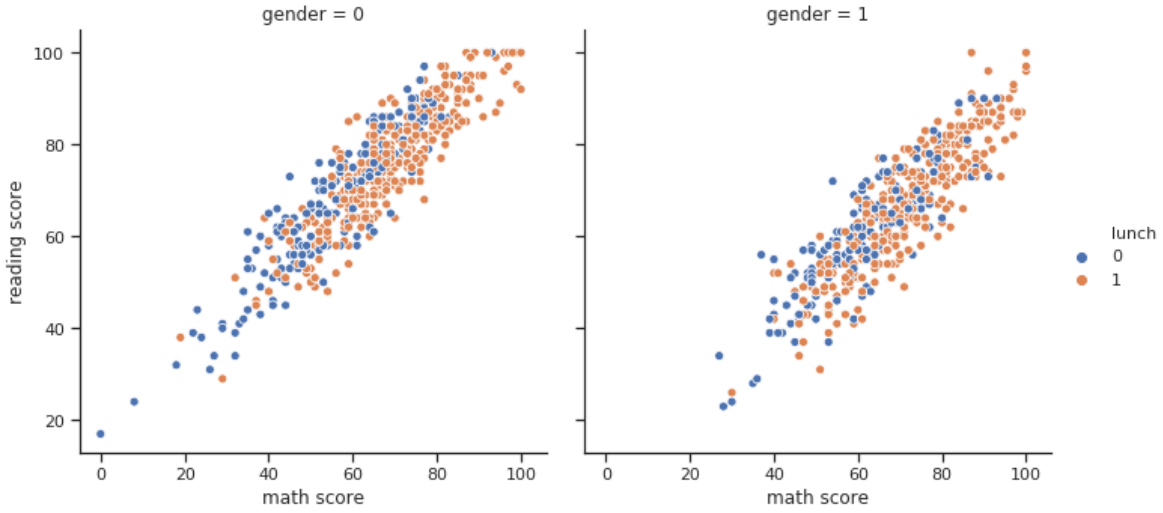

In [29]:
```
sns.relplot(x='math score', y='reading score', data=data, hue = 'lunch', col = 'test preparation course')
```

Out[29]:
```
<seaborn.axisgrid.FacetGrid at 0x7f7918bc7588>
```



In [30]:
```
sns.relplot(x='math score', y='reading score', data=data, hue = 'lunch', col = 'gender')
```

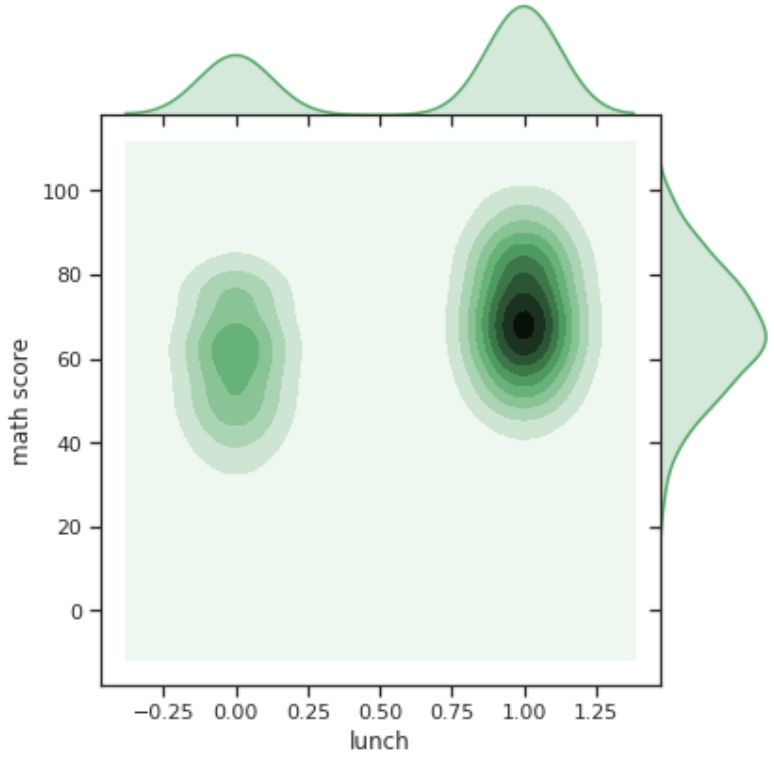
Out[30]: <seaborn.axisgrid.FacetGrid at 0x7f791728ac50>




