Note) Slides and example codes are available:
https://github.com/mint-lab/prog_meets_math

# Python Lab #2:

## Midterm and Final Exam Analysis

Sunglok Choi, Assistant Professor, Ph.D.
Computer Science and Engineering Department, SEOULTECH
sunglok@seoultech.ac.kr | https://mint-lab.github.io/

# Overview

- **Prerequisite**
  - Anaconda (Individual Edition)

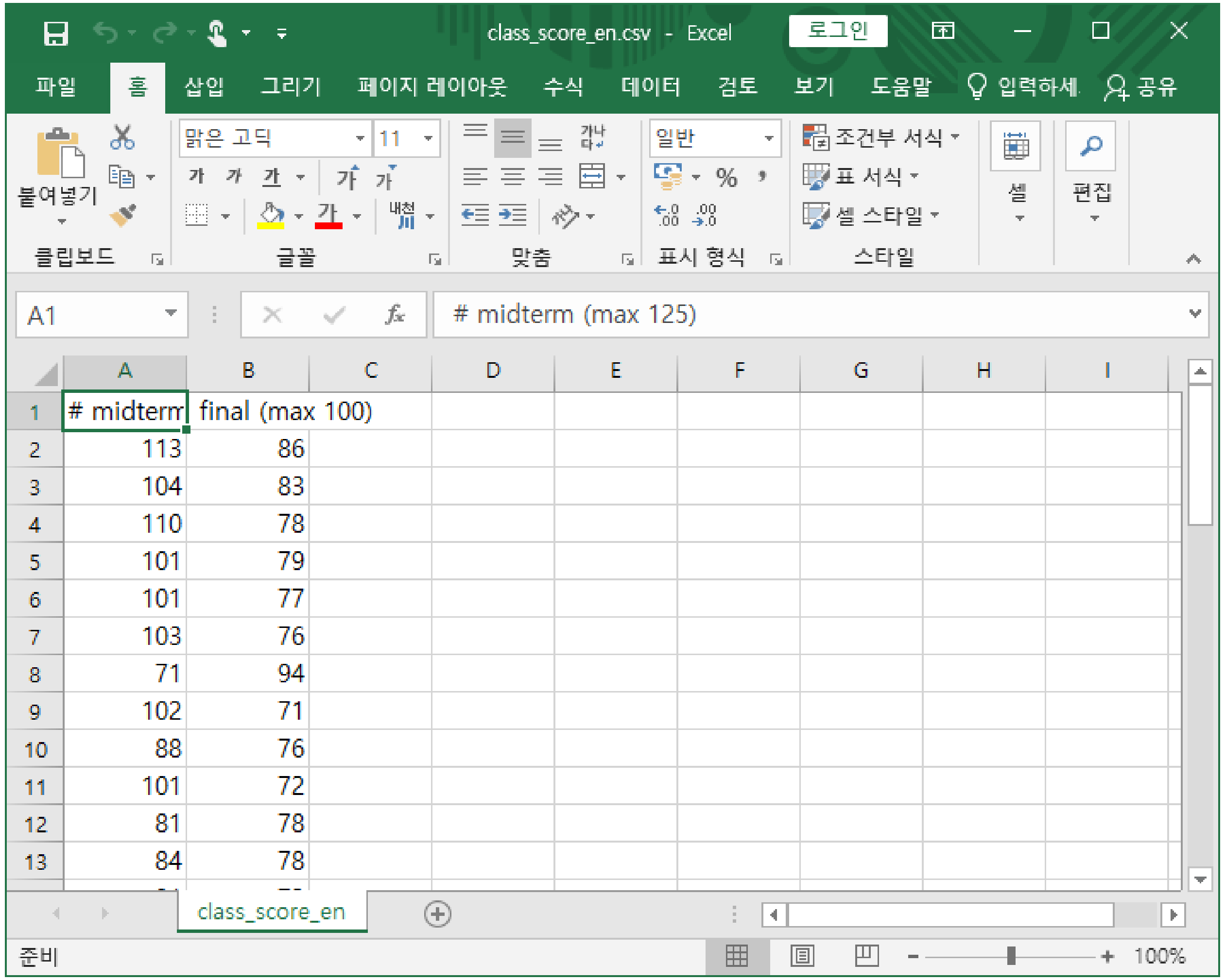
- **Practice) Midterm and Final Exam Analysis**
  - The given data
  - Expected results
  - Practice with the skeleton code
    - Step #1) Read a CSV file as a list of integer numbers
    - Step #2) Calculate the weighted average of each row of data
    - Step #3) Calculate mean, variance, median, min, and max of each column of data

