ormance-screeningassessmentcohort3

June 30, 2023

#Libraries

```
[1]: import pandas as pd #importing panda as pd
     from scipy.stats import ttest_ind # for t-test
     import matplotlib.pyplot as plt # for plotting (like bar plot,␣
      ↪histogram,scatter plot)
     import numpy as np
```

#Task1 Download the dataset and create an IPython Notebook or a Google Colab notebook for this assignment.

```
[2]: from google.colab import drive
     drive.mount('/content/drive')
```

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

#Task2 Load the dataset into a pandas dataframe and display the first 10 rows of the dataframe to gain familiarity with the data structure.

```
[3]: df = pd.read_csv('/content/drive/MyDrive/StudentPerformance Dataset/
      ↪StudentsPerformance.csv')
     result = df.head(10) #This function will return first 10 rows
     print(result)
```

```
   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

  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
```

[4]:

```python
print(df)
```

```
     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
..      …             …                         …           …
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
..                      …         …            …            …
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]
```

#Task3 Perform exploratory data analysis:

[5]:

```python
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Data columns (total 8 columns):
 #   Column                       Non-Null Count  Dtype
---  ------                       --------------  -----
 0   gender                       1000 non-null   object
 1   race/ethnicity               1000 non-null   object
 2   parental level of education  1000 non-null   object
 3   lunch                        1000 non-null   object
 4   test preparation course      1000 non-null   object
 5   math score                   1000 non-null   int64
 6   reading score                1000 non-null   int64
 7   writing score                1000 non-null   int64
dtypes: int64(3), object(5)
memory usage: 62.6+ KB
```

df.info tells us that there are 1000 rows, with no row to have any null values. And it has total 8 columns. Also there we can find data types of each column.

```
[6]: df.dtypes # for specifically checking data types
```

```
[6]: 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
```

```
[7]: df.shape  # for specifically checking rows and columns
```

```
[7]: (1000, 8)
```

```
[8]: df.isnull() #checking if there is any null value
```

```
[8]:      gender  race/ethnicity  parental level of education  lunch  \
     0     False           False                        False  False
     1     False           False                        False  False
     2     False           False                        False  False
     3     False           False                        False  False
     4     False           False                        False  False
     ..      …             …                          …    …
     995   False           False                        False  False
     996   False           False                        False  False
     997   False           False                        False  False
     998   False           False                        False  False
     999   False           False                        False  False

          test preparation course  math score  reading score  writing score
     0                      False       False          False          False
     1                      False       False          False          False
     2                      False       False          False          False
```

```
3                      False       False          False          False
4                      False       False          False          False
..                       …           …          …             …
995                    False       False          False          False
996                    False       False          False          False
997                    False       False          False          False
998                    False       False          False          False
999                    False       False          False          False

[1000 rows x 8 columns]
```

```
[9]: df.isnull().sum()
```

```
[9]: 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
     dtype: int64
```

```
[10]: df.duplicated() #checking if there is ant duplicated value
```

```
[10]: 0      False
      1      False
      2      False
      3      False
      4      False
             …
      995    False
      996    False
      997    False
      998    False
      999    False
      Length: 1000, dtype: bool
```

```
[11]: df.duplicated().sum()
```

```
[11]: 0
```

```
[12]: #.value_counts() function return a Series containing counts of unique values

      print(df["gender"].value_counts())
      print(df["race/ethnicity"].value_counts())
      print(df["parental level of education"].value_counts())
print(df["lunch"].value_counts())
print(df["test preparation course"].value_counts())
print(df["math score"].value_counts())
print(df["reading score"].value_counts())
print(df["writing score"].value_counts())
```

```
female    518
male      482
Name: gender, dtype: int64
group C    319
group D    262
group B    190
group E    140
group A     89
Name: race/ethnicity, dtype: int64
some college          226
associate's degree    222
high school           196
some high school      179
bachelor's degree     118
master's degree        59
Name: parental level of education, dtype: int64
standard        645
free/reduced    355
Name: lunch, dtype: int64
none         642
completed    358
Name: test preparation course, dtype: int64
65    36
62    35
69    32
59    32
61    27
      ..
24     1
28     1
33     1
18     1
8      1
Name: math score, Length: 81, dtype: int64
72    34
74    33
64    32
67    30
73    30
      ..
28     1
```

```
26     1
17     1
32     1
40     1
Name: reading score, Length: 72, dtype: int64
74    35
70    33
68    31
73    28
80    27
      ..
28     1
35     1
19     1
22     1
23     1
Name: writing score, Length: 77, dtype: int64
```

