Programming Questions (50 marks):

In this programming part you are asked to implement a game called ***MagicBoard.***

MagicBoard is a 1-player game using a chess-like board consisting of $d \times d$ squares with d between 5 and 20, and each square contains an integer between 0 and d -1. The rules of the game are simple. The circle marks the start position on the board. The integer (n) in the circled square indicates that the circle can move n squares on the board. In one step the circle can move either n squares east or west or north or south. At each step the chosen direction is fixed. The circle cannot move off the board. The only legal start positions are the four corner squares. The board must contain exactly one goal square with zero as value that can be located anywhere on the board, but its position cannot be identical to the start position.

(4)	2	1	3	1
2	3	2	1	4
3	2	3	1	4
1	3	4	2	3
3	3	1	2	0

For instance, in the above example the circle can move either 4 squares east or south. All other moves are illegal. The objective of the game is to move the circle to the goal square containing the zero value. In the configuration given below, you can solve the game by making the following sequence of steps:

1. Step
Move south

(4)	2	1	3	1
2	3	2	1	4
3	2	3	1	4
1	3	4	2	3
3	3	1	2	0

2. Step
Move east

4	2	1	3	1
2	3	2	1	4
3	2	3	1	4
1	3	4	2	3
(3)	3	1	2	0

3. Step
Move west

4	2	1	3	1
2	3	2	1	4
3	2	3	1	4
1	3	4	2	3
3	3	1	(2)	0

4. Step
Move east

4	2	1	3	1
2	3	2	1	4
3	2	3	1	4
1	3	4	2	3
3	(3)	1	2	0

Final position

4	2	1	3	1
2	3	2	1	4
3	2	3	1	4
1	3	4	2	3
3	3	1	2	(0)

Although the given example is solvable, actually with more than one solution, some board configurations may be unsolvable, i.e., the goal square cannot be reached from the given start position. Below is a simple example.

(1)	4	1	3	1
4	3	2	1	4
3	2	3	1	4
1	3	4	2	3
3	4	1	2	0

In this configuration, the circle can only move to its two adjacent squares with value 4. If it moves to its eastern neighbor, it will bounce south-north between two 4's, and if it moves to its southern neighbor it will bounce east-west between two 4's.