StudentPerformance HypTesting Project

February 4, 2022

```
First 5 rows of data:
   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

  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
Column 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
None
Stats on Numerical Columns:
       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
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75%      77.00000      79.000000      79.000000
max     100.00000     100.000000     100.000000
```

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standard           645
free_or_reduced    355
Name: lunch, dtype: int64
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some college         226
associate degree     222
high school          196
some high school     179
bachelor degree      118
masters degree        59
Name: parent_ed, dtype: int64
```

```
['bachelor degree', 'some college', 'masters degree', 'associate degree', 'high
school', 'some high school']
Categories (6, object): ['some high school' < 'high school' < 'some college' <
'associate degree' < 'bachelor degree' < 'masters degree']
```

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Mean math score of female students: 63.633204633204635
Mean math score of male students: 68.72821576763485
Mean difference: -5.095011134430216
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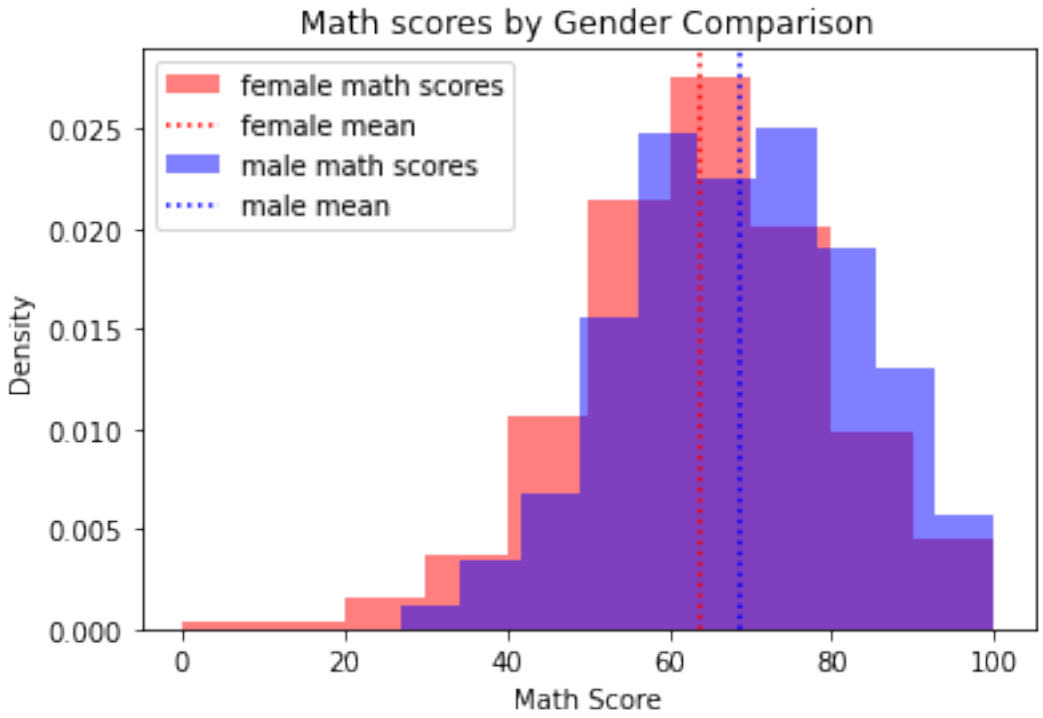
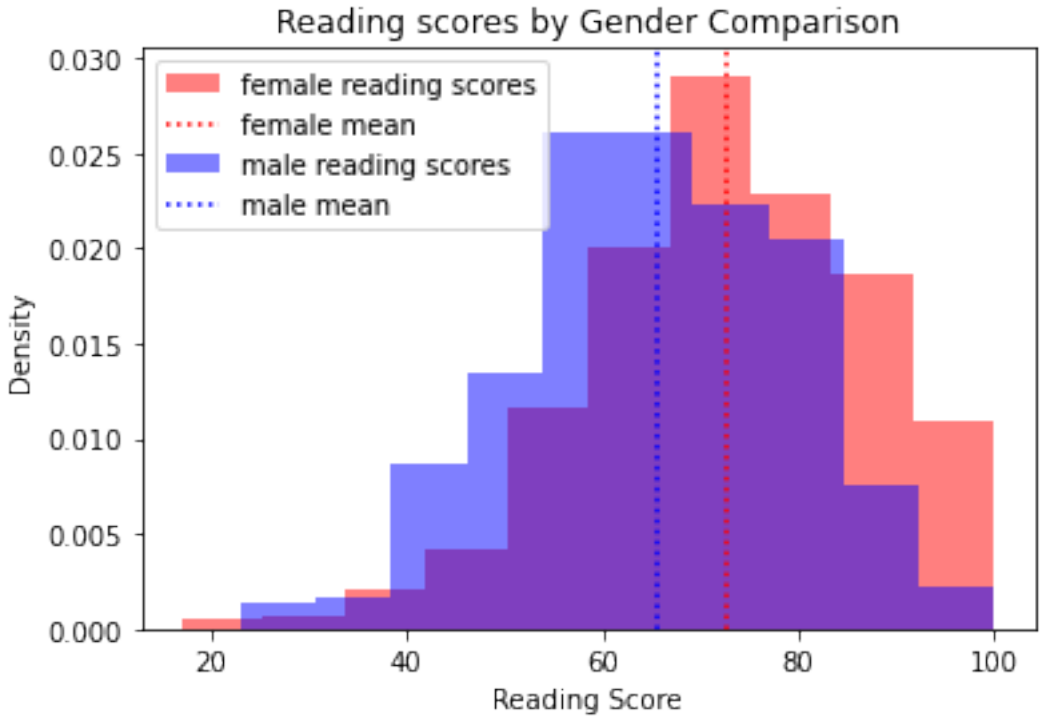