.to_frame() function converts the series object to a dataframe

```
[13]: (df["gender"].value_counts()).to_frame()
```

```
[13]:         gender
       female     518
       male       482
```

```
[14]: (df["gender"].value_counts()).to_frame().values
```

```
[14]: array([[518],
              [482]])
```

```
[15]: (df["race/ethnicity"].value_counts()).to_frame()
```

```
[15]:          race/ethnicity
       group C             319
       group D             262
       group B             190
       group E             140
       group A              89
```

```
[16]: (df["parental level of education"].value_counts()).to_frame()
```

```
[16]:                     parental level of education
       some college                               226
       associate's degree                         222
       high school                                196
       some high school                           179
       bachelor's degree                          118
```

```
master's degree                              59
```

```
[17]: (df["lunch"].value_counts()).to_frame()
```

```
[17]:               lunch
      standard        645
      free/reduced    355
```

```
[18]: (df["test preparation course"].value_counts()).to_frame()
```

```
[18]:            test preparation course
      none                           642
      completed                      358
```

```
[19]: (df["math score"].value_counts()).to_frame()
```

```
[19]:     math score
      65          36
      62          35
      69          32
      59          32
      61          27
      ..         …
      24           1
      28           1
      33           1
      18           1
      8            1

      [81 rows x 1 columns]
```

```
[20]: (df["reading score"].value_counts()).to_frame()
```

```
[20]:     reading score
      72             34
      74             33
      64             32
      67             30
      73             30
      ..            …
      28              1
      26              1
      17              1
      32              1
      40              1

      [72 rows x 1 columns]
```

[21]:
```
(df["writing score"].value_counts()).to_frame()
```

[21]:
```
    writing score
74             35
70             33
68             31
73             28
80             27
..            ...
28              1
35              1
19              1
22              1
23              1

[77 rows x 1 columns]
```

[22]:
```
df.describe() #it will return the description of numeric data in a dataframe by␣
 ↪default
```

[22]:
```
       math score  reading score  writing score
count  1000.00000    1000.000000    1000.000000
mean     66.08900      69.169000      68.054000
std      15.16308      14.600192      15.195657
min       0.00000      17.000000      10.000000
25%      57.00000      59.000000      57.750000
50%      66.00000      70.000000      69.000000
75%      77.00000      79.000000      79.000000
max     100.00000     100.000000     100.000000
```

count returns non-empty values, our data has 1000 data rows and returns 1000-which means there is no empty values. Also, here max value and mean value has not much difference

[23]:
```
df.corr()
```

```
<ipython-input-23-2f6f6606aa2c>:1: FutureWarning:

The default value of numeric_only in DataFrame.corr is deprecated. In a future
version, it will default to False. Select only valid columns or specify the
value of numeric_only to silence this warning.
```

[23]:
```
               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
```

.corr() method shows the correlation of the columns. Each column here is correlated with one another in a good way, as all the values are closer to 1. It means that when one value increases, the other also goes up.

```
[24]: df.describe(include = ['object']) #this will return description of object data␣
        ↪types
```

```
[24]:        gender race/ethnicity parental level of education     lunch  \
      count     1000           1000                        1000      1000
      unique       2              5                           6         2
      top     female        group C                some college  standard
      freq       518            319                         226       645

             test preparation course
      count                     1000
      unique                       2
      top                       none
      freq                       642
```

