

## EN.540.635 “Software Carpentry”

### Group Project - Lazor

Due - Nov 11<sup>th</sup> - Submitted to Blackboard - **NO EXTENSIONS**

For this assignment, you will work through building up a code that will automatically find solutions to the “Lazor” game on [Android](#) and [iPhone](#). Work will be done in groups, and as such the code should be collaborated on via GitHub. The final project submission should be a link to the github page with the full name and email of everyone in the group.

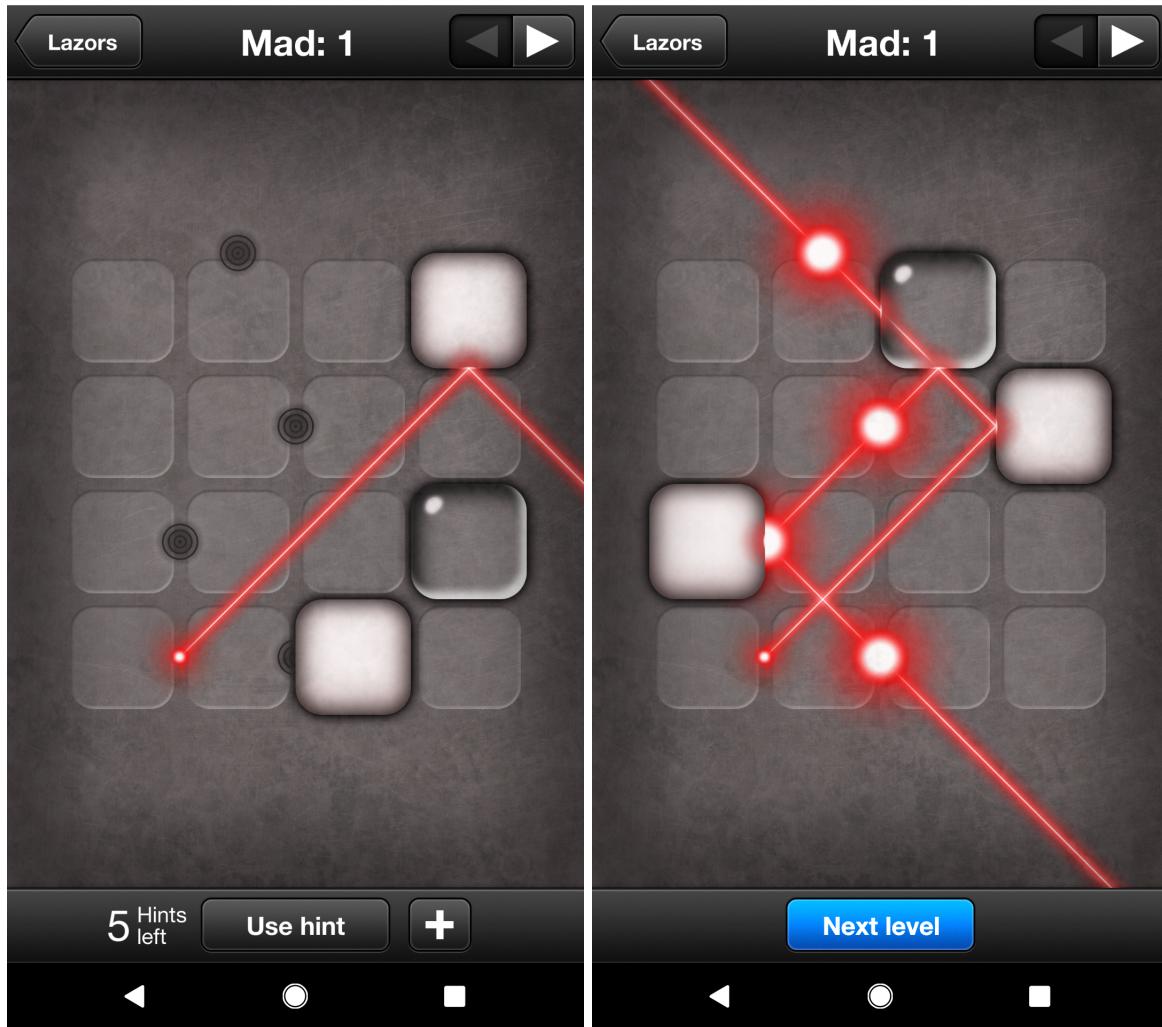


Figure 1: An example level in Lazor (mad-1).