## Jointplot

In [33]:
```
sns.jointplot(x='lunch', y='math score', data=data, kind="kde", space=0, color="g")
```

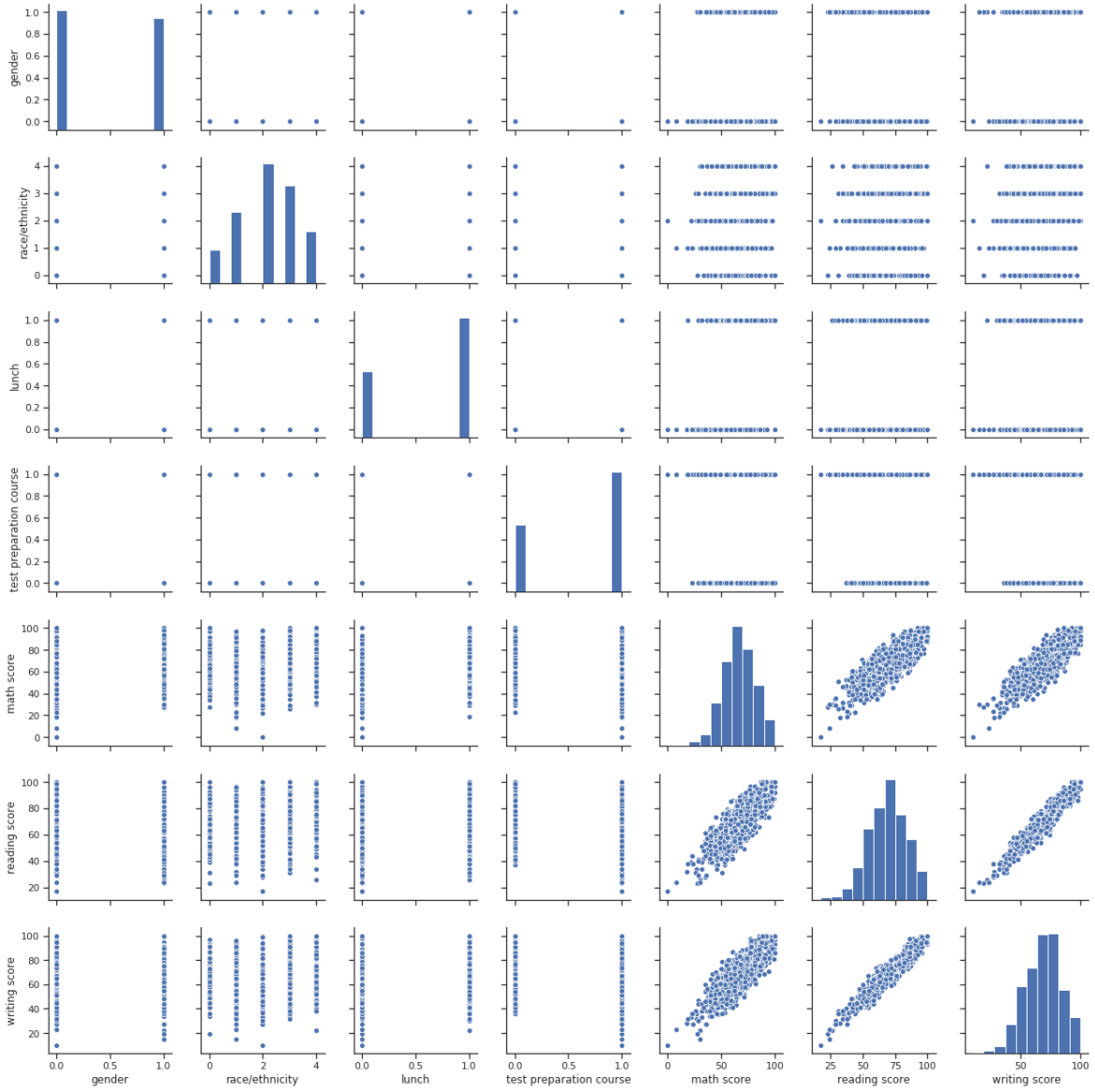
Out[33]: <seaborn.axisgrid.JointGrid at 0x7f7916f6ac50>