here, count shows the non-null rows. unique shows the different values in each columns, like gender has two types- male and female. top shows the most common values in a column and freq shows the frequency of most common value.

```
[25]: def find_outliers_IQR(df):

         q1=df.quantile(0.25)

         q3=df.quantile(0.75)

         IQR=q3-q1

         outliers = df[((df<(q1-1.5*IQR)) | (df>(q3+1.5*IQR)))]

         return outliers
```

```
[26]: outliers = find_outliers_IQR(df['math score'])

      print('"number of outliers: "'+ str(len(outliers)))

      print('"max outlier value: "'+ str(outliers.max()))

      print('"min outlier value: "'+ str(outliers.min()))

      outliers
```

```
"number of outliers: "8
"max outlier value: "26
"min outlier value: "0
```

```
[26]: 17     18
      59      0
      145    22
      338    24
      466    26
      787    19
      842    23
      980     8
      Name: math score, dtype: int64
```

```
[27]: outliers = find_outliers_IQR(df['writing score'])

      print('"number of outliers: "'+ str(len(outliers)))

      print('"max outlier value: "'+ str(outliers.max()))

      print('"min outlier value: "'+ str(outliers.min()))

      outliers
```

```
"number of outliers: "5
"max outlier value: "23
"min outlier value: "10
```

```
[27]: 59     10
      76     22
      327    19
      596    15
      980    23
      Name: writing score, dtype: int64
```

```
[28]: outliers = find_outliers_IQR(df['reading score'])

      print('"number of outliers: "'+ str(len(outliers)))

      print('"max outlier value: "'+ str(outliers.max()))

      print('"min outlier value: "'+ str(outliers.min()))

      outliers
```

```
"number of outliers: "6
"max outlier value: "28
"min outlier value: "17
```

```
[28]: 59     17
      76     26
```

```
211    28
327    23
596    24
980    24
Name: reading score, dtype: int64
```

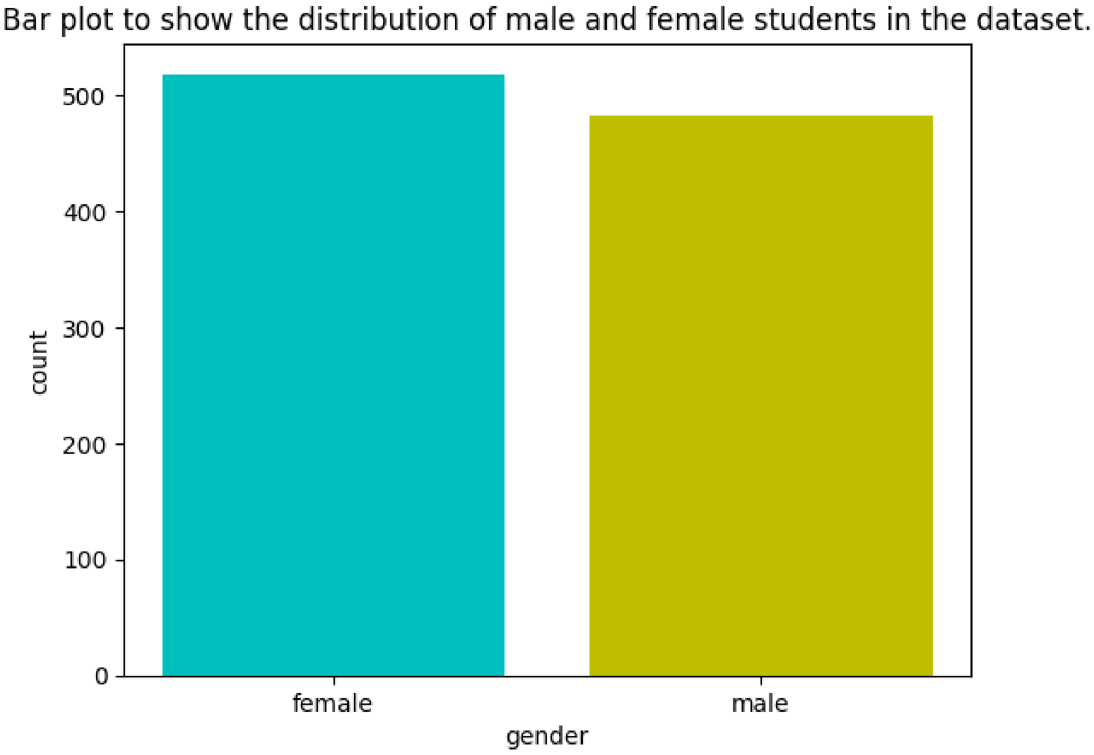
There are very little outliers present in the numeric values and I think they show the variations in the population, for this reason I kept the outliers as it is.

