



## School of Computer Science

COMP30670: Software Engineering  
Semester II

### Assignment 3

On: 20/02/2018

Due: 02/03/2018

#### Q1: \_\_\_\_\_ (100points)

The Science Centre is installing a new display board which is constructed from LED lights.

The board is a square grid of LEDs which we control by sending commands to the unit to turn on or off certain rectangular regions.

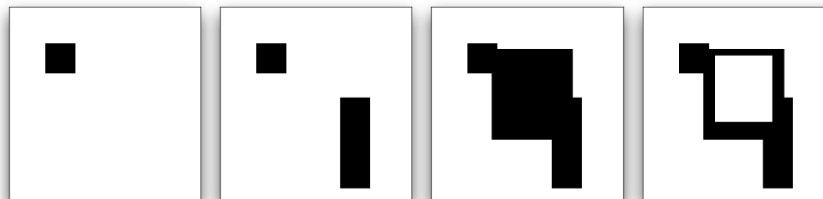
The  $L \times L$  lights can be modelled as a 2 dimensional grid with  $L$  rows of lights and  $L$  lights in each row and the LED's at each corner are  $(0, 0)$ ,  $(0, L - 1)$ ,  $(L - 1, L - 1)$  and  $(L - 1, 0)$ .

The lights are either on or off.

Your job is to test the lights. We test them by sending instructions to turn on, turn off, or switch various inclusive ranges given as coordinate pairs. Each coordinate pair represents opposite corners of a rectangle, inclusive; a coordinate pair like 0,0 through 2,2 therefore refers to 9 lights in a 3x3 square. The lights all start turned off.

For example:

- "turn on 0,0 through 999,999" would turn on (or leave on) every light.
- "switch 0,0 through 999,0" would toggle the first line of 1000 lights, turning off the ones that were on, and turning on the ones that were off.
- "turn off 499,499 through 500,500" would turn off (or leave off) the middle four lights.



You will read a list of these instructions from a file. Your task is to determine how many lights are on after all the instructions have been applied.

- (a) Before you write any code to solve this problem, think about how you will solve it. Write a paragraph (perhaps a diagram) outlining your strategy and how you intend to write the algorithm. (You can include pseudocode if you wish).

[10]

- (b) Use your favourite project structure from Assignment 2. Create a python project in Eclipse with this project structure. You should have at least, a package directory, a tests directory, a README.md file, and a setup.py file. [5]

For example:

```
1 skeleton/
2     README.md
3     NAME/
4     __init__.py
5     docs/
6     setup.py
7     tests/
8     test.py
```

- (c) Create a new Github repository and connect it to your local Eclipse repository as a remote. Make regular, informative commits as you work through and develop your solution. You can branches or git-flow to track development, but these are not strictly necessary. However, I should be able to follow the development of your solution through the github commit comments. [10]
- (d) The input file has the following format: [40]

999

turn on 0,0 through 999,999

switch 0,0 through 999,0

turn off 499,499 through 500,500

where the first line specifies the size of the grid  $0 < L < 10^9$  and the next lines contain the command. The only possible commands are

- "turn on"
- "turn off"
- "switch"

Your setup.py should install a script which reads input from a file (this could be a local file or a network address), specified as a command line argument:

```
1 solve_led --input http://claritytrec.ucd.ie/~alawlor/comp30670/↵
    input_assign3.txt
```

or

```
1 solve_led --input data/input_assign3_b.txt
```

Run your code with each of the following inputs and report the outputs:

1. solve\_led --input http://claritytrec.ucd.ie/~alawlor/comp30670/input\_assign3.txt
2. solve\_led --input http://claritytrec.ucd.ie/~alawlor/comp30670/input\_assign3\_a.txt
3. solve\_led --input http://claritytrec.ucd.ie/~alawlor/comp30670/input\_assign3\_b.txt
4. solve\_led --input http://claritytrec.ucd.ie/~alawlor/comp30670/input\_assign3\_c.txt

5. `solve_led --input http://claritytrec.ucd.ie/~alawlor/comp30670/input_assign3_d.txt`

- (e) Try to follow the Test Driven Development model for this assignment. Think about the piece you are going to write, develop a test, write the test, execute it (it will fail!), then write the code to make it pass. Make sure the commit history reflects the actual development. [20]

Your code should test for various things:

- Existence of the input file
  - Check for errors in the file, any commands which are not "turn on", "turn off" or "switch" should be ignored.
  - If a command affects a region outside the area of the grid, then it will still be executed, but only on the region of lights inside the boundary of the grid.
- (f) Run the code on your Amazon EC2 instance, and demonstrate that you get the same answers as in Part [d](#) [5]
- (g) Comment on the design and complexity of your solution (a couple of paragraphs is fine). For example, you can comment on your algorithm for solving the problem, class structure, data structures, etc.. [10]