- **Assignment**
  - Mission: Complete the given skeleton code

# Practice) Midterm and Final Exam Analysis

- The given data (file: data/class_score_en.csv)

```
# midterm (max 125), final (max 100)
113, 86
104, 83
110, 78
101, 79
101, 77
103, 76
71, 94
102, 71
88, 76
101, 72
81, 78
84, 78
. . .
```



A1: # midterm (max 125)

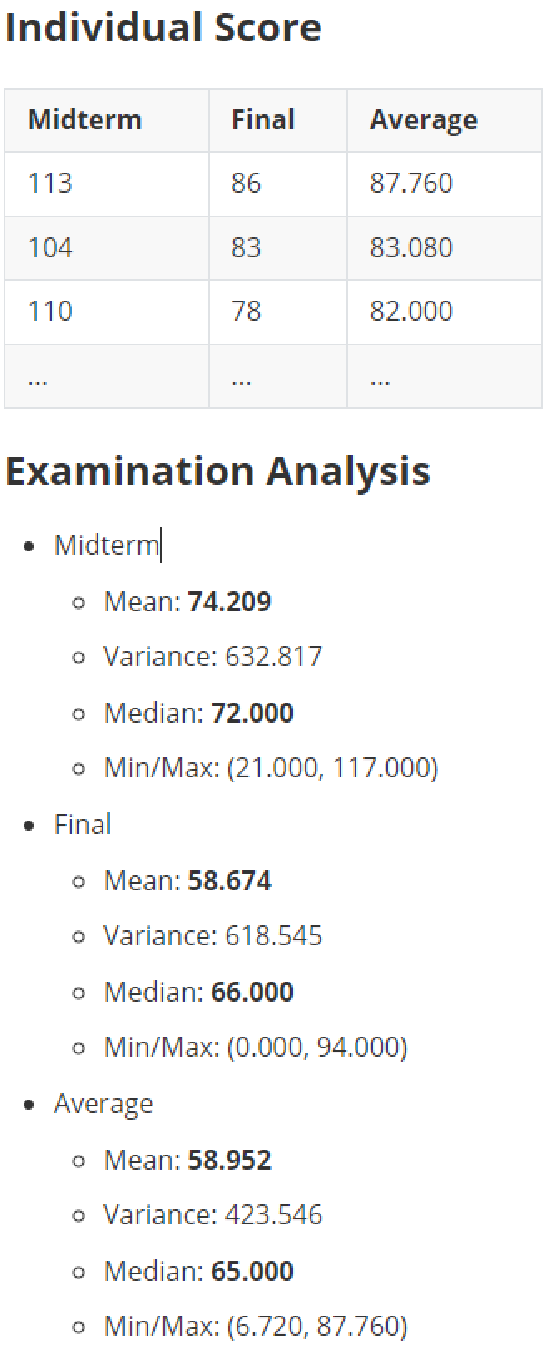
| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | # midterm | final (max 100) | | | | | | | |
| 2 | 113 | 86 | | | | | | | |
| 3 | 104 | 83 | | | | | | | |
| 4 | 110 | 78 | | | | | | | |
| 5 | 101 | 79 | | | | | | | |
| 6 | 101 | 77 | | | | | | | |
| 7 | 103 | 76 | | | | | | | |
| 8 | 71 | 94 | | | | | | | |
| 9 | 102 | 71 | | | | | | | |
| 10 | 88 | 76 | | | | | | | |
| 11 | 101 | 72 | | | | | | | |
| 12 | 81 | 78 | | | | | | | |
| 13 | 84 | 78 | | | | | | | |

# Practice) Midterm and Final Exam Analysis

- Expected results (file: `data/class_score_analysis.md`)
  - Note) The result will be written as a markdown file.

