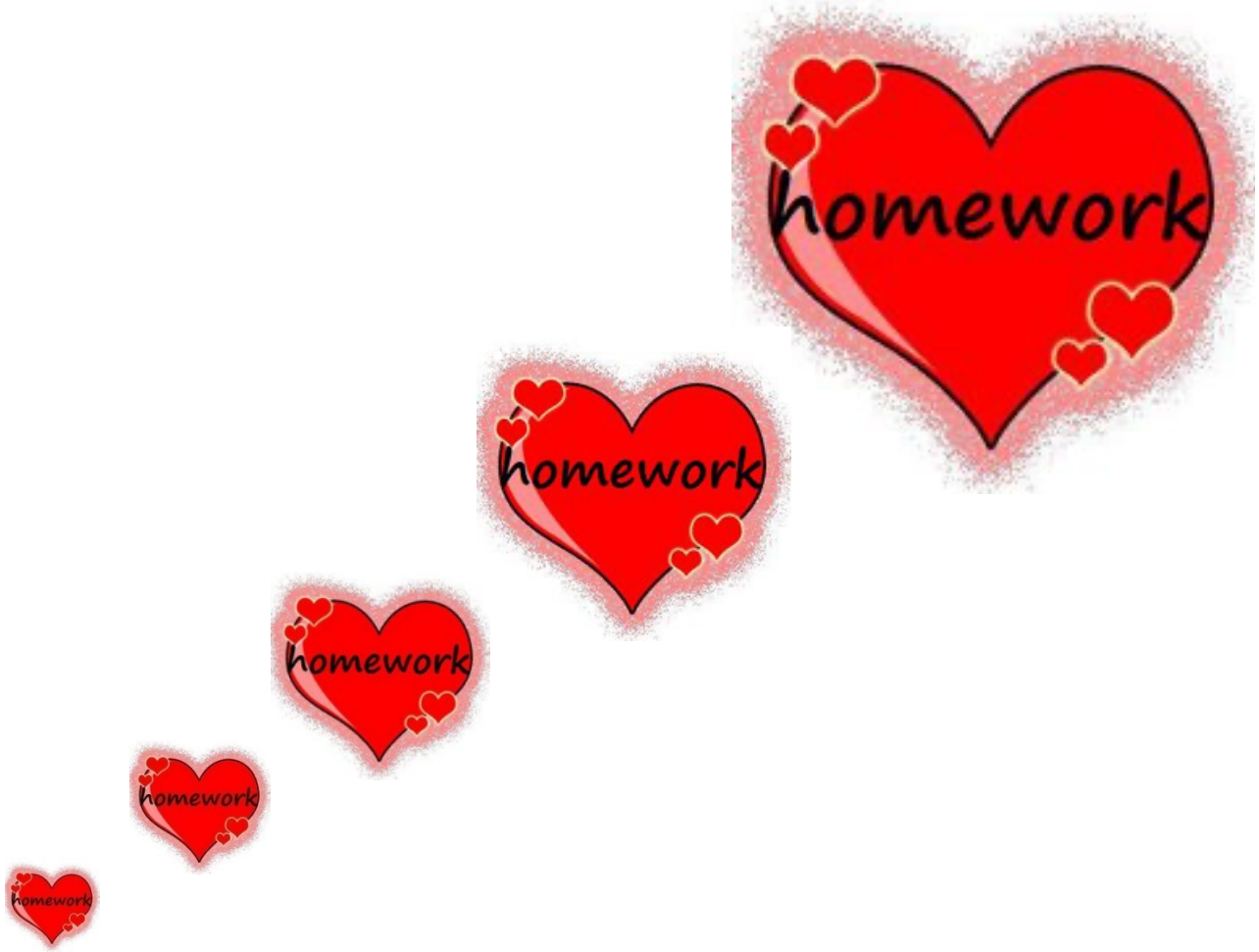
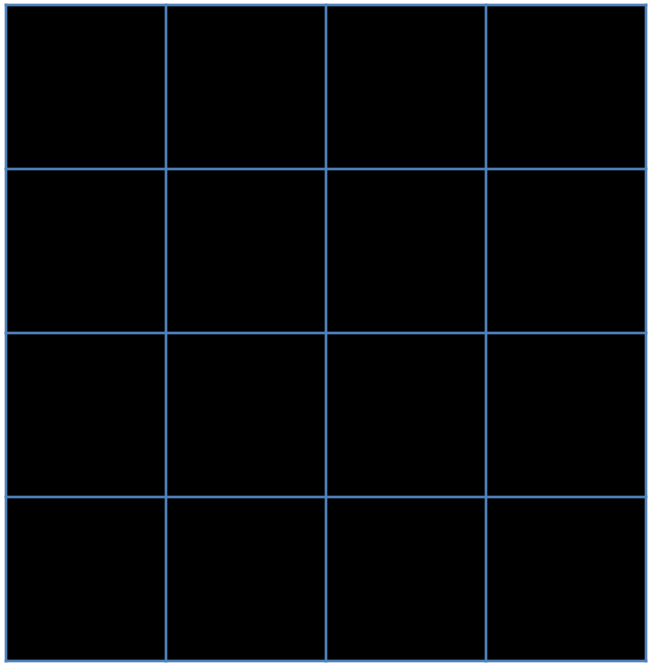
Algorithms 2018