```
P-Value: 9.120185549328822e-08
```

There is a statistically significant difference between female and male math scores.
Male students averaged higher with statistical significance.

<Figure size 432x288 with 0 Axes>

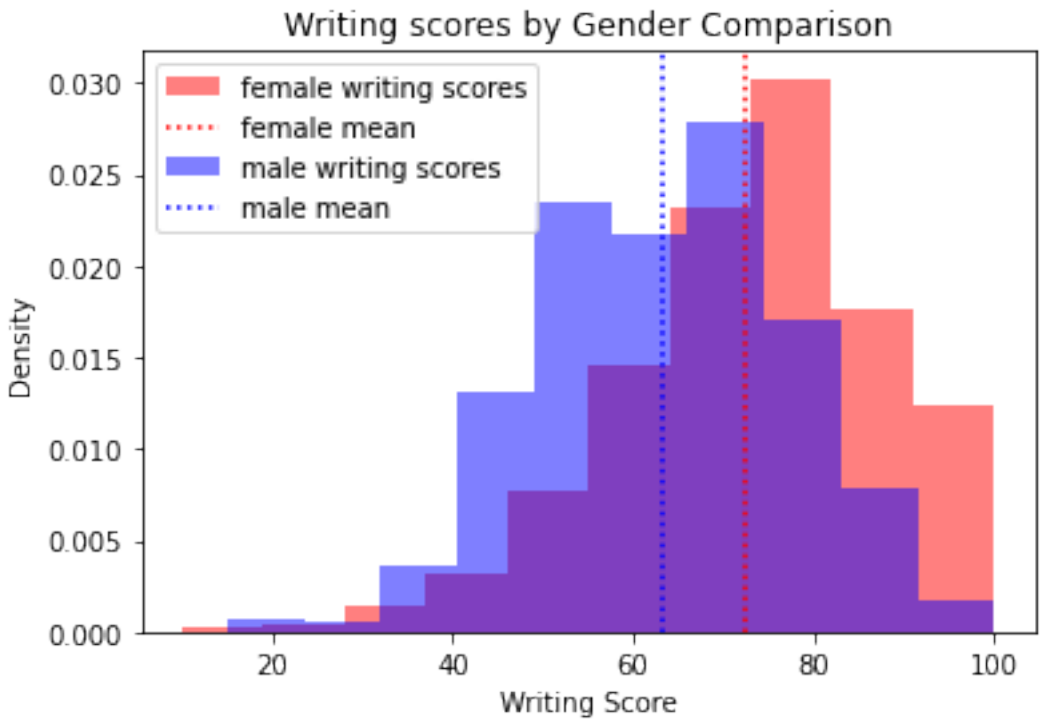
Mean reading score of female students: 72.60810810810811
Mean reading score of male students: 65.47302904564316
Mean difference: 7.135079062464953



P-Value: 4.680538743933289e-15
There is a statistically significant difference between female and male reading scores.
Female students averaged higher with statistical significance.

<Figure size 432x288 with 0 Axes>

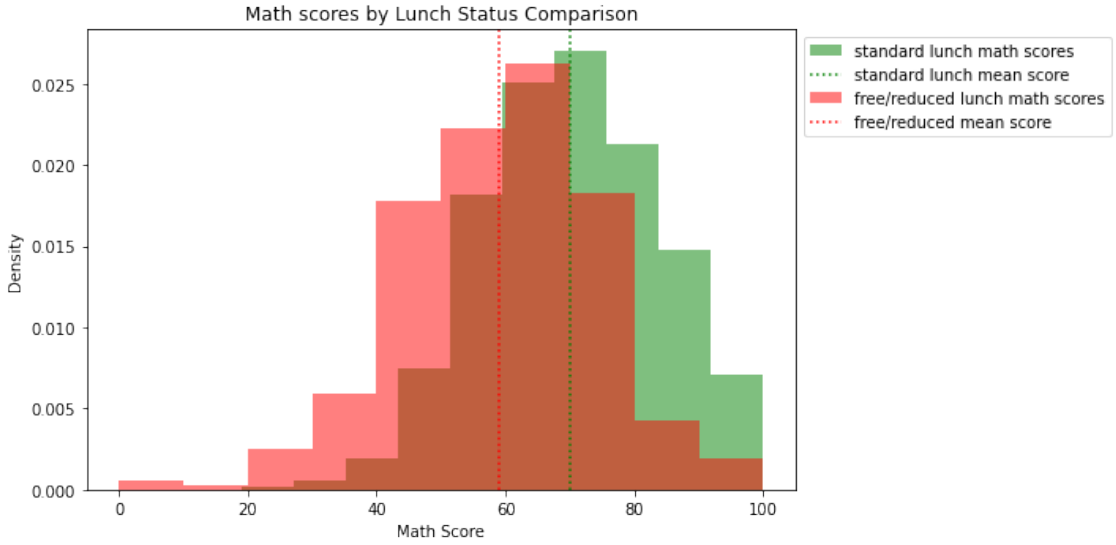
Mean writing score of female students: 72.46718146718146
Mean writing score of male students: 63.31120331950208
Mean difference: 9.155978147679384




```
P-Value: 2.019877706867934e-22
There is a statistically significant difference between female and male writing
scores.
Female students averaged higher with statistical significance.