  - **Individual Score**
    - Write each *midterm*, *final*, and its *average* score
      - Weight: Midterm (40%) and final (60%)
      - Weighted *average* = 40/125 x *midterm* + 60/100 x *final*

  - **Examination Analysis**
    - Write mean, variance, median, and min/max as a summary



## Individual Score

| Midterm | Final | Average |
|---|---|---|
| 113 | 86 | 87.760 |
| 104 | 83 | 83.080 |
| 110 | 78 | 82.000 |
| ... | ... | ... |

## Examination Analysis

- Midterm
  - Mean: **74.209**
  - Variance: 632.817
  - Median: **72.000**
  - Min/Max: (21.000, 117.000)
- Final
  - Mean: **58.674**
  - Variance: 618.545
  - Median: **66.000**
  - Min/Max: (0.000, 94.000)
- Average
  - Mean: **58.952**
  - Variance: 423.546
  - Median: **65.000**
  - Min/Max: (6.720, 87.760)

# Practice) Midterm and Final Exam Analysis

- The given skeleton code (file: `class_score_analysis_skeleton.py`)
  - Step #1) **Read a CSV file** as a list of integer numbers
    - Warning) Please skip the header which starts with #.
    - Implement `read_data()`
  - Step #2) **Calculate the weighted average of each row of data**
    - Implement `calc_weighted_average()`
  - Step #3) **Calculate mean**, **variance**, **median**, and min/max **of each column of data**
    - Implement `analyze_data()`

```python
def read_data(filename):
    # TODO) Read `filename` as a list of integers
    data = []
    return data

def calc_weighted_average(data_2d, weight):
    # TODO) Calculate the weighted averages of each row of `data_
    average = []
    return average

def analyze_data(data_1d):
    # TODO) Calculate summary statistics of the given `data_1d`
    # Note) Please don't use NumPy and other libraries. Do it your
    mean = 0
    var = 0
    median = 0
    return mean, var, median, min(data_1d), max(data_1d)
```

  - Note) Please understand 1) how to access multiple data using zip and 2) how to access each column of the 2D list.

# Practice) Midterm and Final Exam Analysis

- The given skeleton code (file: `class_score_analysis_skeleton.py`)
  - Note) Please understand 1) how to access multiple data using zip and 2) how to access each column of the 2D list.

```python
...
if __name__ == '__main__':
    data = read_data('data/class_score_en.csv')
    if data and len(data[0]) == 2: # Check `data` is valid
        average = calc_weighted_average(data, [40/125, 60/100])

        # Write the analysis report as a markdown file
        with open('class_score_analysis.md', 'w') as report:
            report.write('### Individual Score\n\n')
            report.write('| Midterm | Final | Average |\n')
            report.write('| ------- | ----- | ----- |\n')
            for ((m_score, f_score), a_score) in zip(data, average):
                report.write(f'| {m_score} | {f_score} | {a_score:.3f} |\n')
            report.write('\n\n\n')

            report.write('### Examination Analysis\n')
            data_columns = {
                'Midterm': [m_score for m_score, _ in data],
                'Final'  : [f_score for _, f_score in data],
                'Average': average }
            for name, column in data_columns.items():
                mean, var, median, min_, max_ = analyze_data(column)
                report.write(f'* {name}\n')
                report.write(f'  * Mean: **{mean:.3f}**\n')
                report.write(f'  * Variance: {var:.3f}\n')
                report.write(f'  * Median: **{median:.3f}**\n')
                report.write(f'  * Min/Max: ({min_:.3f}, {max_:.3f})\n')
```

# Assignment

- Mission
  - Complete the given skeleton code (`class_score_analysis_skeleton.py`)
  - Submit your code (`class_score_analysis.py`) and its output (`class_score_analysis.md`)

- Condition
  - Please follow the above filename convention.
  - Please do not use other libraries such as NumPy and others. Do it yourself with only Python built-in functions.
  - You can start from scratch (without using the given skeleton code).
    - However, you should use the given data.
  - You can freely change the given skeleton code if necessary.

- Submission
  - Deadline: **September 24, 2025 23:59** (firm deadline; no extension)
  - Where: e-Class > Assignments
  - Score: Max 10 points