

# Algorithms 2018



homework:)



homework:)



homework:)

# Homework #2

- Consider the following 4 x 4 array.

	0	1	2	3
0	3	-3	-2	-1
1	2	6	-5	1
2	-3	-5	2	4
3	2	4	0	-2

# Homework #2

- The sum of numbers in the following gray rectangle becomes 2 ( $=6-5-5+2+4+0$ ).

3	-3	-2	-1
2	6	-5	1
-3	-5	2	4
2	4	0	-2

# Homework #2

- The sum of numbers in the following gray rectangle becomes 5 ( $=1+4$ ).

3	-3	-2	-1
2	6	-5	1
-3	-5	2	4
2	4	0	-2

# Homework #2

- The sum of numbers in the following gray rectangle becomes 8 ( $=2+6$ ).

3	-3	-2	-1
2	6	-5	1
-3	-5	2	4
2	4	0	-2

# Homework #2

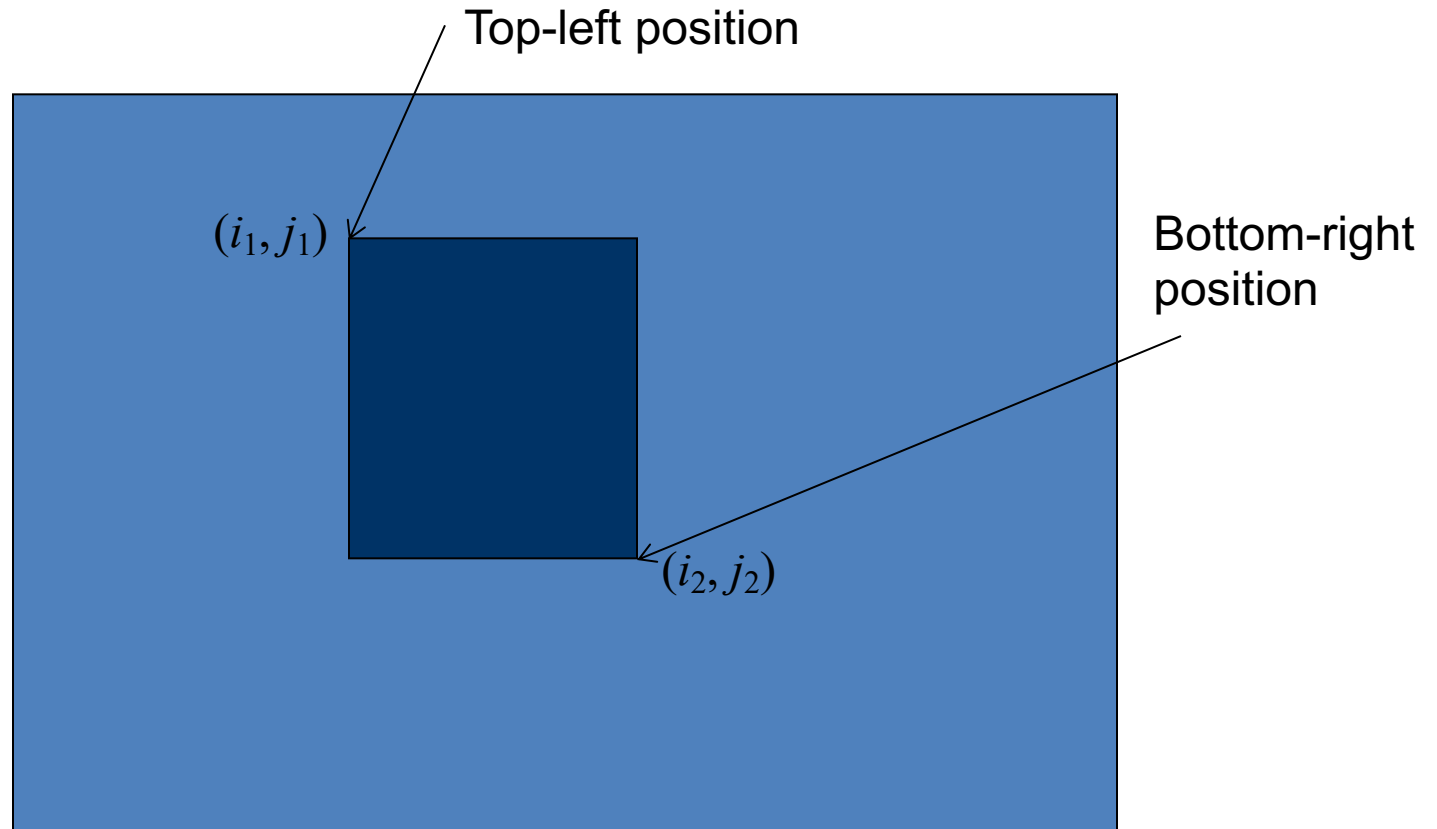
- The sum of numbers in the following gray rectangle becomes  $-8$  ( $= -3 - 5$ ).