## Парные диаграммы

In [27]:
```
sns.pairplot(data)
```

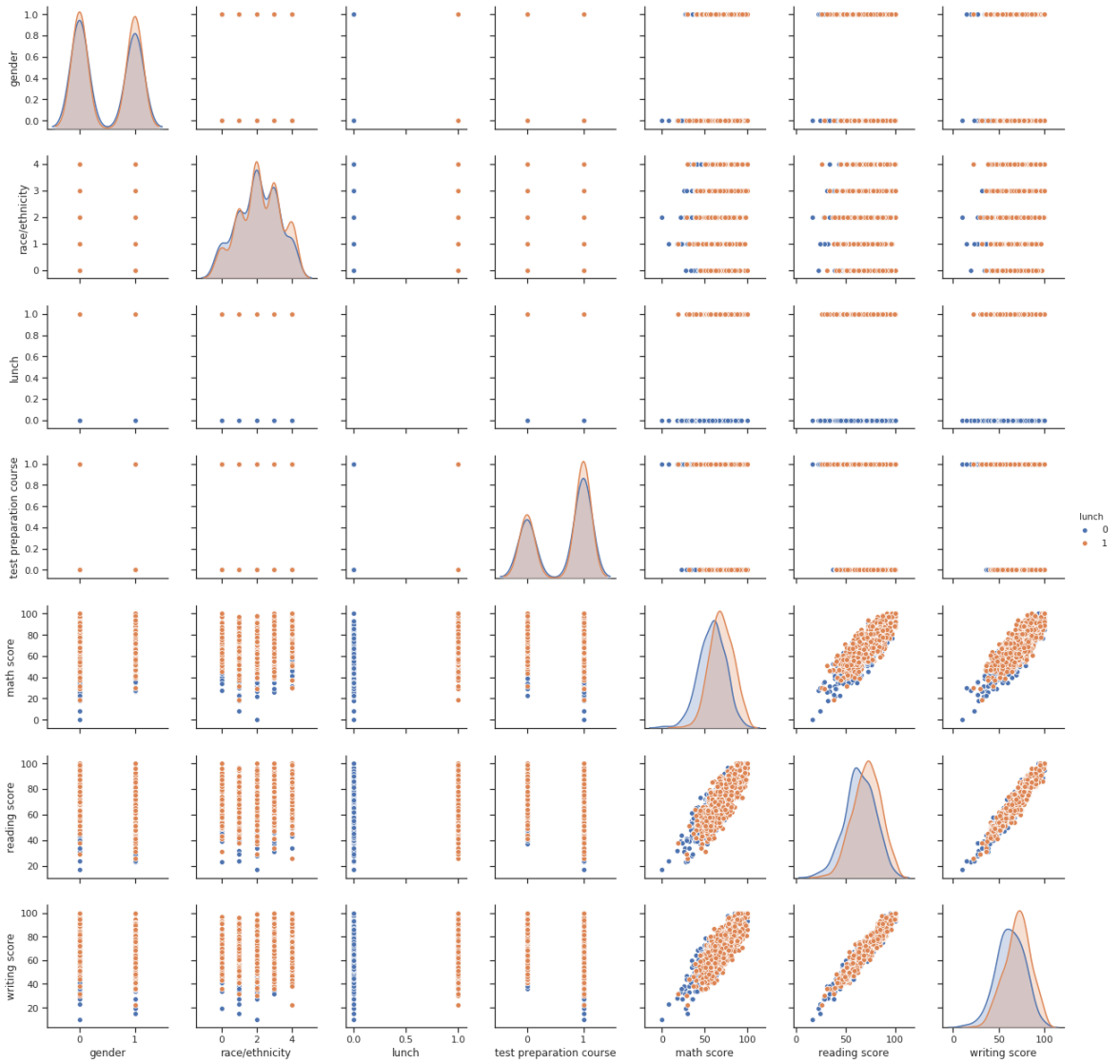
Out[27]:
```
<seaborn.axisgrid.PairGrid at 0x7f791bcfee48>
```