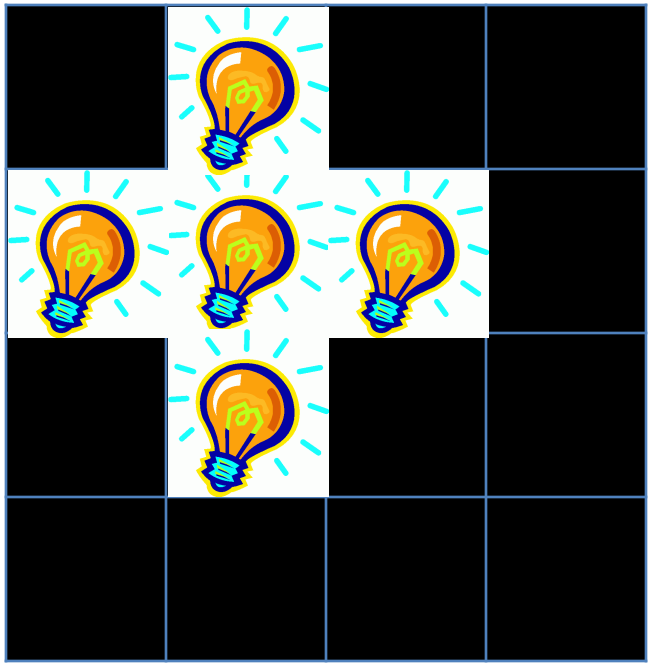
Homework #3

- Consider the following 4 x 4 array.



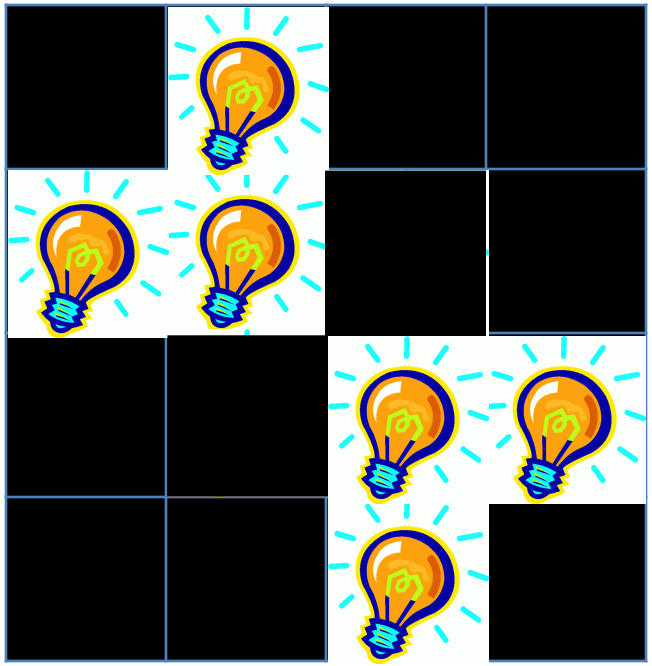
Homework #3

- First, if we turn on the switch in the position (the 2nd row, the 2nd column), the array becomes…



