

Samsung R&D Algo Challenge

DevCon Summit 2017





PROBLEM DESCRIPTION

S-DOTA

You are playing a new version of DOTA. In this version, you can control two Heroes. Your goal is to attack or send your heroes to the base of your enemies at the least possible time. However, your heroes' strengths have a negative characteristic. They must keep a minimum distance of two cells apart, otherwise, their powers will cancel out and you will automatically lose the game.

The Map has several obstacles, and your heroes cannot pass thru the obstacles or go beyond the boundaries of the map. Your hero can move in any direction (as shown in Figure 1). Each step takes 1 second, and your heroes can move in parallel (at the same time).

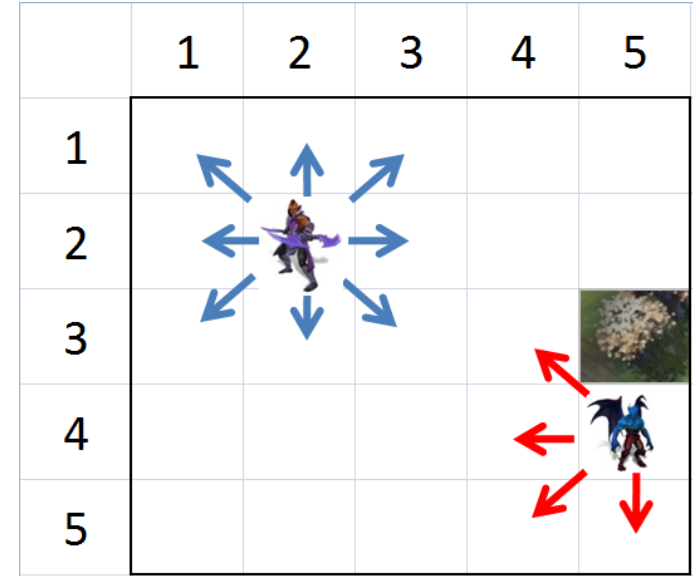


Fig. 1 – The Heroes can move in any direction, except thru the obstacles or beyond the map boundaries



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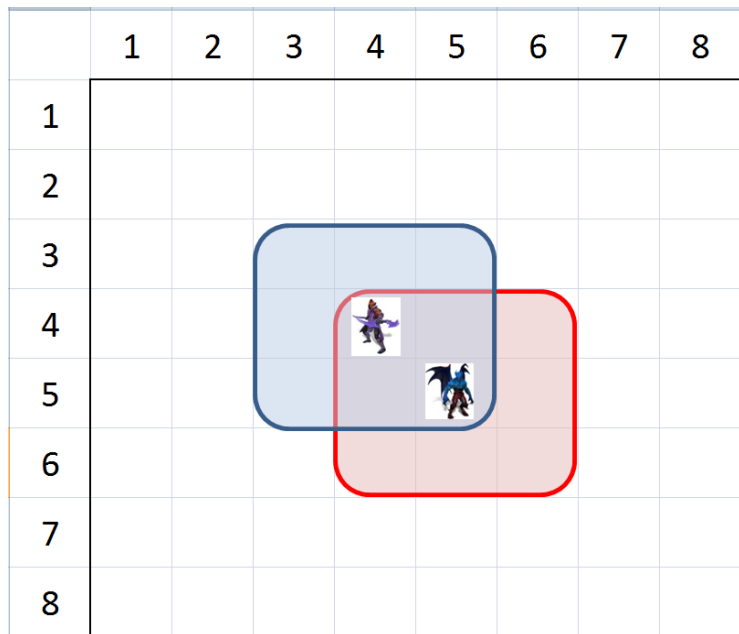


Fig. 2 – The Heroes will cancel out their power if they get close to each other. You must avoid this situation.



Fig. 3 – Example 1. The 1st hero at Cell (2,2) needs to attack the base T1, while the 2nd Hero from Cell (3,4) needs to attack the 2nd base T2. The minimum time to reach both targets is 3 s. Second hero needs only 2 steps [(4,3),(4,2)] to reach T2, while 1st hero needs to avoid getting close to 2nd Hero and thus takes longer path in 3 steps: [(2,3), (3,4),(4,4)]



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	1	2	3	4	5	6
1			T2			
2						
3						T1
4						
5						
6						

Fig. 4 – Example 2.

Find the minimum time for the Hero at (1,1) to reach target T1 and Hero at (6,6) to reach target T2
Map size is 6 x 6.




	1	2	3	4	5	6
1			T2			
2	1					
3	2					T1
4	3					
5	 		3	2	1	
6						

Fig. 5 – Wrong solution. The heroes met after 4 steps using the path shown above.



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	1	2	3	4	5	6
1			T2			
2	1					
3		2				T1
4						
5				2	1	
6						

Fig. 5 – @Time = 3 s.

To avoid the two heroes getting too close to each other, the first hero needs to hide at Cell (3,3) while the 2nd hero goes to Cell (5,3) in 3 steps.













	1	2	3	4	5	6
1			T2			
2						
3	6	2				T1
4	5					
5		4	3	2	1	
6						

Fig. 6 – @Time = 7 s.

The first hero remains stationary at Cell (3,3) until the 2nd hero reached Cell (2,1).



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

Fig. 7 – @Time = 9 s.

The 2nd hero reached his target at Cell (1,3), while the 1st hero has moved to Cell (4,1).


	1	2	3	4	5	6
1		8				
2	7					
3	6	8	7			
4	9					14
5		10	11	12	13	
6						

Fig. 8 – @Time = 15 s.

The 2nd Hero finally reached his target at Cell (3,6).
So the minimum time to reach the two targets is 15 s.



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Function Signature

Implement the function

int mySolution(int N, int H1row, int H1col, int H2row, int H2col, int T1row, int T1col, int T2row, int T2col, int obstacle[MAX_SIZE])

N is the size of the map. $5 \leq N \leq 25$.

(H1row,H1col) indicates the coordinate of the first Hero.

(H2row,H2col) indicates the coordinate of the second Hero.

(T1row,T1col) indicates the coordinate of the first Target

(T2row,T2col) indicates the coordinate of the second Target

obstacle is the flattened representation of the obstacles within the NxN map. A value of 1 indicates an obstacle, while a value of 0 indicates no obstacle. The array is padded with 0s from index NxN to MAX_SIZE. The maximum size of this array is a constant value MAX_SIZE = 625.



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Function Output

The mySolution function shall return an integer value indicating the minimum time it takes for the two heroes to reach their targets.

If there's no solution, then the function shall return -1



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Sample parameter values

*Referring to Figure 3, the parameters to be passed in **mySolution** function shall be:*

$N = 5$	$obstacle[] =$
$H1row = 2$	$[1,0,1,1,1,$
$H1col = 2$	$0,0,0,0,0,$
$H2row = 3$	$1,1,0,0,0,$
$H2col = 4$	$1,0,0,0,1,$
$T1row = 4$	$1,0,0,0,1,$
$T1col = 4$	$0,0,0,0,0,$
$T2row = 4$	$0,0,0,0,0,$
$T2col = 2$	$\dots 0]$

The function shall return **3** as the correct answer.



Thank you.