#Task4

```
[29]: #Create a bar plot to show the distribution of male and female students in the␣
        ↪dataset.
      students = df['gender'].value_counts()
      students
```

```
[29]: female    518
      male      482
      Name: gender, dtype: int64
```

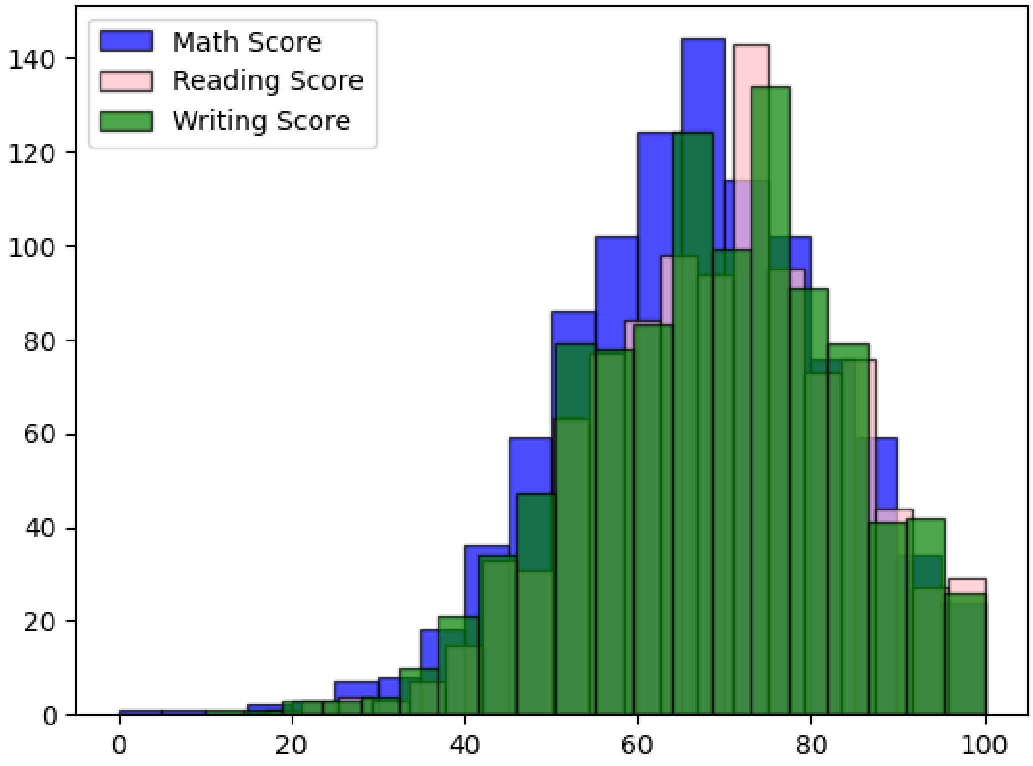
```
[30]: x= students.index
      y= students.values
      plt.bar(x,y,color=('c','y'))

      #function for add title
      plt.title("Bar plot to show the distribution of male and female students in the␣
        ↪dataset.")
      plt.grid(False)
      #function to add label
      plt.xlabel("gender")
      plt.ylabel("count")

      # function to show the plot
      plt.show()
```



we can see from the bar plot that most of the students in the dataset are of the gender female.

```
[31]: #Create a histogram to show the distribution of the scores in math, reading,␣
      ↪and writing.
      m_score = df[['math score']]
      r_score = df[['reading score']] #here we are extracting the score columns and␣
      ↪saving the dataframes in the variables
      w_score = df[['writing score']]

      # plotting first histogram
      plt.hist(m_score, bins = 20, label='Math Score', alpha=.7, color='blue',␣
      ↪edgecolor='black')

      # plotting second histogram
      plt.hist(r_score, bins = 20, label="Reading Score", color='pink',alpha=.7,
               edgecolor='black')

      # plotting third histogram
      plt.hist(w_score, bins = 20,label="Writing Score", color='green', alpha=.7,
               edgecolor='black')
      plt.legend()#

      # Showing the plot using plt.show()
```

```
plt.show()
```

