Problem Solving

Group Project #2: Maximum Profit

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Maximum Profit

- You are going to lease a piece of land
- For each unit:
  - You need to pay F dollars (single price for all units)
  - You will earn $A(i, j)$ dollars (depending on the location)
  - Your profit by the lease: $A(i, j) - F$

- Goal: Find a rectangular area that maximizes your profit.

Example

- Given a matrix A and $F = 100$,

	$j = 0$	$j = 1$	$j = 2$	$j = 3$	$j = 4$
$i = 0$	110	130	80	170	160
$i = 1$	150	120	170	160	90
$i = 2$	110	190	180	120	30
$i = 3$	10	80	110	130	140
$i = 4$	120	130	30	120	90
$i = 5$	60	120	80	100	50

- If you lease from $(1,0)$ to $(4,2)$
  - Your profit is: $150 + 120 + 170 + 110 + 190 + 180 + 10 + 80 + 110 + 120 + 130 + 30 - 12 \times 100 = 200$
  - Note that**, the index is row major [i.e. (i, j)] and begins with 0** like C/C++ programming languages.

Example

- Given a matrix A and $F = 100$,

	$j = 0$	$j = 1$	$j = 2$	$j = 3$	$j = 4$
$i = 0$	110	130	80	170	160
$i = 1$	150	120	170	160	90
$i = 2$	110	190	180	120	30
$i = 3$	10	80	110	130	140
$i = 4$	120	130	30	120	90
$i = 5$	60	120	80	100	50

- If you lease from $(0,0)$ to $(2,3)$
  - Your profit is: $110 + 130 + 80 + 170 + 150 + 120 + 170 + 160 + 110 + 190 + 180 + 120 - 12 \times 100 = 490$
  - It is the maximum case.

Input & Output

- Input
  - $N \times M$ matrix A, where $5 \leq N, M \leq 40$
  - Each $A(i, j)$ is a multiple of 10, ranging from 10 to 990
  - F is also a multiple of 10, ranging from 10 to 990

- Output
  - The indices of the left upper and right lower corner
  - Example: $(3,2), (10,9)$
  - Note that, we use the **indexing rule of C/C++ language**.

Rules

- You can only use white papers and pens

- We will perform 3 or 4 plays
  - For each play, you will have T minutes $(2 \leq T \leq 15)$
  - You may need different algorithms depending on T

Presentation

- Present the strategy of your team
  - Prepare slides (Powerpoint)
  - 3 – 5 minutes for each team
    - Penalty for exceeding time

- Play: 70%
- Presentation: 30%

Schedule

- May/20: in-class practice, Q&A
  (OpenSW Room, 6th floor, Semiconductor Bd.)
- May/27: play
  (OpenSW Room, 6th floor, Semiconductor Bd.)
- May/29: presentation