

# Digital Schoolhouse Puzzle Page

“If I had an hour to solve a problem I'd spend 55 minutes thinking about the problem and 5 minutes thinking about solutions”

Albert Einstein

## Welcome to the Digital Schoolhouse Puzzle Page

On this paper, we will investigate a Knight's Shortest Path...

### A Knight's Shortest Path

What is the minimum number of moves needed for a chess knight to go from one corner of a 100 × 100 board to the diagonally opposite corner?

#### Answer:

The minimum number of moves is 64.

Although the knight cannot move along the straight line towards its goal, it can stay on the main diagonal after each pair of its moves. Thus, if its start and finish squares are (1, 1) and (100, 100), respectively., a sequence of 66 moves such as:

$$(1, 1) - (3, 2) - (4, 4) - \dots - (97, 97) - (99, 98) - (100, 100)$$

solves the problem.

Given the nature of the knight's moves, it is convenient to measure the distance between the two squares on the board by the so-called Manhattan distance, which is computed as the number of rows plus the number of columns between two squares in question. Here the Manhattan distance between start and finish squares is  $(100 - 1) + (100 - 1) = 198$ . Since, one knight's move decrease this distance by no more than 3, the knight will need at 66 moves to reach its destination.

### Linkage to Computer Science

The solution to the puzzle can be considered “greedy” algorithm since each on step the algorithm decreases the Manhattan distance to the destination square as much as possible.

#### Solutions

6	9	5	8	1	4	3	7	2
5	9	8	2	7	2	8	5	5
4	1	4	3	6	3	5	6	9
7	2	6	4	5	3	1	8	9
9	3	8	1	6	2	8	5	4
4	7	3	8	1	9	7	6	2
3	6	9	2	4	1	7	5	8
5	1	4	7	8	9	2	3	6
8	7	2	3	6	5	4	9	1

Puzzle 48: (Hard, difficulty rating 0.62)

4	9	7	8	5	2	6	3	1
2	3	1	7	6	9	4	8	5
2	7	9	4	1	3	5	6	8
4	9	8	7	3	5	6	2	1
7	1	3	2	8	6	4	5	9
6	2	5	9	4	1	3	8	7
9	8	1	3	5	4	2	7	6
3	6	2	1	7	9	8	4	5
5	4	7	8	6	2	9	1	3

Puzzle 47: (Medium, difficulty rating 0.47)

1	5	4	2	7	3	6	6	8
2	3	7	8	1	6	5	4	2
9	2	8	6	5	4	1	3	7
7	9	6	4	8	1	2	5	3
5	3	8	6	3	9	7	2	1
6	7	8	5	6	8	8	7	6
3	6	1	5	9	2	7	8	4
2	4	5	7	3	8	9	6	1
8	7	9	1	4	6	3	2	5

Puzzle 46: (Easy, difficulty rating 0.43)

### Puzzle 46: Easy

	7	9					2	
					8			
3		1					7	8
4	1			6	5		7	9
	8			2			1	
7	9		4	8			5	3
	2	8					1	
			8					
	5						6	9

### Puzzle 47: Medium

5	4		8				1	
	6		1					
		1	3		4	2		6
			9			3	8	
	1						5	
	9	8			5			
2		9	4		3	5		
					7		3	
	3				8		9	4

### Puzzle 48: Hard

8	7		3		5		9	
			7		9	2		
	6						5	
4	5				7	6		
9								7
		6	4				8	9
	8						1	
		3	9		2			
	9		8		4		7	2