<Figure size 432x288 with 0 Axes>

Mean math score of standard lunch students: 70.03410852713178
Mean math score of free/reduced lunch students: 58.92112676056338
Mean difference: 11.112981766568396
```




```
P-Value: 2.4131955993137074e-30
There is a statistically significant difference between standard and
free/reduced lunch math scores.
Standard lunch students averaged higher with statistical significance.
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<Figure size 432x288 with 0 Axes>
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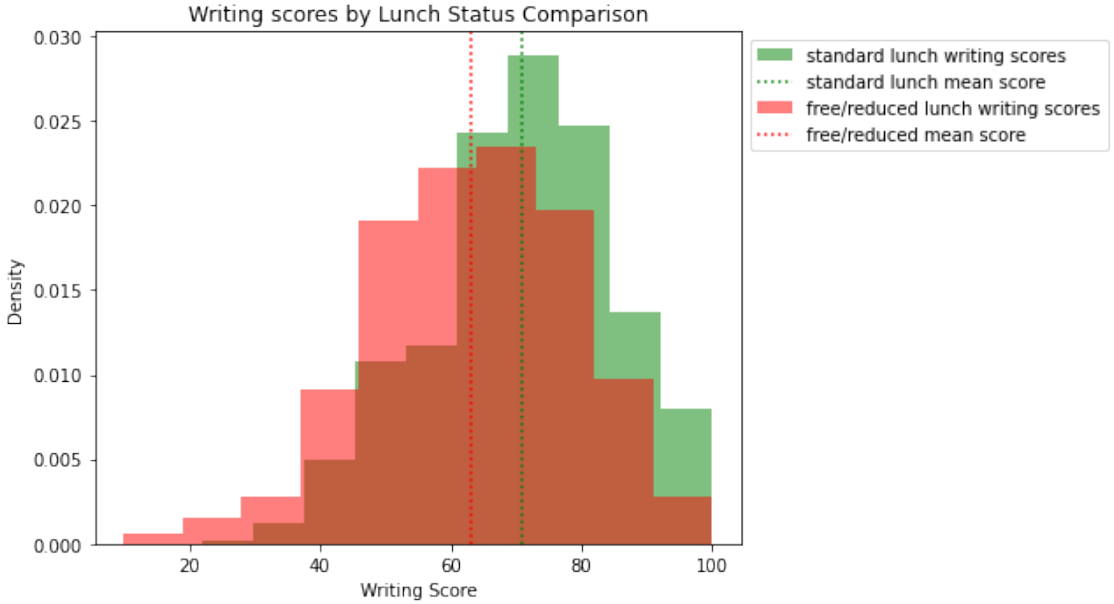
```
Mean reading score of standard lunch students: 71.65426356589147
Mean reading score of free/reduced lunch students: 64.65352112676057
Mean difference: 7.000742439130903
```

```
