Exploratory Data analyis of Student Performance Dataset

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

In [3]:
```
df = pd.read_csv('student.csv')
```

Insight 1

- The dataset contains **8 columns** and **1000 records**
- Four are Categorical Features and 3 are numerical Features

In [4]:
```
df.head()
```

Out[4]:

	gender	race_ethnicity	parental_level_of_education	lunch	test_preparation_course
0	female	group B	bachelor's degree	standard	none
1	female	group C	some college	standard	completed
2	female	group B	master's degree	standard	none
3	male	group A	associate's degree	free/reduced	none
4	male	group C	some college	standard	none

In [5]:
```
df.shape
```

Out[5]:
```
(1000, 8)
```

In [8]:
```
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
```

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

Out[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
```

In [10]:
```
df.duplicated().sum()
```

Out[10]:
```
0
```

In [11]:
```
df.nunique()
```

Out[11]:
```
gender                         2
race_ethnicity                 5
parental_level_of_education    6
lunch                          2
test_preparation_course        2
math_score                    81
reading_score                 72
writing_score                 77
dtype: int64
```

In [84]:
```
df['race_ethnicity'].unique()
```

Out[84]:
```
array(['group B', 'group C', 'group A', 'group D', 'group E'],
      dtype=object)
```

In [85]:
```
df['parental_level_of_education'].unique()
```

Out[85]:
```
array(["bachelor's degree", 'some college', "master's degree",
       "associate's degree", 'high school', 'some high school'],
      dtype=object)
```

In [86]:
```
df['lunch'].unique()
```

Out[86]:
```
array(['standard', 'free/reduced'], dtype=object)
```

In [87]:
```
df['test_preparation_course'].unique()
```

Out[87]:
```
array(['none', 'completed'], dtype=object)
```

In [12]:
```
df.describe()
```

Out[12]:

	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

Insight 2

- There is not any missing values in the dataset
- Duplicates are also not present in the dataset

About Gender

1. 2 Gender Mentioned *Male* and *Female*

About race_ethnicity In total 5 different ethnicity are mentioned:

1. Group('A', 'B', 'C', 'D', 'E')

About parental_level_of_education In total 6 different level of education are mentioned:

1. "bachelor's degree"
2. 'some college'
3. "master's degree"
4. "associate's degree
5. 'high school
6. 'some high school

About Lunch There are two type of lunch found

1. Standard
2. Free/reduced

About test_preparation_course Tells the status of completion

Features like : math_score, reading_score, writing_score tell use about the marks scored by each student in those subject respectively.'

In [13]:
```
df.head()
```

Out[13]:

	gender	race_ethnicity	parental_level_of_education	lunch	test_preparation_course
0	female	group B	bachelor's degree	standard	none
1	female	group C	some college	standard	completed
2	female	group B	master's degree	standard	none
3	male	group A	associate's degree	free/reduced	none
4	male	group C	some college	standard	none

In [14]:
```
df.tail()
```

Out[14]:

	gender	race_ethnicity	parental_level_of_education	lunch	test_preparation_cour
995	female	group E	master's degree	standard	complete
996	male	group C	high school	free/reduced	no
997	female	group C	high school	free/reduced	complete
998	female	group D	some college	standard	complete
999	female	group D	some college	free/reduced	no

In [18]:
```
numerical_features = [feature for feature in df.columns if df[feature].dtype!='O']
```

In [19]:
```
cat_features = [feature for feature in df.columns if df[feature].dtype == 'O']
```

In [20]:
```
numerical_features
```

Out[20]:
```
['math_score', 'reading_score', 'writing_score']
```

In [21]:
```
cat_features
```

Out[21]:
```
['gender',
 'race_ethnicity',
 'parental_level_of_education',
 'lunch',
 'test_preparation_course']
```

Checking the Imbalance in the dataset

The dataset is pretty much balanced, it dosen't seem to be biased

In [22]:
```
df.gender.value_counts()
```

Out[22]:
```
gender
female    518
male      482
Name: count, dtype: int64
```

In [23]:
```
df.race_ethnicity.value_counts()
```

Out[23]:
```
race_ethnicity
group C    319
group D    262
group B    190
group E    140
group A     89
Name: count, dtype: int64
```

In [24]:
```
df.columns
```

Out[24]:
```
Index(['gender', 'race_ethnicity', 'parental_level_of_education', 'lunch',
       'test_preparation_course', 'math_score', 'reading_score',
       'writing_score'],
      dtype='object')
```

Scores Grouped by Categorical Features to see the performance of students

In [88]:
```
def group_by_mean(f1,f2):
    df2=df[[f1,f2]].groupby([f2]).mean()
    print(df2)
```

In [89]:
```
group_by_mean('reading_score','gender')
```