3	-3	-2	-1
2	6	-5	1
-3	-5	2	4
2	4	0	-2

# Homework #2

- Given an  $n \times n$  integer array, your program should find a rectangle such that the sum of numbers in the rectangle is maximized/minimized.
- Your program should output the maximum/minimum summation value in the first line, and in the next line, the top-left and bottom-right positions of the rectangle that gives the maximum/minimum summation value.
- Note that  $n$  is less than or equal to **1,000**.

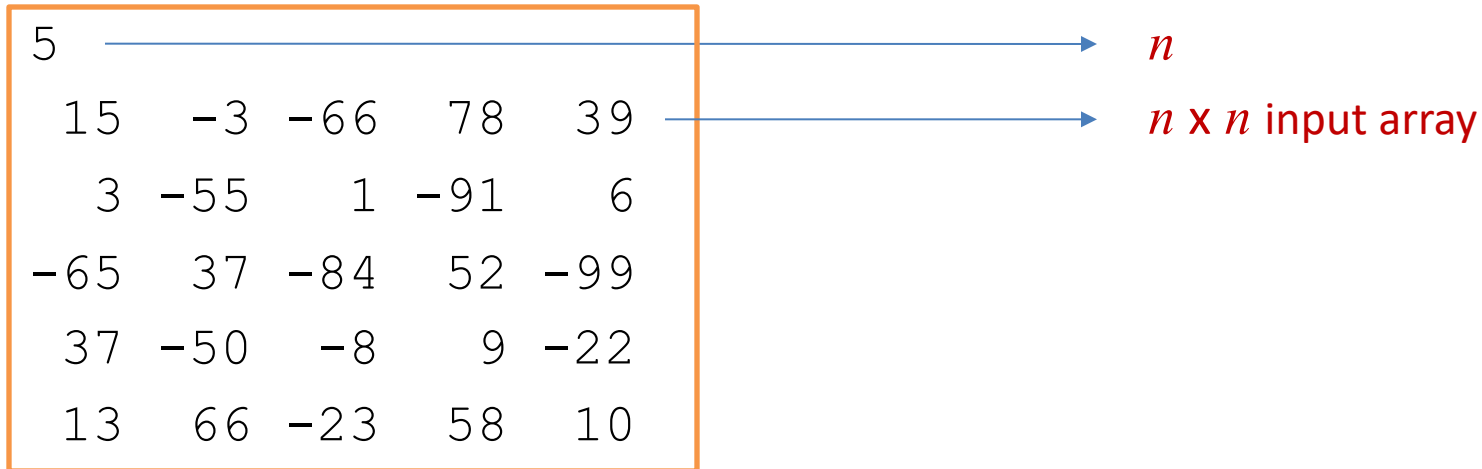
# Homework #2





# Examples (1/4)

- Input (standard/console input)



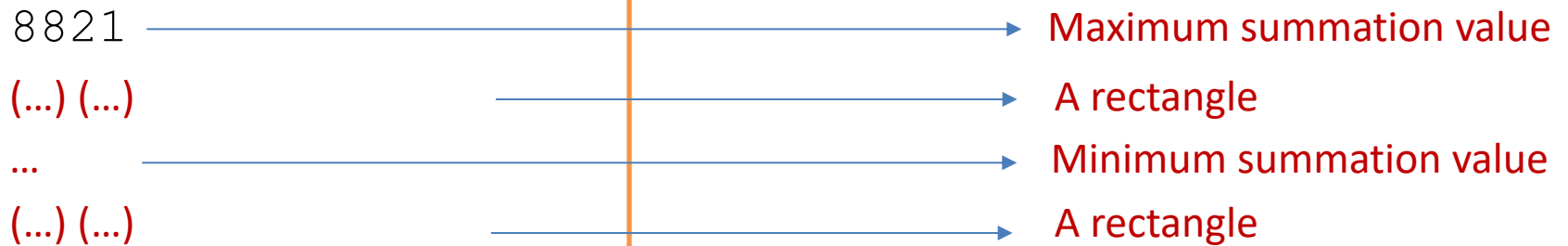
- Output (standard/console output)