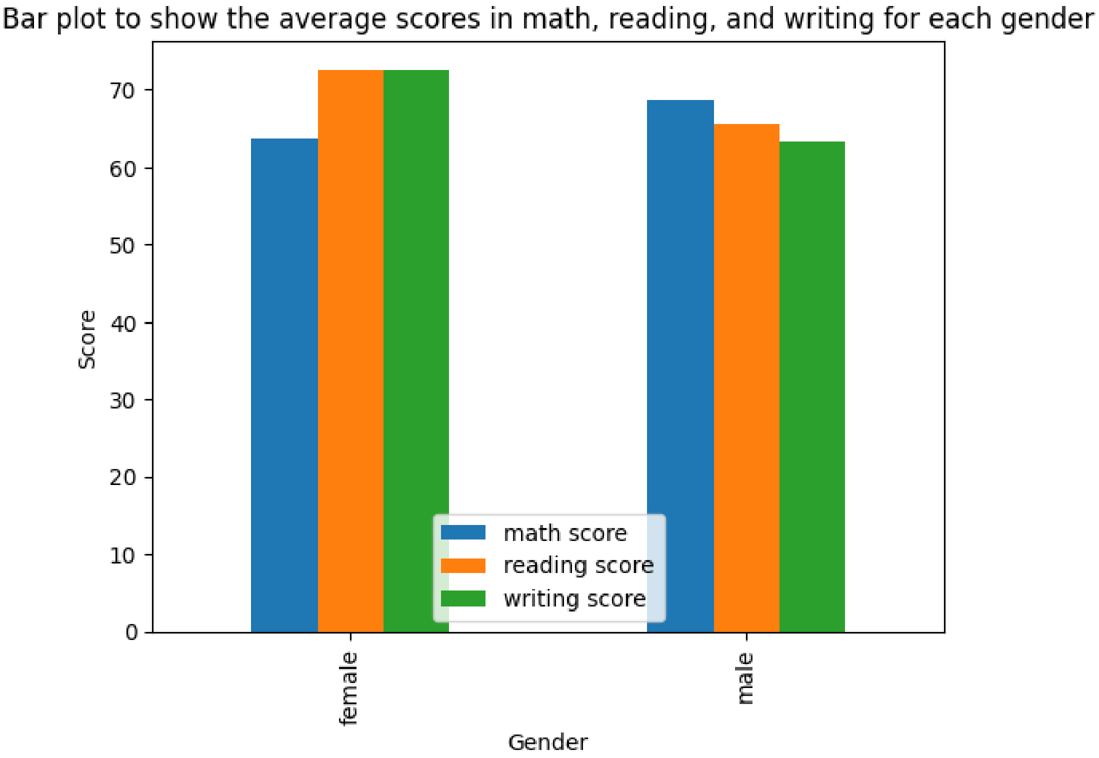


in this histogram, we can see that there is overlap of the math, reading and writing score. The three columns has the values almost in the same range, but the ‘math score’ column has some lowest values, other than the other two columns. “reading score” and “writing score” columns also has some values far from the most frequent values. The most frequent score among the variables is between 65-75 which is in “math score” column. The second most frequent marks between 70-75, which is in “writing score” column. The highest score one got is in “writing score”

[32]:
```
#Create a bar plot to show the average scores in math, reading, and writing for␣
↪each gender.
avgScore = df.pivot_table(values=['math score', 'reading score', 'writing␣
↪score'], index=['gender'], aggfunc='mean')
#creating dataframe using pivot_table of 3 columns and have set index ='gender'␣
↪because we want to group by female and male in pivot table
```

[33]:
```
plt.figure(figsize=(10, 5))#specifying figure size
avgScore.plot(kind='bar')#plot() makes plots of dataframe avgScore
plt.title('Bar plot to show the average scores in math, reading, and writing␣
↪for each gender')
plt.xlabel('Gender')
plt.ylabel('Score')
plt.legend( loc ="lower center")# is used to Place a legend on the axes.
# Showing the plot using plt.show()
plt.show()
```

```
<Figure size 1000x500 with 0 Axes>
```