In [35]:
```
sns.pairplot(data, hue = "lunch")
```

```
/usr/local/lib/python3.6/dist-packages/statsmodels/nonparametric/kde.py:494: Run
timeWarning: invalid value encountered in true_divide
  binned = fast_linbin(X,a,b,gridsize)/(delta*nobs)
/usr/local/lib/python3.6/dist-packages/statsmodels/nonparametric/kdetools.py:34:
RuntimeWarning: invalid value encountered in double_scalars
  FAC1 = 2*(np.pi*bw/RANGE)**2
```

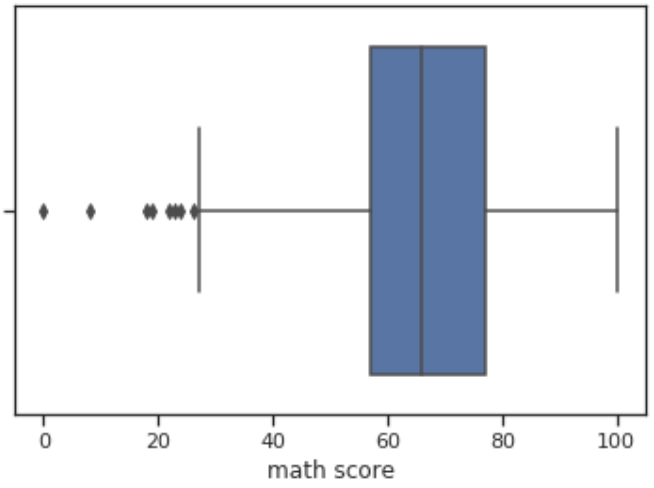
Out[35]: <seaborn.axisgrid.PairGrid at 0x7f7916e33898>




# Ящик с усами

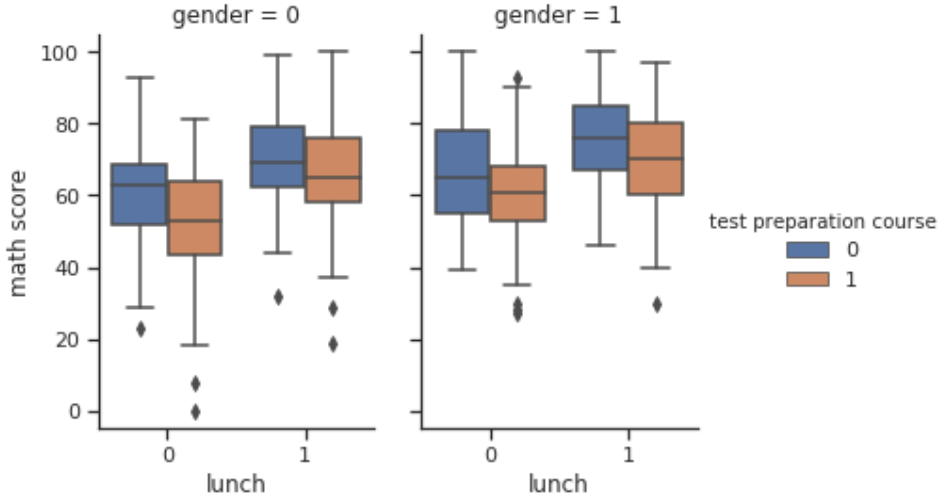
In [41]:
```
sns.boxplot(x=data['math score'])
```