# Examples (2/4)

- Input (standard/console input)
  - testcase100.txt

- Output (standard/console output)



8821 —————→ Maximum summation value  
(...) (...) —————→ A rectangle  
... —————→ Minimum summation value  
(...) (...) —————→ A rectangle

The diagram shows four lines of output. The first line is '8821', the second is '(...) (...)', the third is '...', and the fourth is '(...) (...)'. Each line has a blue arrow pointing to a red text description on the right. The first arrow points to 'Maximum summation value', the second to 'A rectangle', the third to 'Minimum summation value', and the fourth to 'A rectangle'. The first two lines are enclosed in an orange box.

# Examples (3/4)

- Input (standard/console input)
  - testcase500.txt

- Output (standard/console output)

The diagram shows a box containing four lines of output. Blue arrows point from each line to a red text description on the right. The first line '34329' points to 'Maximum summation value'. The second line '(...) (...)' points to 'A rectangle'. The third line '...' points to 'Minimum summation value'. The fourth line '(...) (...)' points to 'A rectangle'.

34329	→	Maximum summation value
(...) (...)	→	A rectangle
...	→	Minimum summation value
(...) (...)	→	A rectangle

# Examples (4/4)

- Input (standard/console input)
  - testcase1000.txt

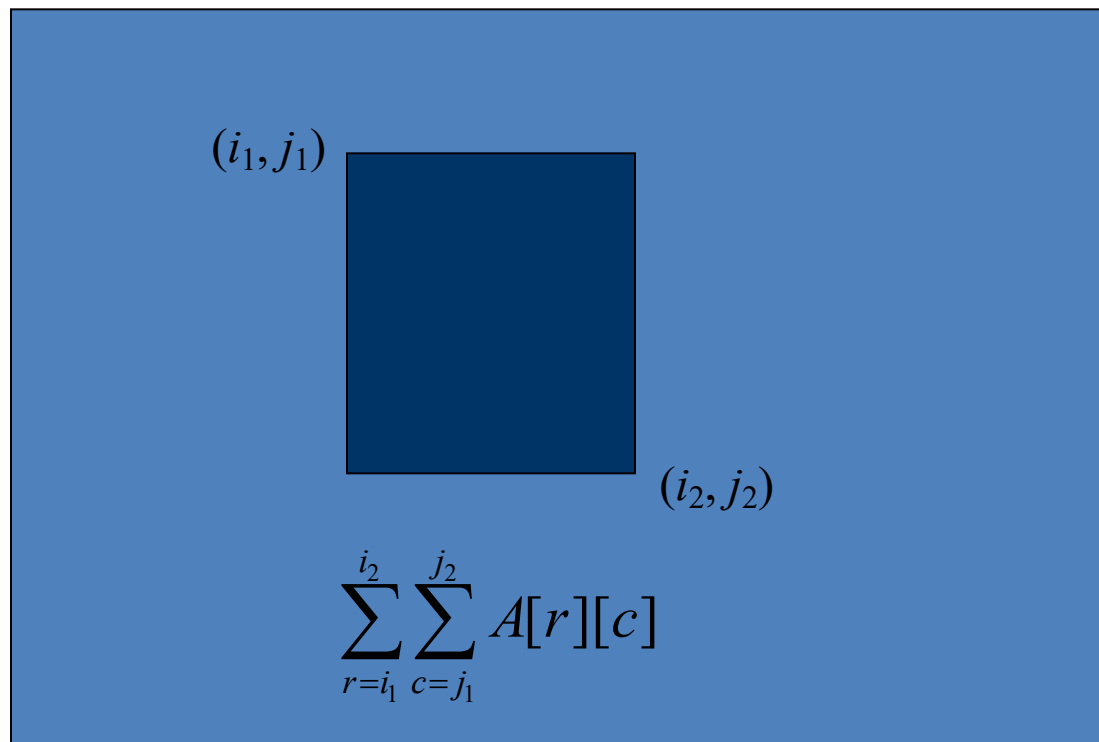
- Output (standard/console output)

93472 → Maximum summation value  
(...) (...) → A rectangle  
... → Minimum summation value  
(...) (...) → A rectangle

The diagram shows four lines of output. The first line is '93472', the second is '(...) (...)', the third is '...', and the fourth is '(...) (...)'. Each line has a blue arrow pointing to a red text description on the right. The first arrow points to 'Maximum summation value', the second to 'A rectangle', the third to 'Minimum summation value', and the fourth to 'A rectangle'. The first three lines are enclosed in an orange rectangular box.

