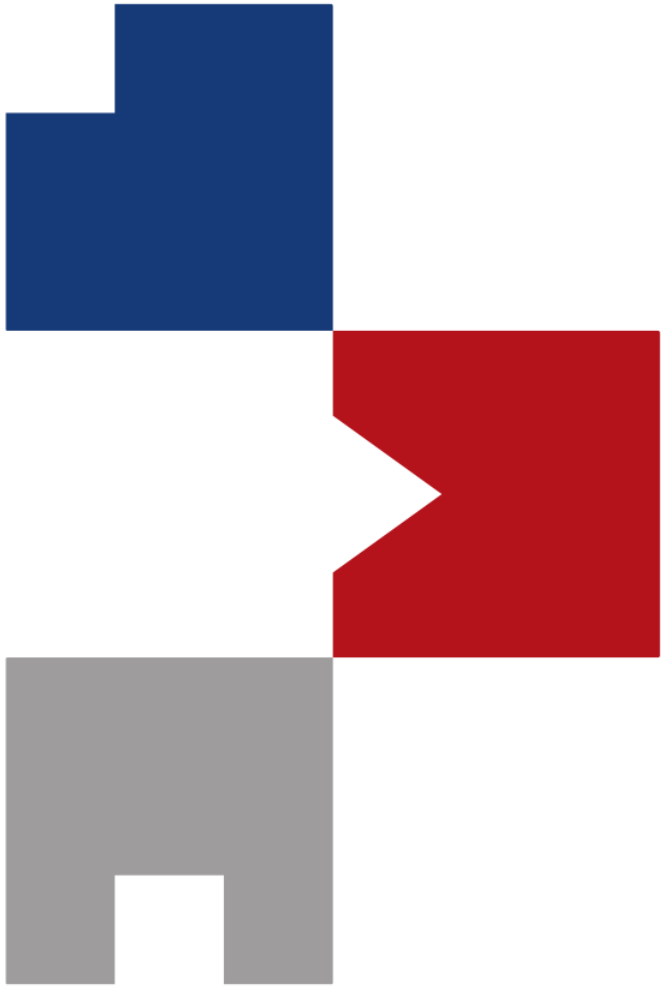
Note) Slides and example codes are available:
https://github.com/mint-lab/prog_meets_math



Math Lab #2:
Final Exam Score Prediction

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Overview

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

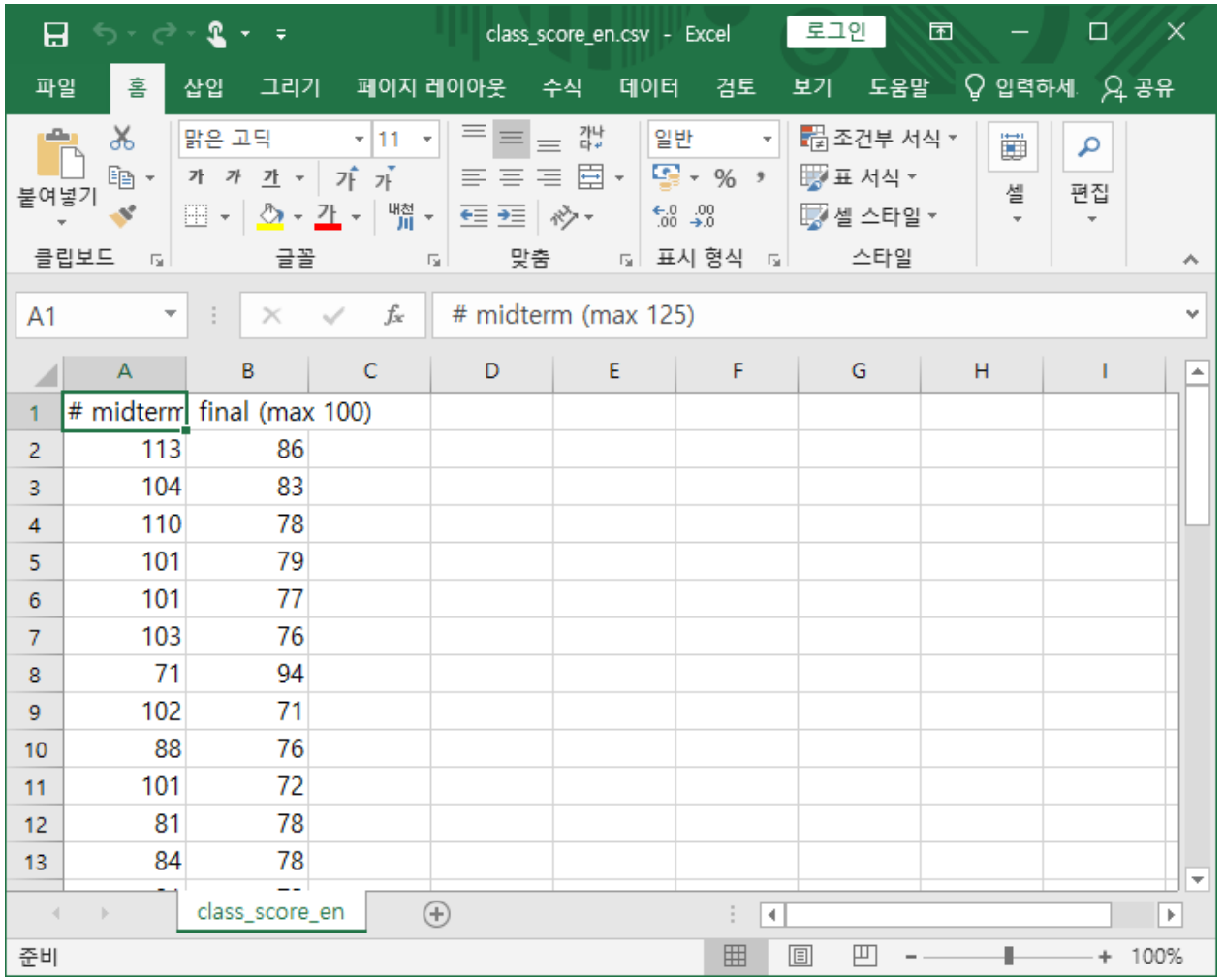
- **Practice) Final Exam Score Prediction**
  - The given data
  - Expected results
  - Practice with the skeleton code
    - Step #1) Find a best-fit line

