

UNIVERSITY COLLEGE DUBLIN



MSC COMPUTER SCIENCE (CONVERSION) COMP30670
SOFTWARE ENGINEERING (CONVERSION)

Assignment 3

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Initial Design

Having read the project brief I broke down the assignment into a series of steps. I then broke these steps into smaller solutions which would reflect methods in a class.

Take data input from a text file/url.

Method 1: read a file line by line.

Parse that data into a data structure.

Method 2: add the data in each line to a two dimensional list.

Apply that data to a template data structure.

Method 3: create a template data structure of the correct size.

Method 4: apply the list taken from the file to the template list.

Return a integer query of the resulting data structure.

Method 5: read the number of items in the list which are in an on state.

This left me with 6 methods which needed to be implemented:

1. parseFile
2. parseEachLine
3. getSize
4. applyValues
5. getResult

I would also need a series of lists to store data as it passed through the system:

- parseList - would store each line in the input file.
- ledStateList - would reflect the LED array in an off position and then be updated as each line was read.

Final Solution

My final solution is quite similar to the initial design solution with a few tweaks.

1. The parseFile method now calls the other class methods as it iterates through the input document. This removes an iteration over the parseList list which I then removed.
2. The getSize functionality is integrated into the parseFile method. It's a simple line of code and I felt it didn't make sense for it to have its own method.
3. I created a new method createTemplate. This should have existed from the beginning. For a long time its functionality existed in the getSize method.

4. I added a method called `changeState` to break up the `applyValues` method. `ApplyValues` was becoming too large. `ApplyValues` now calls `changeState` on each line in the input text file. `ChangeState` applies each line to the `ledStateList`.
5. The `parseEachLine` method became much more complicated as I realised that the input files had issues such as negative values and spelling errors. I should of checked each input file from the beginning and examined carefully the input data. I would've broken up this method had I done that.

Learning Outcomes

I was unhappy with the efficiency of my result so I spent quite a long time refactoring the code to get it to run faster. My refactoring focused on reducing the number of iterations I was performing.

I tried to use a dictionary instead of a list. This would remove the need for me to make a template two dimensional list and would allow me to index directly to the state position. I implemented this (it's available in my GitHub history) and it performed marginally slower than my first solution.

Then I tried to use a set instead. I believed that operations on a set are very fast. I turned each x, y location into a tuple and if it was supposed to be on I would add it to a set and off remove it etc. This solution ended up being even slower than the dictionary. I believe this is because a set is immutable and each operation on it creates a new set in memory. This is very time consuming.

Disappointed by my failures I returned to the two dimensional list approach. I did however learn a few things about the differences between lists, dictionaries and sets. I actively implemented each of them and for more information on why my solutions were incorrect I got a great explanation from a demonstrator in the class about the speed of each operation.

GitHub Link

https://github.com/hinfeyg2/comp30670_assignment3

EC2 Screenshot

Below is a screenshot of my Amazon EC2 server.

Commands used

Download and install:

"`sudo pip3 install git+https://github.com/hinfeyg2/comp30670_assignment3.git"`

Run the app:

"`LedSwitcher input_assign3.txt`"

Result: 400410

```
(venv) ubuntu@ip-172-31-15-237:~$ sudo pip3 install git+https://github.com/hinfeyg2/comp30670_assignment3.git
Downloading/unpacking git+https://github.com/hinfeyg2/comp30670_assignment3.git
  Cloning https://github.com/hinfeyg2/comp30670_assignment3.git to /tmp/pip-xo4fcgw8-build
  Running setup.py (path:/tmp/pip-xo4fcgw8-build/setup.py) egg_info for package from git+https://github.com/hinfeyg2/comp30670_assignment3.git

Installing collected packages: LedSwitcher
  Running setup.py install for LedSwitcher

  Installing LedSwitcher script to /usr/local/bin
Successfully installed LedSwitcher
Cleaning up...
(venv) ubuntu@ip-172-31-15-237:~$ ls
input_assign3.txt
(venv) ubuntu@ip-172-31-15-237:~$ LedSwitcher input_assign3.txt
400410
(venv) ubuntu@ip-172-31-15-237:~$ LedSwitcher http://claritytrec.ucd.ie/~alawlor/comp30670/input_assign3.txt
400410
```

Outputs for Each Input

```
(virtualenv) GavsLaptop:test gavinhinfey$ python test.py
Input File ../test/testinputs/input_assign3.txt
Result 400410

Input File ../test/testinputs/input_assign3_a_v2.txt
Result 11322278

Input File ../test/testinputs/input_assign3_b_v2.txt
Result 42880639

Input File ../test/testinputs/input_assign3c.txt
Result 477452

Input File ../test/testinputs/input_assign3d.txt
Result 349037

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Ran 5 tests in 2175.226s

OK
```