# Naïve Method

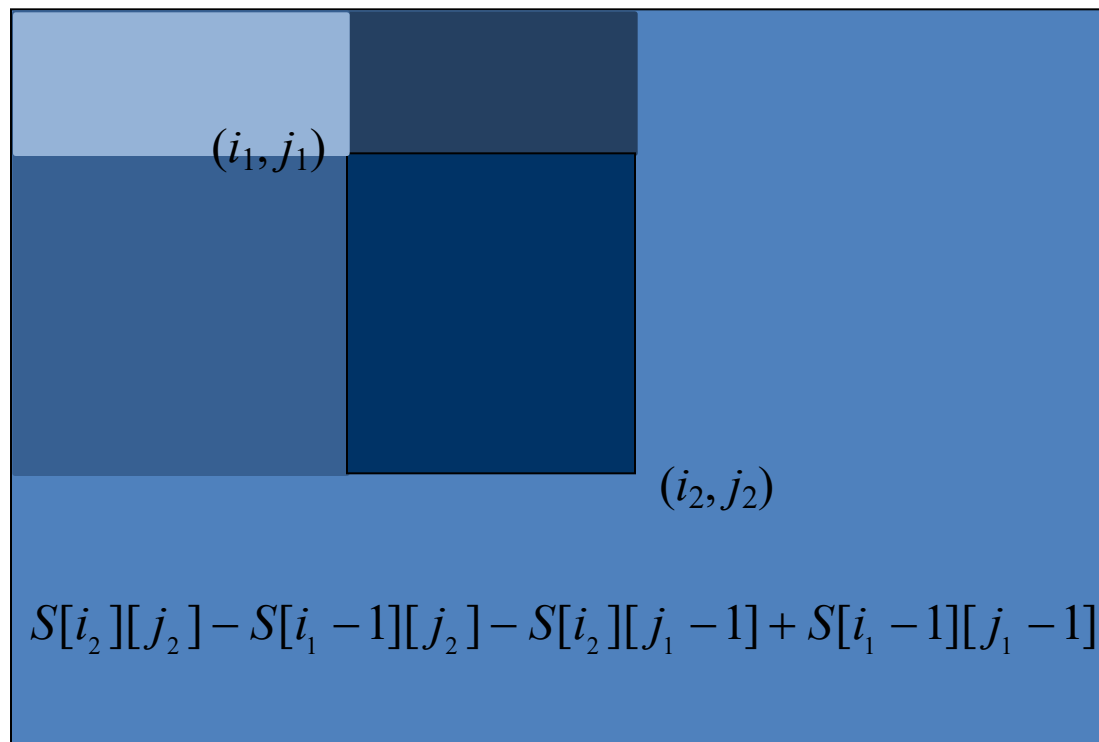
- $O(n^6)$ -time algorithm



$A[ ][ ]$

# Better Method

- $O(n^4)$ -time algorithm



$A[ ][ ]$

# Your Method

- Design  $O(n^3)$ -time algorithm
  - Dynamic Programming
- Cf. Section 2.6 and Problem 2.f of the auxiliary textbook.

# Due Date

- Soft deadline: **May 13, 2018**
- Hard deadline: May 20, 2018
  - But, will be deducted 10% per one day from your original score

Submission Date	Deduction Rate
May 14	10%
May 15	20%
May 16	30%
May 17	40%
May 18	50%
May 19	60%
May 20	70%
May 21	100%



# Notice (cont'd)

- You should observe the format of input & output exactly.
- You should submit a compressed file (**HW2\_your-ID.zip**) containing the following three files to the “u-campus” web-site (<http://info.kw.ac.kr>).
  - **HW2\_your-ID.hwp/doc** // report document
  - **HW2\_your-ID.cpp/cc** (or **.java**) // source code
  - **HW2\_your-ID.exe** // executable file

# Notice (cont'd)

- Source code
  - It should be compiled in
    - **C/C++ Language: Visual Studio 2010 or higher, or g++**
    - **Java Language: not restricted**
    - **You should note your environment in your report.**
  - Your name and student ID should be noted at the top of your source files in the form of comment.
- Report
  - Free format.
  - But, it must include several examples for testing your program and your own discussion.
  - It will be an important factor for getting a good score.
  - Mention your programming language together with compiler.