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

Practice) Final Exam Score Prediction

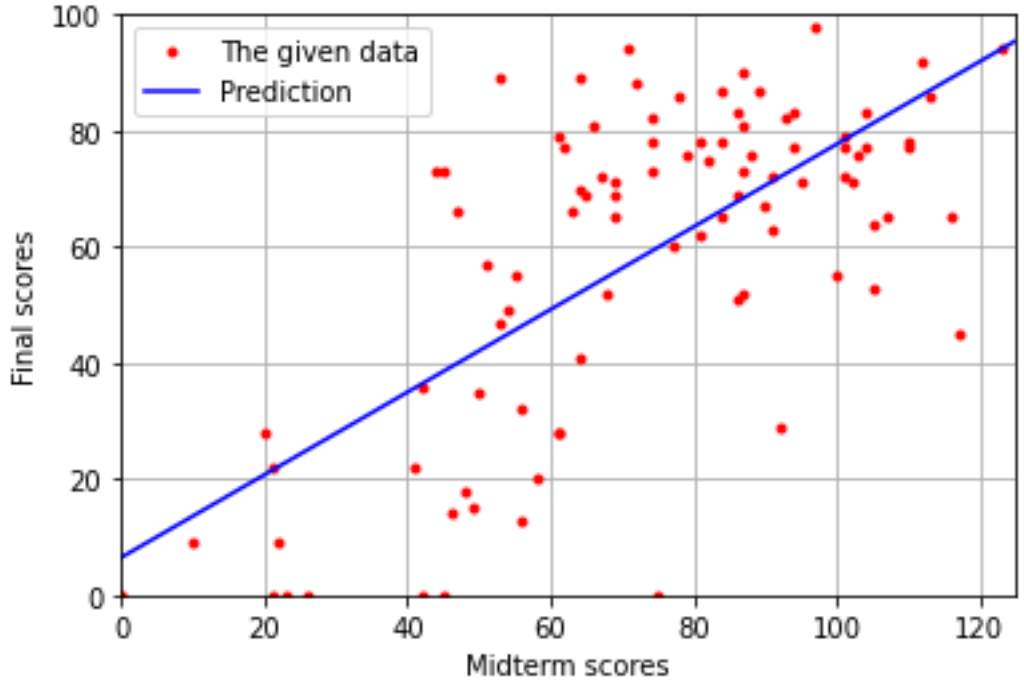
- The given data (file: `data/class_score_en.csv`)

```
# 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
. . .
```



Practice) Final Exam Score Prediction

- Expected results
  - Problem
    - Given: The midterm exam score
    - Output: The final exam score
  - Solution: Line fitting



  - Examples

```
Q) Please input your midterm score? 10
A) Your final score is expected to be 13.608.

Q) Please input your midterm score? 40
A) Your final score is expected to be 34.970.

Q) Please input your midterm score? 90
A) Your final score is expected to be 70.573.

Q) Please input your midterm score? 120
A) Your final score is expected to be 91.934.
```

Practice) Final Exam Score Prediction

- The given skeleton code

  (class_score_predict_skeleton.py)

  - Step #1) Find a line

$$\begin{bmatrix} x_1 & 1 \\ x_2 & 1 \\ \vdots & \vdots \\ x_n & 1 \end{bmatrix} \begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix}$$

$$(\mathrm{A}\mathbf{x} = \mathbf{b})$$

```python
import numpy as np
import matplotlib.pyplot as plt

if __name__ == '__main__':
    midterm_range = np.array([0, 125])
    final_range = np.array([0, 100])

    # Load score data
    class_kr = np.loadtxt('data/class_score_kr.csv', delimiter=',')
    class_en = np.loadtxt('data/class_score_en.csv', delimiter=',')
    data = np.vstack((class_kr, class_en))

    # Estimate a line: final = slope * midterm + y_intercept
    line = [0, 0] # TODO: Find the best [slope, y_intercept] from 'data'

    # Predict scores
    final = lambda midterm: line[0] * midterm + line[1]
    while True:
        given = input('Q) Please input your midterm score (Enter or -1: exit)? ')
        if given == '' or float(given) < 0:
            break
        print(f'A) Your final score is expected to be {final(float(given)):.3f}.')

    # Plot scores and the estimated line
    plt.figure()
    plt.plot(data[:,0], data[:,1], 'r.', label='The given data')
    plt.plot(midterm_range, final(midterm_range), 'b-', label='Prediction')
    ...
```

Assignment

- Mission
  - Complete the given skeleton code (`class_score_predict_skeleton.py`)
  - Submit your code (`class_score_predict.py`) and its prediction plot (`class_score_predict.png`)
- Condition
  - Please follow the above filename convention.
  - Please do not use `numpy.polyfit()`, `numpy.linalg.lstsq()`, and `sklearn.linear_model.LinearRegression`.
    - You already have the ability to implement it using `numpy.linalg.pinv()`.
  - 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: **October 15, 2025 23:59** (firm deadline; no extension)
  - Where: e-Class > Assignments
  - Score: Max 10 points