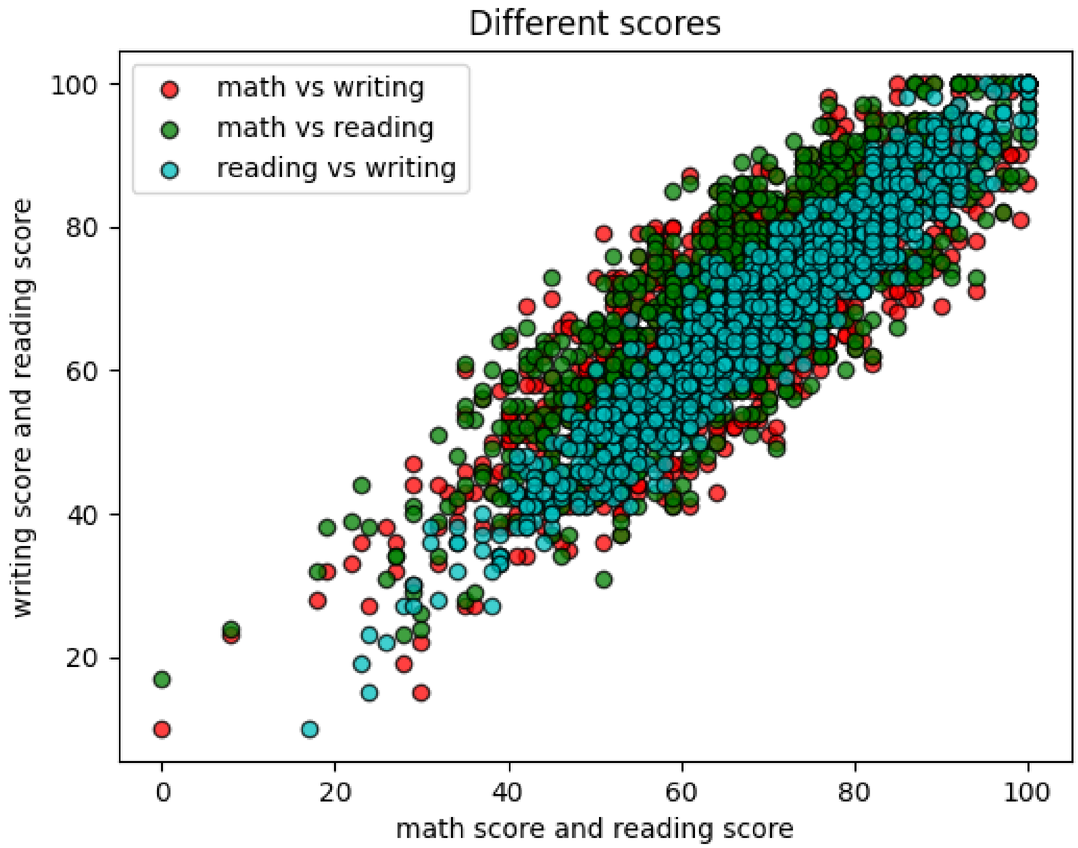


Bar plot to show the average scores in math, reading, and writing for each gender

It is visible from the bar plot that female students has scored btter than male students. Also, math students has scored better in maths than the female students. Male students has earned lowest scors in writing part.

```
[78]: math_score = df['math score']
reading_score = df['reading score']#saving the dataframes in the variables
writing_score = df['writing score']

#calling the scatter()method for showing the scatter plot.
plt.scatter(math_score, writing_score,  color='r', edgecolor = 'black',␣
  ↪linewidth = 1, alpha = 0.75, label = 'math vs writing')
plt.scatter(math_score, reading_score, color = 'g', edgecolor = 'black',␣
  ↪linewidth = 1, alpha = 0.75, label = 'math vs reading')
plt.scatter(reading_score, writing_score, color = 'c', edgecolor = 'black',␣
  ↪linewidth = 1, alpha = 0.75, label = 'reading vs writing')

plt.legend()# is used to Place a legend on the axes.
plt.title('Different scores')
plt.xlabel('math score and reading score')#specifying labels of x-axis
plt.ylabel('writing score and reading score')#specifying labels of y-axis
```

```
[78]: Text(0, 0.5, 'writing score and reading score')
```



The scatter plot shows moderately strong and positive relationships among different scores.