You will be given free reign in how to tackle this problem; however, some criteria must be met:

1. You must read in the Lazor board via a text file. The specified file format will be further elaborated below.
2. You must use a class object to describe the blocks within the game.
3. You must have an output file that shows the valid solution (text, image, etc). Output file format is up to you; however, it must be easy to understand.
4. The code should NOT be slow. I have attached various boards in text file format for your benchmarking. I will be using these (and possibly others) to test out your code. Try to make it such that these run at a reasonable pace. None

of the attached boards should take more than 1 minute (some should be under 5 seconds); however, your code has 2 minutes to solve each individual board. If your solution of any single board takes more than 2 minutes, points will be deducted. If your solution is absurdly fast for all boards, I may give bonus points!

5. Your boards should allow for (a) reflect blocks, (b) opaque blocks, and (c) refract blocks. Further, you should account for boards in which a block is fixed in a starting position.

## Board File Format (.bff)

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```
# This is a comment
# This example is for mad 1 in Lazor
#   x = no block allowed
#   o = blocks allowed
#   A = fixed reflect block
#   B = fixed opaque block
#   C = fixed refract block

# Grid will start at top left being 0, 0
# Step size is by half blocks
# Thus, this leads to even numbers indicating
# the rows/columns between blocks , and odd numbers
# intersecting blocks.

GRID START
o   o   o   o
o   o   o   o
o   o   o   o
o   o   o   o
GRID STOP

# Here we specify that we have 2 reflect blocks and 1 refract block
A 2
C 1

# Now we specify that we have two lasers
#   x, y, vx, vy
# NOTE! because 0, 0 is the top left , our axis
# are as follows:
#
#   ----- \ +x
#   |           |
#   |           |
#   |           |
#   \|/ +y
#
L 2 7 1 -1

# Here we have the points that we need the lazers to intersect
P 3 0
P 4 3
P 2 5
P 4 7
```

---

## Points Considered During Grading

### GitHub

- Was it used appropriately?
- Does the code exist online for me to access?
- Is there a README or Website?

### Reading in BFF Files

- Was it done correctly?
- Is it robust?
- Does it work without any errors or requirements?

### Use of Class Objects

- Were classes used appropriately or were they simply jammed into the code?

### Blocks Accounted For

- Were all blocks (reflect, opaque, and refract) accounted for?
- Were fixed blocks of the above types accounted for?

### Solution

- Is the solution correct?
- Did it take too long to solve the boards?
- Is the solution output in a file?
- Is the solution easy to parse back to a board (ie. is it easy to understand)?

### Misc

- Are docstrings used?
- Is PEP 8 styling used?
- Is the code commented appropriately?
- Were unit tests written?
- Are errors handled appropriately?

## Optional Challenges, Possibility of Bonus Points

**Challenge 1:** If you've played around with this solver for a little bit, you'll quickly come to the realization that the larger the boardgame, the longer the solution takes. This can be narrowed down to two culprits:

1. The generation of potential boards
2. The play through of each board

There are many ways of speeding up both of these sections. This completely optional challenge is to figure out how to go about speeding up this code. NOTE! If you do find some way of speeding this up, and are able to adequately explain how it works (don't just copy things from online... I have ways of finding out), then you will also get bonus points on this assignment.

**Keep in mind though, if your base code is slow due to the algorithm/approach you took, and you speed it up using some method like parallelization, there may still be point reductions (and no bonus points given). So focus on the base assignment first before taking on this optional challenge!**