



ARTIFICIAL INTELLIGENCE PROJECT

Minesweeper

1	1	2	0	0	3	1	5	2	P	R	A	T	H	A	M	E	S	H	W	A	N	I
1	1	2	0	0	3	1	4	6	A	M	A	N	T	E	J	W	A	N	I			
1	1	2	0	0	3	1	4	8	V	A	I	B	H	A	V	G	A	R	J	E		



Introduction

	1				1		1
	1			1	2		
1	1			1		4	
				1	2		
1	1		1	1	2	2	2
	2	1	1		1		
2			2	1	1		
1	2		1				

Minesweeper is a single player puzzle game that consists of a grid of cells, where some of the cells contain hidden “**mines**.”

Clicking on a safe cell reveals a number that indicates number of mins in neighbouring cells. Clicking on a cell that contains a mine blasts it. Our objective is to flag all cells containing mines.



PROGRAM DESCRIPTION **PEAS**

01

Performance Measure

The performance measure of your agent will be a score calculated based on the number of tiles your agent has uncovered. Points are awarded to your agent only if it successfully solves the entire world.

The game ends if your agent uncovers a mine. In either of these cases, you'll get a zero.

Actuators

The Agent has actions like-

Uncover: uncover a tile.

Flag: Flag a tile if there is a mine under it.

Unflag: Unflag a tile if there is no mine under it.

02

Environment

An N by N world of tiles under which there might or might not be landmines. Mines are randomly placed and the agent dies if it uncovers a mine. Agent wins if it uncovers all tiles with no mines.

04

Sensors

Following an 'Uncover' action, your agent will perceive the hint number associated with the previous 'Uncover' action. This number represents how many mines are within that tile's immediate neighbors. Following a FLAG or UNFLAG action, your agent will perceive -1.



Methodology

knowledge-based agents make decisions by considering their knowledge base, and making inferences based on that knowledge. One way we could represent an AI's knowledge about a Minesweeper game is by making each cell a propositional variable that is true if the cell contains a mine, and false otherwise.

A	B	C
D	1	E
F	G	H

From above image we can see that one of the eight neighboring cells is a mine. Therefore, we could write a logical expression like the below to indicate that one of the neighboring cells is a mine.

$\text{Or}(A, B, C, D, E, F, G, H)$



Proposed Solution

A	B	C
D	1	E
F	G	H

From the image we can see that one of the eight neighboring cells is a mine.

Therefore, one approach is to write a logical expression like the below to indicate that one of the neighboring cells is a mine.

```
Or(  
    And(A, Not(B), Not(C), Not(D), Not(E), Not(F), Not(G), Not(H)),  
    And(Not(A), B, Not(C), Not(D), Not(E), Not(F), Not(G), Not(H)),  
    And(Not(A), Not(B), C, Not(D), Not(E), Not(F), Not(G), Not(H)),  
    And(Not(A), Not(B), Not(C), D, Not(E), Not(F), Not(G), Not(H)),  
    And(Not(A), Not(B), Not(C), Not(D), E, Not(F), Not(G), Not(H)),  
    And(Not(A), Not(B), Not(C), Not(D), Not(E), F, Not(G), Not(H)),  
    And(Not(A), Not(B), Not(C), Not(D), Not(E), Not(F), G, Not(H)),  
    And(Not(A), Not(B), Not(C), Not(D), Not(E), Not(F), Not(G), H)  
)
```



But using this method we will have 2^{64} models which is not feasible.
Thus we represent a mine by

$$\{A, B, C, D, E, F, G, H\} = 1$$

which means that exactly one of the A,B,C,D,E,F,G,H is a mine.
Each time we push this information in Knowledge Base and then infer from knowledge base to flag a mine or to make a move on safe cell.



Here we can see that our AI has inferred fromt the KB that

$$\{(4,4), (5,4), (3,4)\} = 1$$

from $\{(5, 3), (3, 3)\} = 1$

and $\{(4, 4), (3, 4), (5, 4), (3, 3), (5, 3)\} = 2$



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Thank You

SLIDE PRESENTATIONS DESIGN