#Task5 Perform basic statistical analysis

```
[35]: #Calculate mean, median, and mode for math, reading, and writing scores.
      mScore_mean = df['math score'].mean()
      mScore_median = df['math score'].median()
      mScore_mode = df['math score'].mode()
      print('Mean: ' ,mScore_mean)
      print('Median: ' ,mScore_mean)
      print('Mode: ',mScore_mean)
```

```
Mean:  66.089
Median:  66.089
Mode:  66.089
```

[36]:

```
rScore_mean = df['reading score'].mean()
rScore_median = df['reading score'].median()
rScore_mode = df['reading score'].mode()
print('Mean: ' ,rScore_mean)
print('Median: ' ,rScore_mean)
print('Mode: ',rScore_mean)
```

```
Mean:  69.169
Median:  69.169
Mode:  69.169
```

[37]:

```
wScore_mean = df['writing score'].mean()
wScore_median = df['writing score'].median()
wScore_mode = df['writing score'].mode()
print('Mean: ' ,rScore_mean)
print('Median: ' ,rScore_mean)
print('Mode: ',rScore_mean)
```

```
Mean:  69.169
Median:  69.169
Mode:  69.169
```

as the mean, meadian and mode are all the same for each column, we can say that the distribution is symmetric

[38]:

```
#Calculate the standard deviation for math, reading, and writing scores.
mScore_std = df['math score'].std()
rScore_std = df['reading score'].std()
wScore_std = df['writing score'].std()
print("Math Score Standard Deviation: ", mScore_std)
print("Reading Score Standard Deviation: ", rScore_std)
print("Writing Score Standard Deviation: ", wScore_std)
```

```
Math Score Standard Deviation:  15.16308009600945
Reading Score Standard Deviation:  14.600191937252216
Writing Score Standard Deviation:  15.19565701086965
```

[44]:

```
#Test if there's a significant difference between male and female students'
#performance in math, reading, and writing using an appropriate statistical␣
 ↪test (e.g., t-test).
group1 = df[df['gender']=='female']
group2= df[df['gender']=='male']
```

```
<ipython-input-44-4a64b37c4fe8>:6: FutureWarning:

The default value of numeric_only in DataFrame.mean is deprecated. In a future
version, it will default to False. In addition, specifying 'numeric_only=None'
is deprecated. Select only valid columns or specify the value of numeric_only to
```

```
silence this warning.
```

```
[44]: math score       68.728216
      reading score    65.473029
      writing score    63.311203
      dtype: float64
```

```
[48]: group3 = df[df['gender']=='male'].mean() # to check the mean values of scores␣
        ↪where gender = male
      group3
```

```
<ipython-input-48-f6f74b357992>:1: FutureWarning:

The default value of numeric_only in DataFrame.mean is deprecated. In a future
version, it will default to False. In addition, specifying 'numeric_only=None'
is deprecated. Select only valid columns or specify the value of numeric_only to
silence this warning.
```

```
[48]: math score       68.728216
      reading score    65.473029
      writing score    63.311203
      dtype: float64
```

```
[47]: group4 = df[df['gender']=='female'].mean() # to check the mean values of scores␣
        ↪where gender = female
      group4
```

```
<ipython-input-47-f18e206aa25e>:1: FutureWarning:

The default value of numeric_only in DataFrame.mean is deprecated. In a future
version, it will default to False. In addition, specifying 'numeric_only=None'
is deprecated. Select only valid columns or specify the value of numeric_only to
silence this warning.
```

```
[47]: math score       63.633205
      reading score    72.608108
      writing score    72.467181
      dtype: float64
```

```
[41]: ttest_ind(group1['math score'], group2['math score'])
```

```
[41]: Ttest_indResult(statistic=-5.383245869828983, pvalue=9.120185549328822e-08)
```

```
[42]: ttest_ind(group1['reading score'], group2['reading score'])
```

```
[42]: Ttest_indResult(statistic=7.959308005187657, pvalue=4.680538743933289e-15)
```

```
[43]: ttest_ind(group1['writing score'], group2['writing score'])
```

```
[43]: Ttest_indResult(statistic=9.979557910004507, pvalue=2.019877706867934e-22)
```

as all the pValues are much less than 0.05, we can reject the null hypothesis and say that there is significant differenece between the scores of male and female students.

In conclusion- the dataset has no null or duplicate values, math score, wrting score and reading scores are correlated with one another, the dataset has more female students than male, female students' average score is greater than that of male students', but male students has done better in math than female students.