Homework #3

- Next, if we turn on the switch in the position (the 3rd row, the 3rd column), the array becomes…



Homework #3

- Given an n x n binary array corresponding to the target on/off state, your program should find switches to push, to make the final on/off state.
  - As the number of switches is smaller, you will get better score.
- Initial state is that all bulbs are in off-states.
- Each switch changes the states of the bulb in the same position and its (at most four) possible neighbors.
  - ON → OFF & OFF → ON
- '#' means off-state and 'O' means on-state.
- Note that the positive integer n is less than or equal to **<u>20</u>**.
- If there are more than one solution, print one of them. If there is no solution, print "no solution.\n".

Example I

- Input (standard/console input)

```
5
# # # # #
# # # # #
# # # # #
# # # # #
# # # # #
```

n

final state

- Output (standard/console output)

```
# # # # #
# # # # #
# # # # #
# # # # #
# # # # #
```

switches to push

Example II

- Input (standard/console input)

```
5
# O # O #
O # O # O
# O # O #
O # O # O
# O # O #
```

n

final state

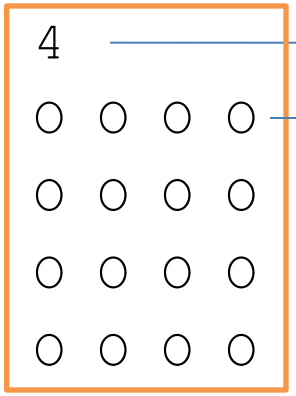
- Output (standard/console output)

```
# O # # O
O # O # O
# O # # O
# # # # #
O O O # #
```

switches to push

Example III

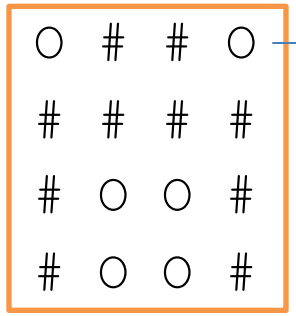
- Input (standard/console input)



n

final state

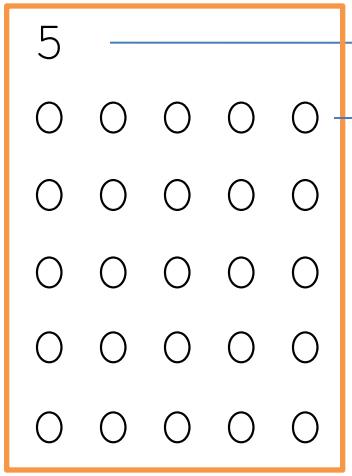
- Output (standard/console output)



switches to push

Example IV

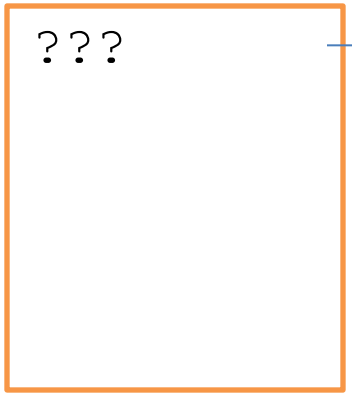
- Input (standard/console input)



n

final state

- Output (standard/console output)



switches to push

Hint: Time Complexity

- Naïve method
  - $O(2^{n \times n})$
- Backtracking with some trick: **required**
  - $O(n^2 2^n)$
- More advanced technique based on graph structure & linear algebra: **not required**
  - $\Theta(n^6)$

Due Date

- Soft deadline: **June 6, 2018**
- Hard deadline: June 8, 2018
  - But, will be deducted 30% per one day from your original score

Submission Date	Deduction Rate
June 7	30%
June 8	60%
June 9	100%

Notice

- You should observe the format of input & output exactly.

- You should submit a compressed file (**HW3_your-ID.zip**) containing the following three files to the "u-campus" web-site (http://info.kw.ac.kr).
  - **HW3_your-ID.hwp/doc** // *report document*
  - **HW3_your-ID.cpp/cc** (or **.java**) // *source code*
  - **HW3_your-ID.exe** // *executable file*

Notice (cont'd)

- Source code
  - It should be compiled in
    - **C/C++ Language: Visual Studio 2010 or higher, or gcc/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.