```
        reading_score
gender
female      72.608108
male        65.473029
```

In [90]:
```
group_by_mean('writing_score','gender')
```

```
        writing_score
gender
female      72.467181
male        63.311203
```

In [91]:
```
group_by_mean('math_score','race_ethnicity')
```

```
                math_score
race_ethnicity
group A          61.629213
group B          63.452632
group C          64.463950
group D          67.362595
group E          73.821429
```

In [92]:
```
group_by_mean('reading_score','race_ethnicity')
```

```
                reading_score
race_ethnicity
group A             64.674157
group B             67.352632
group C             69.103448
group D             70.030534
group E             73.028571
```

In [93]:
```
group_by_mean('writing_score','race_ethnicity')
```

```
                writing_score
race_ethnicity
group A             62.674157
group B             65.600000
group C             67.827586
group D             70.145038
group E             71.407143
```

Added a new metric total_score and average to ease out the analysis

In [95]:
```
df['total_score'] = (df['math_score'] + df['reading_score'] + df['writing_score'])
```

In [96]:
```
df['average'] = df['total_score']/3
```

In [97]:
```
df.head()
```

Out[97]:

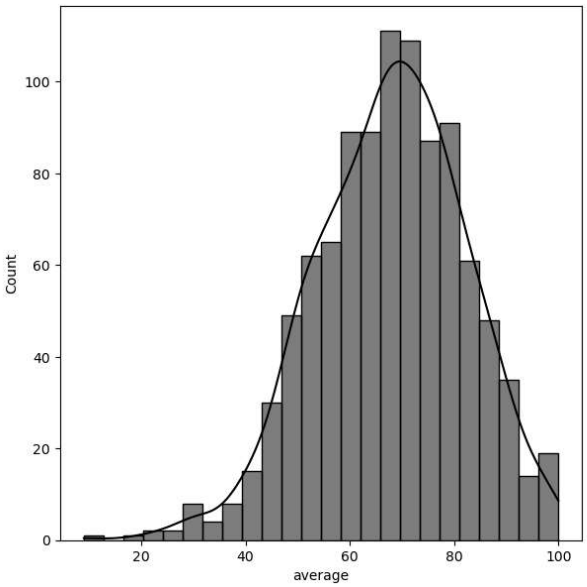
	gender	race_ethnicity	parental_level_of_education	lunch	test_preparation_course
0	female	group B	bachelor's degree	standard	none
1	female	group C	some college	standard	completed
2	female	group B	master's degree	standard	none
3	male	group A	associate's degree	free/reduced	none
4	male	group C	some college	standard	none

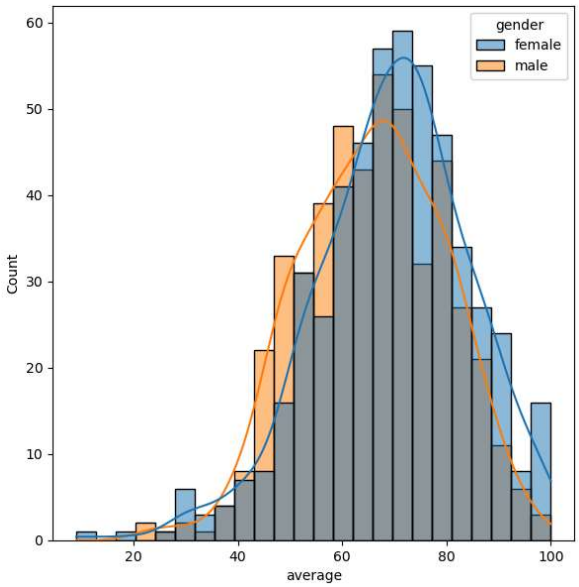
Visualizations

In [98]:
```
import seaborn as sns
import matplotlib.pyplot as plt
```

In [99]:
```
fig,axis= plt.subplots(1,2,figsize=(15,7))
plt.subplot(121)
sns.histplot(data = df, x='average',kde=True, color='black')
plt.subplot(122)
sns.histplot(data=df,x='average',kde=True,hue='gender')
```

Out[99]:
```
<Axes: xlabel='average', ylabel='Count'>
```





Insight 3

From the aboe graph we can conclude that

1. The data is normally distributed
2. Females are good in scoring in exams

In [103…