Out[41]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7915b10cf8>
```




In [44]:
```
sns.catplot(x='lunch', y='math score', hue ='test preparation course', col = 'gender', data=data, kind="box", height=4, aspect=.7)
```

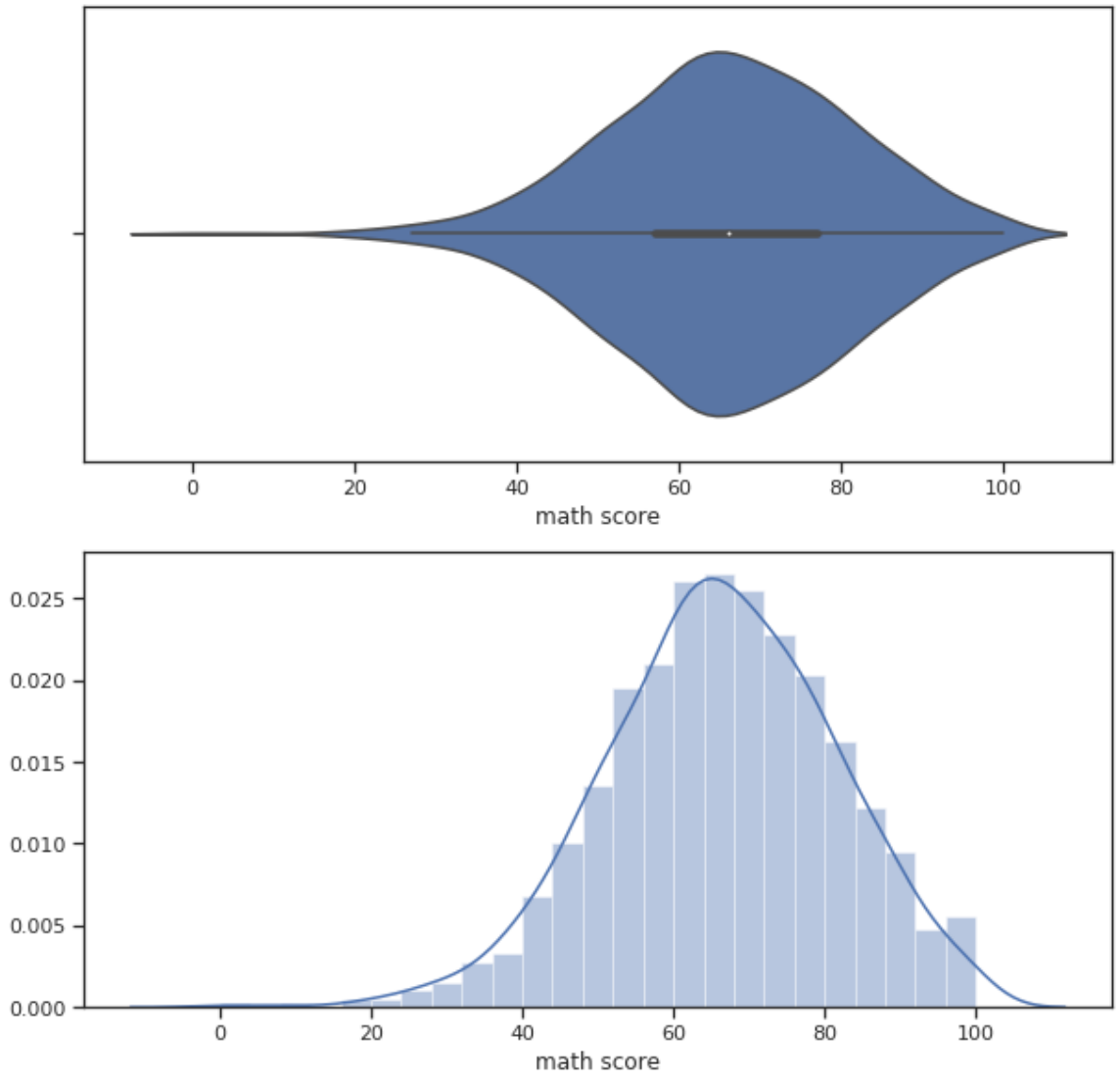
Out[44]:
```
<seaborn.axisgrid.FacetGrid at 0x7f7915a9a908>
```




# Violin plot

In [49]:
```
fig, ax = plt.subplots(2, 1, figsize=(10,10))
sns.violinplot(ax=ax[0], x='math score', data=data)
sns.distplot(data['math score'], ax=ax[1])
```

Out[49]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7f7915503cc0>
```




In [53]:
```
sns.catplot(x="lunch", y="math score", hue ='test preparation course', col = 'gender', color = 'b', data=data, kind="violin", split=True, height=4, aspect=.7);
```