National Taipei University of Technology
Artificial Intelligence (spring, 2014)

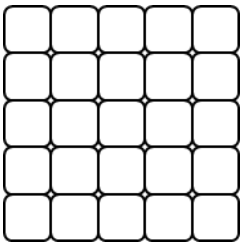
Homework #4

(Due: Wednesday, May, 7th)

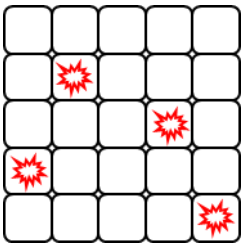
For solving the lights out problem[1][2][3] by using A* algorithm, you should define the problem-specific relation **`s`**, **`start`**, **`goal`** and **`h`**.

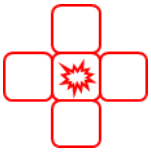
The rule of the game as follow:

1. A block  means a light. Yellow block  means light on. White block means light off.
2. Make blocks to form a n×n square.



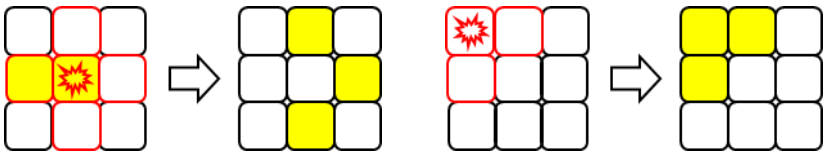
3. You can select any light on the square.

  means select.

4.  Each selection will affect the adjacent lights and selection itself.
5. The effect will turn the light from on to off or from off to on.

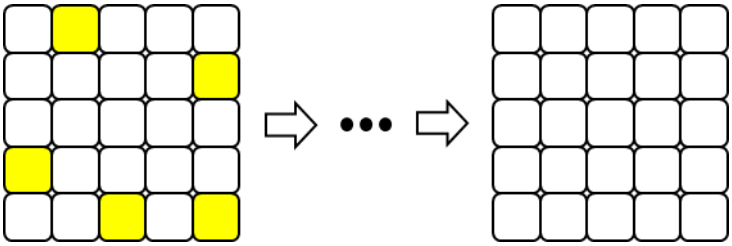
(1)  : from on to off (2)  : from off to on

For example,

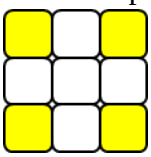
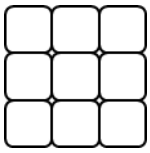


6. The game is start with some lights on. The goal is to turn off all lights.

   For example,



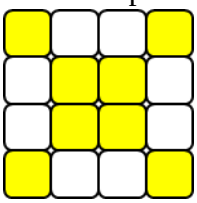
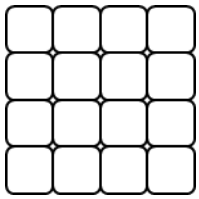
(1) (60%) Solve the problem for size 3×3.

start( **). goal(**  **).**

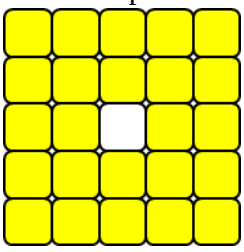
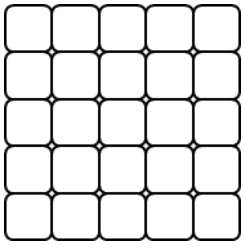
1. The query `?- start(Start), bestfirst(Start, Solution).` must be run correctly.
2. Put the code `:-consult(bestfirst).` on top of the source code for not writing bestfirst program many times and duplicated. DO NOT modify the bestfirst.pl.
3. Solve means without incur out of local stack and get the solution within 30 seconds.

(2) (10%) Write tests cases for **`s`** and other rules if needed.

(3) (10%) Solve the problem for size 4×4.

start( **). goal(**  **).**

(4) (10%) Solve the problem for size 5×5.

start( **). goal(**  **).**

(5) (10%) Describe in brief how you define **`h`**.

If you solve more than one problem, you must put the code in different files. Files name are **4-1.pl**, **4-2.pl**, **4-3.pl**.

Reference:

[1] Lights Out Wikipedia: http://en.wikipedia.org/wiki/Lights_Out_(game)
[2] Lights Out Online Game1: http://www.addictinggames.com/puzzle-games/lightsout.jsp
[3] Lights Out Online Game2: http://www.logicgamesonline.com/lightsout/

Note:

- The programs must be runnable in SWI-Prolog.
- You must package your programs in a single zip file named XXX_hw4.zip, where XXX is your student identity number.
  Submit the whole file to open cyber classroom. The first-time Login ID and password are student number.
- If the answer is not a program, you must answer the question in a single text file (txt, doc, etc.).
- A penalty will be applied if predicate name, program name or zip file name is not defined as above.