```
def subplot_cat_features(f1):
    fig,axis= plt.subplots(1,3,figsize=(25,6))
    plt.subplot(131)
    sns.histplot(data = df, x='average',kde=True, hue=f1)

    plt.subplot(132)
    plt.title('Male')
    sns.histplot(data=df[df['gender']=='male'],x='average',kde=True,hue=f1)

    plt.subplot(133)
    plt.title('Female')
    sns.histplot(data=df[df['gender']=='female'],x='average',kde=True,hue=f1)
```

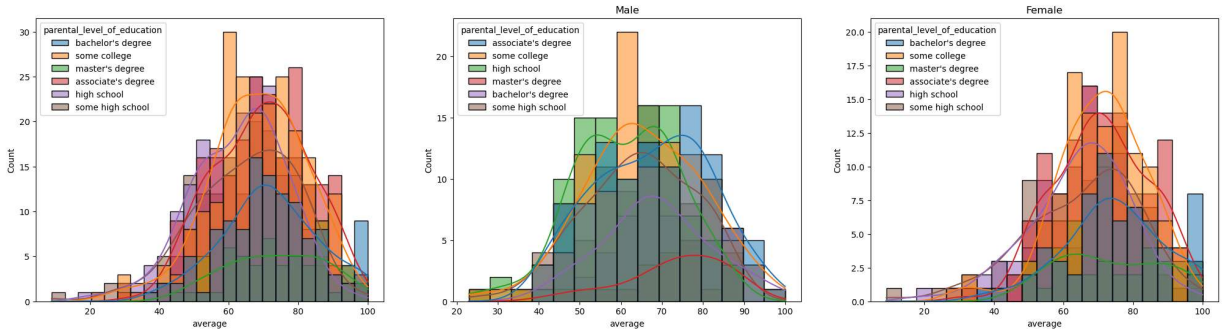
Insight 4

From the below, distribution of **parental_level_of_education** we can see

1. Masters degree have great impact in score of students
2. Followed by Bachelor's degree impact score more
3. Rest the features are normally distribued and have the similar impact

In [108…

