

Module 4: Introduction to NumPy & Pandas

Case Study II

Domain – Education (focus – Data analysis)

Business challenge/requirement

You are a data analyst with University of Cal USA (Not a machine learning expert yet as you still have not completed ML with Python Course :-)). The University has data of Math, Physics and Data Structure score of sophomore students. This data is stored in different files. The University has hired a data science company to do analysis of scores and find if there is any correlation of score with age, ethnicity etc. Before the data is given to the company you have to do data wrangling.

Key issues

Ensure students identify is not revealed to the agency and only relevant data is shared

Data volume

- In thousands, but only around 1800 records are shared in files MathScoreTerm1.csv
DSScoreTerm1.csv, PhysicsScoreTerm1.csv

Business benefits

University can get more students enrollment by improving its international ranking through personalized course/curriculum for students

Approach to Solve

You have to use fundamentals of Numpy and Pandas covered in module 4.

1. Read the three csv files which contains the score of same students in term1 for each Subject
2. Remove the name and ethnicity column (to ensure confidentiality)
3. Fill missing score data with zero
4. Merge the three files
5. Change Sex(M/F) Column to 1/2 for further analysis
6. Store the data in new file – ScoreFinal.csv

Enhancements for code

You can try these enhancements in code

1. Convert ethnicity to numerical value
2. Fill the missing score for a student to the average of the class

```
import pandas as pd

# Load the CSV files
math_scores = pd.read_csv('MathScoreTerm1.csv')
physics_scores = pd.read_csv('PhysicsScoreTerm1.csv')

# Display summary information about each dataset
print("Math Scores Summary:")
print(math_scores.describe(include='all'))

print("\nPhysics Scores Summary:")
print(physics_scores.describe(include='all'))

# Remove the Name and Ethnicity columns from math_scores and physics_scores
math_scores = math_scores.drop(columns=['Name', 'Ethnicity'])
physics_scores = physics_scores.drop(columns=['Name', 'Ethnicity'])

# Fill missing score data with zero
math_scores['Score'] = math_scores['Score'].fillna(0)
physics_scores['Score'] = physics_scores['Score'].fillna(0)

# Merge the math_scores and physics_scores on ID, Age, Subject, and Sex
merged_scores = pd.merge(math_scores, physics_scores, on=['ID', 'Age', 'Sex'], suffixes=('_Math', '_Physics'))

# Change Sex(M/F) column to 1/2 for further analysis
merged_scores['Sex'] = merged_scores['Sex'].map({'M': 1, 'F': 2})

# Store the data in a new file – ScoreFinal.csv
merged_scores.to_csv('MergeScoreFinal.csv', index=False)

print("Processing and merging completed. The final merged file is saved as MergeScoreFinal.csv.")
```

```
[john@squid use-case-II]$  
[john@squid use-case-II]$ python3 use-case2-1.py  
Math Scores Summary:  
      Name      Score      Age      Ethnicity Subject Sex      ID  
count      599  596.000000  599.000000      599      599  599  599.000000  
unique      596      NaN      NaN      4      1      2      NaN  
top    MICHAEL THOMPSON      NaN      NaN  White American  Maths      M      NaN  
freq      2      NaN      NaN      288      599  480      NaN  
mean      NaN  74.348993  19.121870      NaN      NaN  NaN  300.000000  
std      NaN  16.217918  1.052234      NaN      NaN  NaN  173.060683  
min      NaN  31.000000  18.000000      NaN      NaN  NaN  1.000000  
25%      NaN  65.000000  18.000000      NaN      NaN  NaN  150.500000  
50%      NaN  78.500000  19.000000      NaN      NaN  NaN  300.000000  
75%      NaN  88.000000  20.000000      NaN      NaN  NaN  449.500000  
max      NaN  95.000000  21.000000      NaN      NaN  NaN  599.000000  
  
Physics Scores Summary:  
      Name      Score      Age      Ethnicity Subject Sex      ID  
count      599  593.000000  599.000000      599      599  599  599.000000  
unique      596      NaN      NaN      4      1      2      NaN  
top    MICHAEL THOMPSON      NaN      NaN  White American  Physics      M      NaN  
freq      2      NaN      NaN      288      599  480      NaN  
mean      NaN  70.598651  19.121870      NaN      NaN  NaN  300.000000  
std      NaN  15.997280  1.052234      NaN      NaN  NaN  173.060683  
min      NaN  27.000000  18.000000      NaN      NaN  NaN  1.000000  
25%      NaN  61.000000  18.000000      NaN      NaN  NaN  150.500000  
50%      NaN  78.000000  19.000000      NaN      NaN  NaN  300.000000  
75%      NaN  84.000000  20.000000      NaN      NaN  NaN  449.500000  
max      NaN  94.000000  21.000000      NaN      NaN  NaN  599.000000  
Processing and merging completed. The final merged file is saved as MergeScoreFinal.csv.  
[john@squid use-case-II]$
```

MergeScoreFinal.csv > data

```
1  Score_Math, Age, Subject_Math, Sex, ID, Score_Physics, Subject_Physics
2  88.0, 18, Maths, 1, 1, 84.0, Physics
3  85.0, 19, Maths, 1, 2, 81.0, Physics
4  45.0, 19, Maths, 1, 3, 41.0, Physics
5  82.0, 18, Maths, 1, 4, 78.0, Physics
6  82.0, 18, Maths, 2, 5, 78.0, Physics
7  95.0, 20, Maths, 1, 6, 91.0, Physics
8  95.0, 18, Maths, 1, 7, 91.0, Physics
9  65.0, 19, Maths, 1, 8, 61.0, Physics
10 88.0, 18, Maths, 1, 9, 84.0, Physics
11 88.0, 19, Maths, 2, 10, 84.0, Physics
12 53.0, 20, Maths, 1, 11, 49.0, Physics
13 53.0, 20, Maths, 1, 12, 49.0, Physics
14 66.0, 19, Maths, 1, 13, 62.0, Physics
15 88.0, 18, Maths, 1, 14, 84.0, Physics
16 88.0, 21, Maths, 2, 15, 84.0, Physics
17 82.0, 20, Maths, 1, 16, 78.0, Physics
18 31.0, 18, Maths, 1, 17, 0.0, Physics
19 95.0, 18, Maths, 1, 18, 91.0, Physics
20 91.0, 18, Maths, 1, 19, 87.0, Physics
21 66.0, 18, Maths, 2, 20, 62.0, Physics
22 82.0, 18, Maths, 1, 21, 78.0, Physics
23 66.0, 18, Maths, 1, 22, 62.0, Physics
24 75.0, 18, Maths, 1, 23, 71.0, Physics
25 65.0, 19, Maths, 1, 24, 61.0, Physics
26 91.0, 20, Maths, 2, 25, 87.0, Physics
27 91.0, 18, Maths, 1, 26, 87.0, Physics
28 53.0, 20, Maths, 1, 27, 49.0, Physics
29 91.0, 20, Maths, 1, 28, 87.0, Physics
30 88.0, 21, Maths, 1, 29, 84.0, Physics
31 85.0, 19, Maths, 2, 30, 81.0, Physics
```