P-Value: 2.0027966545279011e-13
There is a statistically significant difference between standard and
free/reduced lunch reading scores.
Standard lunch students averaged higher with statistical significance.

<Figure size 432x288 with 0 Axes>

Mean writing score of standard lunch students: 70.8232558139535
Mean writing score of free/reduced lunch students: 63.02253521126761
Mean difference: 7.800720602685885
```




```
P-Value: 3.1861895831664765e-15
There is a statistically significant difference between standard and
free/reduced lunch writing scores.
Standard lunch students averaged higher with statistical significance.

<Figure size 432x288 with 0 Axes>
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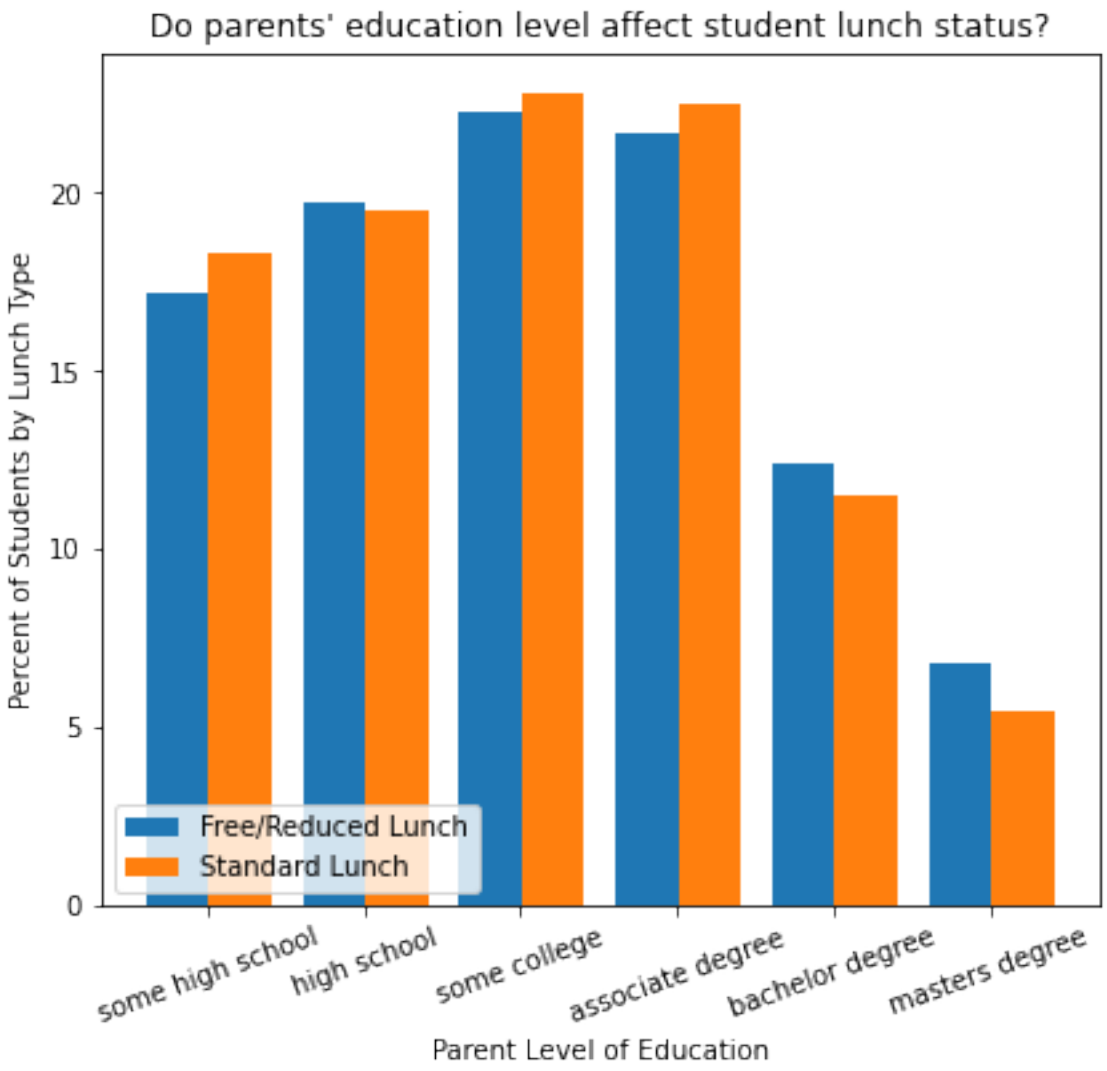
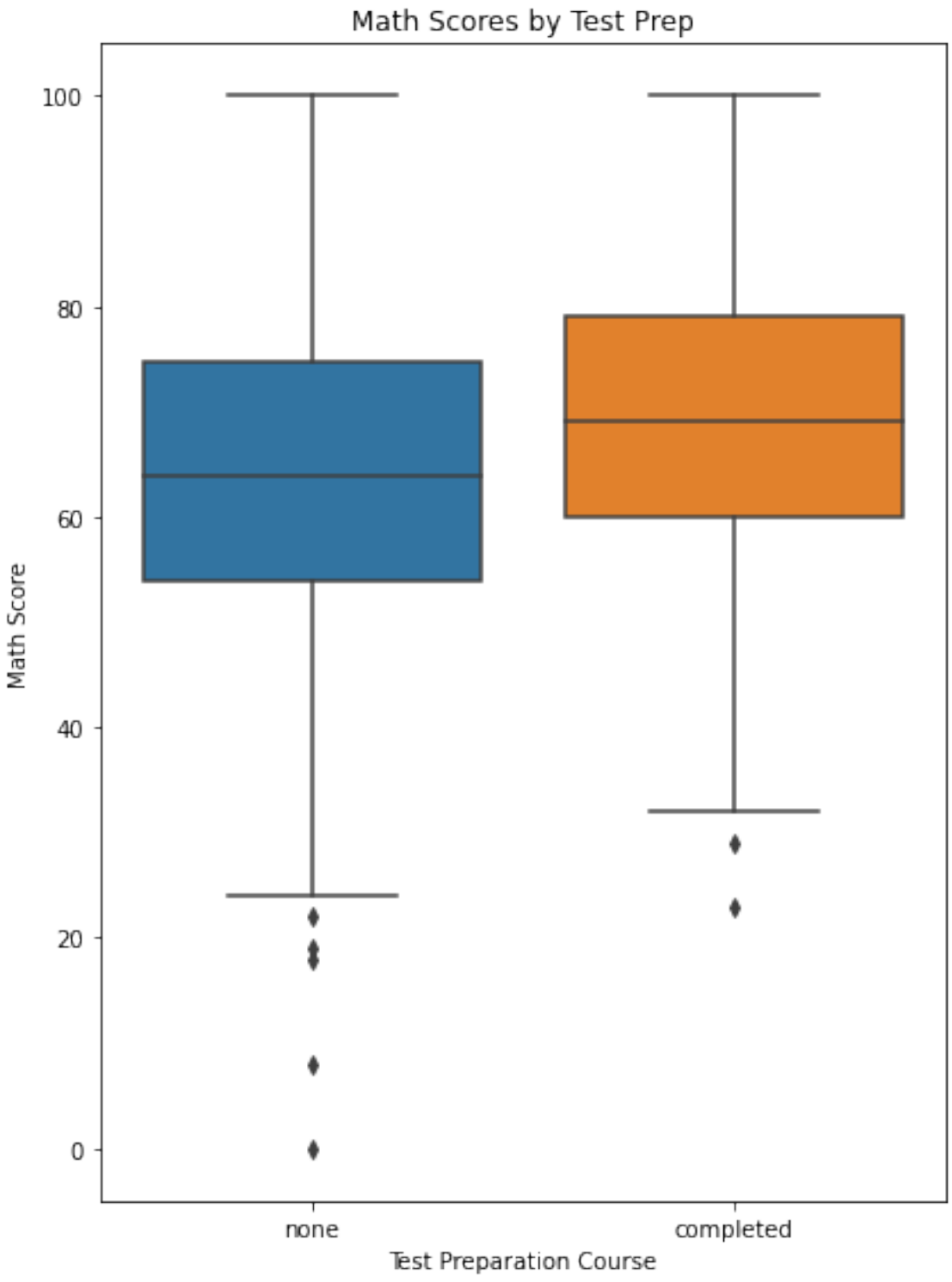



```
P-Value: 0.9531014927218223
There is NOT a statistically significant relationship between parental education
level and whether the student receives free/reduced lunch.

<Figure size 432x288 with 0 Axes>

Mean math score of students who completed the Test Prep Course:
69.69553072625699
Mean math score of students who did not complete the Test Prep Course:
64.0778816199377
Mean difference: 5.617649106319291
```




```
P-Value: 1.5359134607147415e-08
There is a statistically significant difference between math scores of students
who completed the test prep course vs those who didn't.
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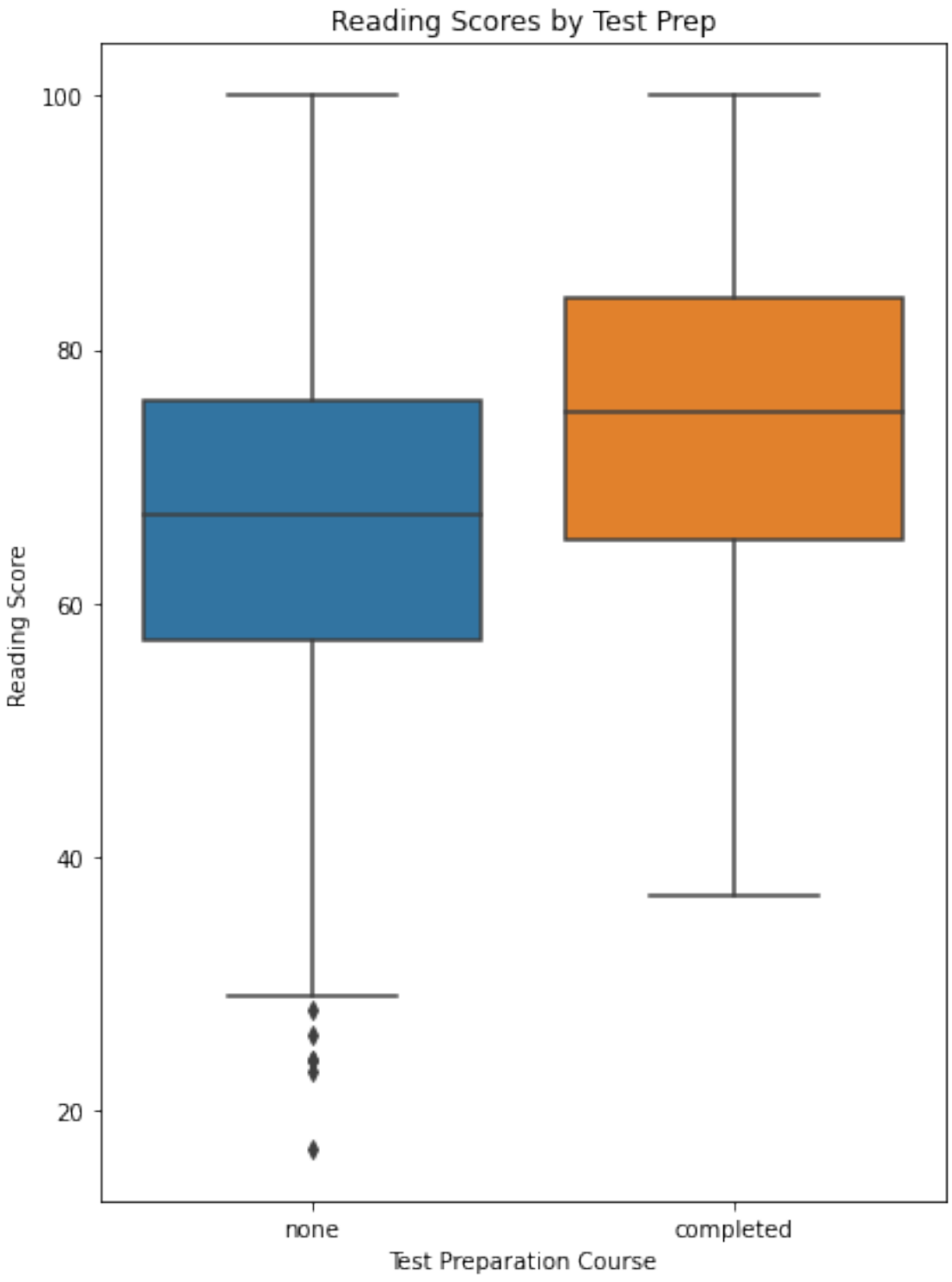
Students who completed the test prep course averaged higher with statistical significance.

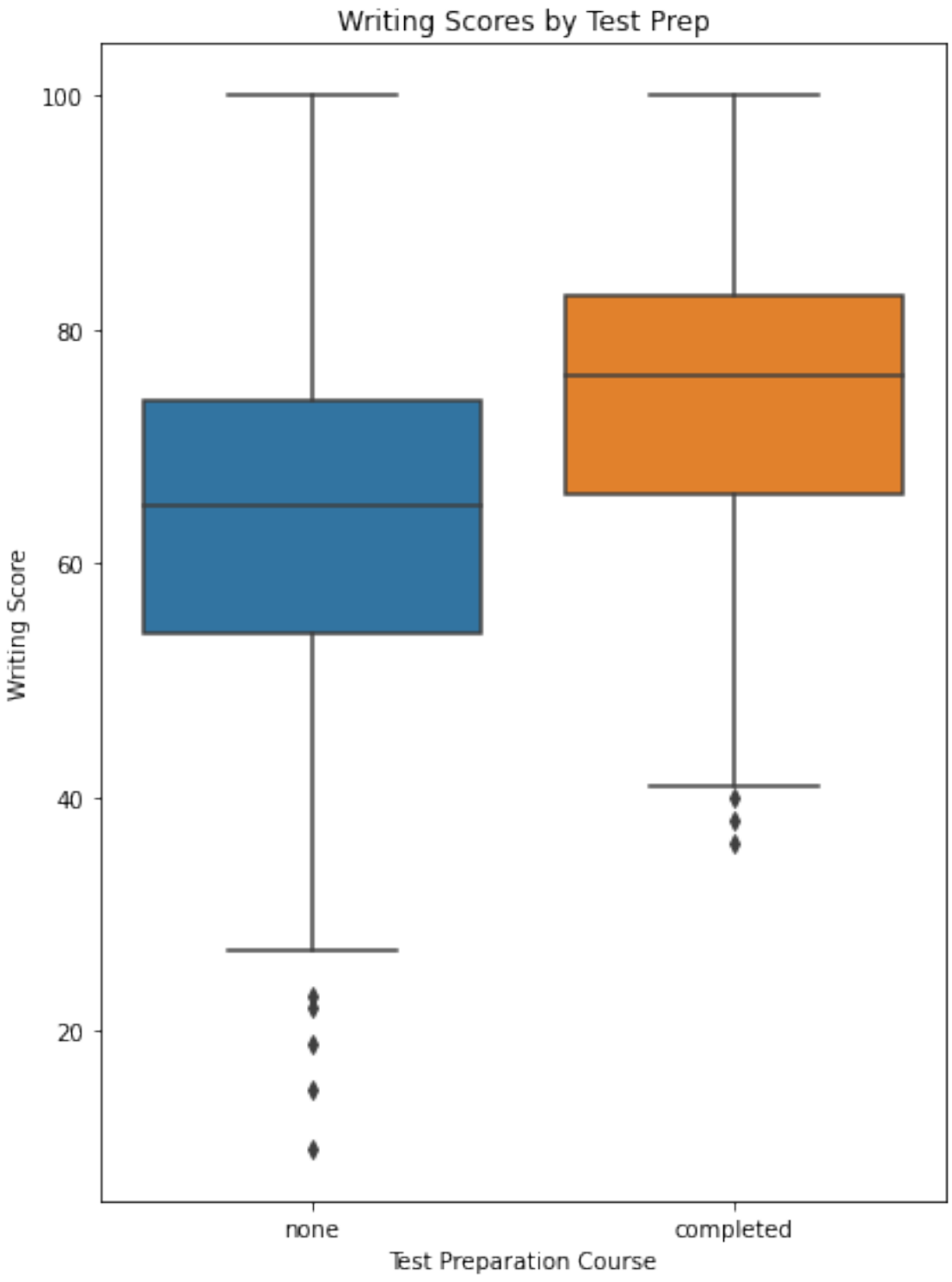
Mean reading score of students who completed the Test Prep Course:
73.89385474860335
Mean reading score of students who did not complete the Test Prep Course:
66.53426791277259
Mean difference: 7.359586835830754




```
P-Value: 9.081783336892205e-15
There is a statistically significant difference between reading scores of
students who completed the test prep course vs those who didn't.
```

Students who completed the test prep course averaged higher with statistical significance.

Mean writing score of students who completed the Test Prep Course:
74.41899441340782
Mean writing score of students who did not complete the Test Prep Course:
64.50467289719626
Mean difference: 9.914321516211558




```
P-Value: 3.68529173524572e-24
There is a statistically significant difference between writing scores of
students who completed the test prep course vs those who didn't.
```

Students who completed the test prep course averaged higher with statistical significance.

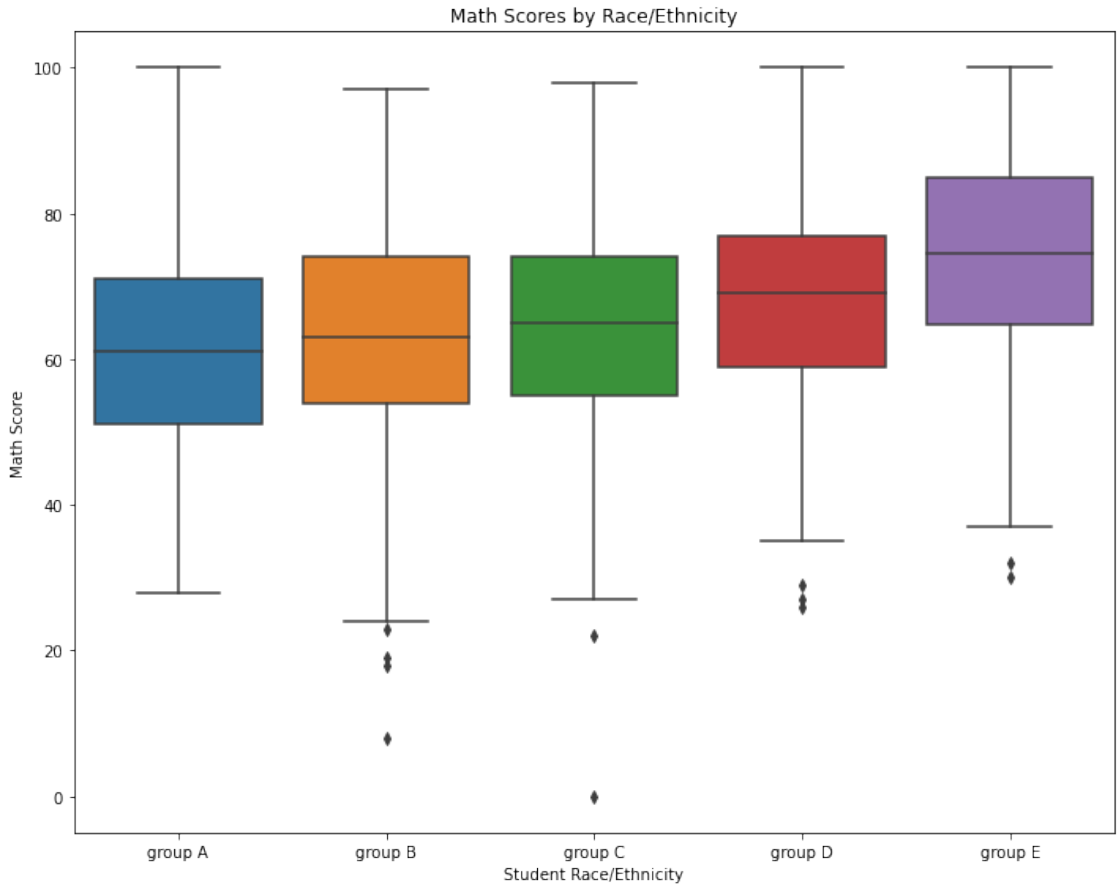
P-value: 1.3732194030370688e-11
There is a statistically significant difference in math scores among the ethnic groups in this data.

Multiple Comparison of Means - Tukey HSD, FWER=0.05

group1	group2	meandiff	p-adj	lower	upper	reject
group A	group B	1.8234	0.8597	-3.36	7.0068	False
group A	group C	2.8347	0.4966	-2.0028	7.6723	False
group A	group D	5.7334	0.0138	0.7824	10.6844	True
group A	group E	12.1922	0.001	6.7215	17.6629	True
group B	group C	1.0113	0.9	-2.6867	4.7094	False
group B	group D	3.91	0.0441	0.0647	7.7552	True
group B	group E	10.3688	0.001	5.8741	14.8635	True
group C	group D	2.8986	0.1287	-0.4659	6.2632	False
group C	group E	9.3575	0.001	5.2665	13.4485	True
group D	group E	6.4588	0.001	2.2343	10.6834	True

There are statistically siginificant differences in math scores between:
group A and group D
group A and group E
group B and group D
group B and group E
group C and group E
group D and group E

The largest difference in math scores was 12.1922% between group A and group E



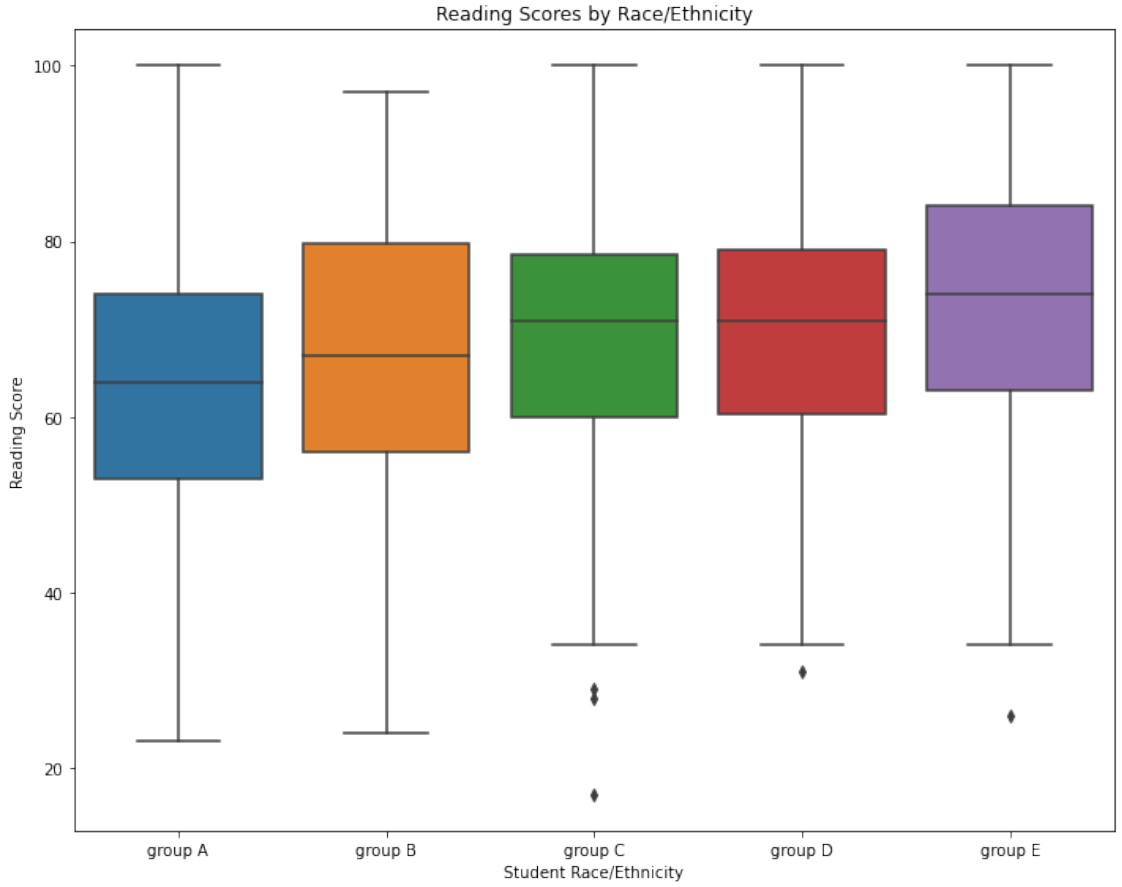
P-value: 0.0001780089103235947
There is a statistically significant difference in reading scores among the ethnic groups in this data.

Multiple Comparison of Means - Tukey HSD, FWER=0.05

group1	group2	meandiff	p-adj	lower	upper	reject
group A	group B	2.6785	0.5875	-2.3998	7.7567	False
group A	group C	4.4293	0.0801	-0.3101	9.1687	False
group A	group D	5.3564	0.0219	0.5058	10.2069	True
group A	group E	8.3544	0.001	2.9947	13.7141	True
group B	group C	1.7508	0.656	-1.8722	5.3738	False
group B	group D	2.6779	0.2956	-1.0893	6.4451	False
group B	group E	5.6759	0.0041	1.2724	10.0794	True
group C	group D	0.9271	0.9	-2.3692	4.2234	False
group C	group E	3.9251	0.0583	-0.0829	7.9331	False
group D	group E	2.998	0.2768	-1.1408	7.1369	False

There are statistically siginificant differences in reading scores between:
group A and group D
group A and group E
group B and group E

The largest difference in reading scores was 8.3544% between group A and group E



P-value: 1.0979189070067382e-05
There is a statistically significant difference in writing scores among the ethnic groups in this data.

Multiple Comparison of Means - Tukey HSD, FWER=0.05

group1	group2	meandiff	p-adj	lower	upper	reject
group A	group B	2.9258	0.5444	-2.3436	8.1953	False
group A	group C	5.1534	0.0346	0.2356	10.0712	True
group A	group D	7.4709	0.001	2.4377	12.504	True
group A	group E	8.733	0.001	3.1715	14.2945	True
group B	group C	2.2276	0.4857	-1.5318	5.987	False

```
group B group D    4.545 0.0133   0.636  8.4541   True
group B group E   5.8071 0.0049  1.2379 10.3764   True
group C group D   2.3175 0.3448 -1.1029  5.7378  False
group C group E   3.5796 0.1294 -0.5793  7.7385  False
group D group E   1.2621    0.9 -3.0326  5.5568  False
-----------------------------------------------------
```

```
There are statistically siginificant differences in writing scores between:
group A and group C
group A and group D
group A and group E
group B and group D
group B and group E
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The largest difference in writing scores was 8.733% between group A and group E
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