```
subplot_cat_features('parental_level_of_education')
```

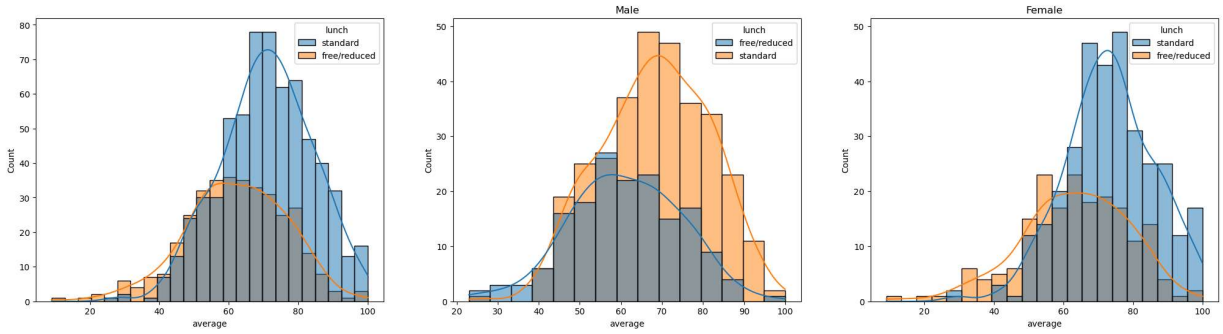


Insight 4

From the below, distribution of **Lunch** we can see

1. Student having Standard meals are performing well with scores

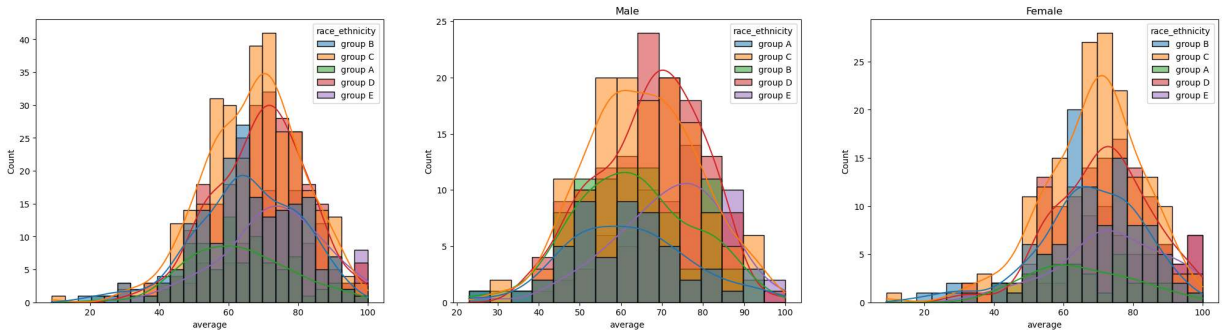
In [105…
```
subplot_cat_features('lunch')
```



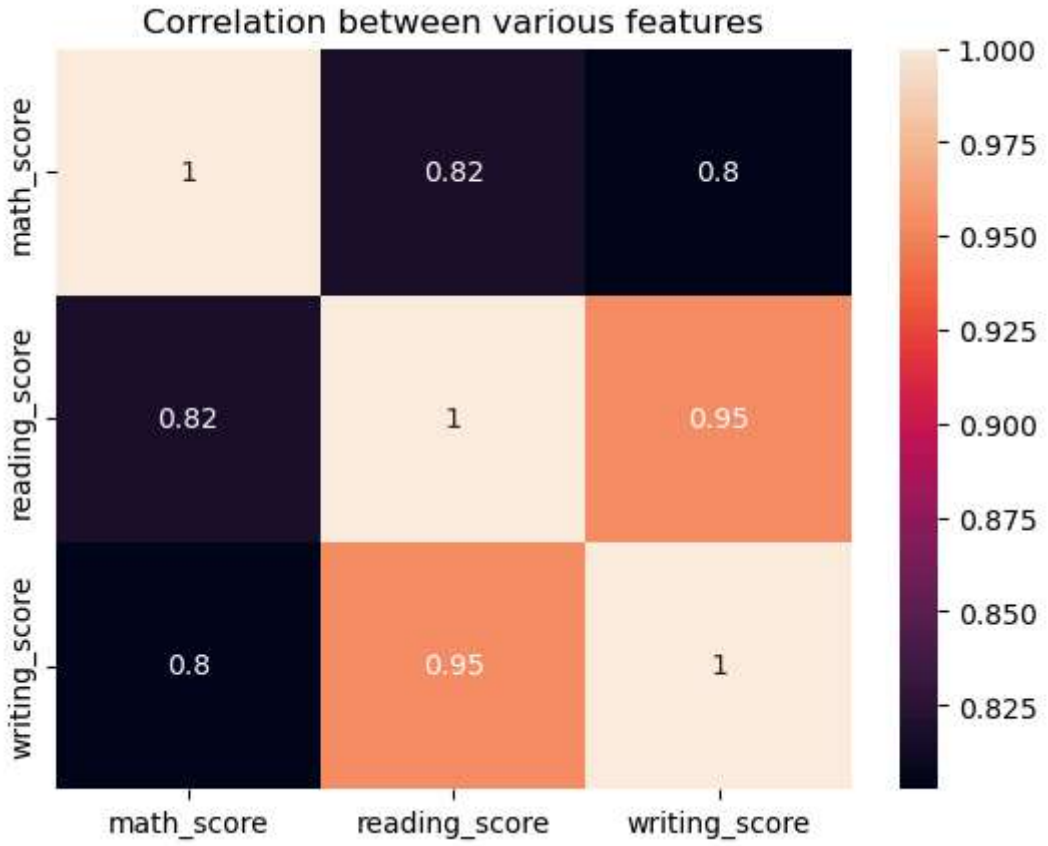
Insight 5

1. The Group A,B data is a bit left skewed which show less scores
2. The Group E males are performing well than other groups
3. Remaing Group C,D are normally distributed and performing average

In [109…
```
subplot_cat_features('race_ethnicity')
```



In [112…
```
sns.heatmap(df[numerical_features].corr(),annot=True)
plt.title("Correlation between various features")
plt.show()
```


Correlation between various features
math_score
reading_score
writing_score
1
0.82
0.8
0.82
1
0.95
0.8
0.95
1
math_score
reading_score
writing_score
1.000
0.975
0.950
0.925
0.900
0.875
0.850
0.825

In [ ]:

In [ ]: