

# UCF Practice Problem

## Token Game

*filename:* tokengame

The token game is played on a 4 x 4 board with four numbered tokens, labeled 1 through 4, inclusive. Each token starts on a unique cell. Each token must be moved to a unique destination cell, different from where it starts, and different from any of the other starting or ending locations. Here is an example of a valid starting grid:

S1	E4		S2
			E1
S4			
E2	S3		E3

Each of the labels with the prefix "S" represents a starting square. The number following the "S" represents the token number. Similarly, each of the labels with the prefix "E" represents an ending square and the number following the "E" is a token number. On a single move, each token may move up, down, left or right. A token may NOT be moved off the grid, may NOT be moved onto a square containing another token, and may NOT be moved onto an ending location that is not its own. The goal of the game is to move each of the tokens to their corresponding ending locations. Write a program to determine if this is possible, and if so, the minimum number of moves necessary to achieve the goal.

For the puzzle above, we can take 2 moves to get token 3 to its ending location, then move token 2 to the left once, down three times and left 2 times, then move token 1 down once and to the left 3 times, followed by moving token four left once and down twice. Token 3 is moved 2 times, Token 2 is moved 6 times, Token 1 is moved 4 times and Token 4 is moved 3 times for a total of 15 moves. This is minimal since each token moves its Manhattan distance.

### **The Problem:**

Given the initial board setting for the token game, determine if it's possible to complete the game, and if so, determine the fewest number of moves necessary to complete the game.

### **The Input:**

The first line of input contains a single positive integer,  $n$  ( $1 \leq n \leq 100$ ), the number of games to evaluate. The games follow, with each description taking four lines. The  $i^{\text{th}}$  ( $1 \leq i \leq 4$ ) of these lines contains information about the  $i^{\text{th}}$  token for the game. The first two integers on each of these lines are  $sr_i$  and  $sc_i$ , respectively, representing the starting row and column value of the  $i^{\text{th}}$  token. The last two integers on each of these lines are  $er_i$  and  $ec_i$ , respectively, representing the ending row and column of the  $i^{\text{th}}$  token. All four values on a line will be space separated. All of these values will be integers in between 1 and 4, inclusive. All of the eight locations specified will be unique.

**The Output:**

For each input case, on a line by itself, output -1 if the corresponding game is not possible to complete, or output the minimum number of moves necessary to complete the game.

**Sample Input**

2	15
1 1 2 4	-1
1 4 4 1	
4 2 4 4	
3 1 1 2	
1 1 1 4	
2 2 1 2	
2 3 1 3	
2 1 2 4	

**Sample Output**