

Robotics: Homework Assignment #9

1)

POTENTIAL FIELD (U in units of JOULS)							
ROW \ COL	1	2	3	4	5	6	7
1	1	1	1	1	1	2	2
2	1	2	2	1	1	2	2
3	1	2	2	1	1	3	3
4	1	1	1	1	1	3	3
5	-1	-1	1	1	1	1	1
6	-1	-1	3	3	-1	-2	-2
7	-2	-2	3	3	-1	-2	-2

THINGS TO REMEMBER

$F = -\nabla U$; Means that any change in potential will always induce a force that will push a robot from a higher potential towards a lower potential

Question: Indicate the path or paths (Robot starts at ROW=1, COL=1 and travels to ROW=7, COL=7) through the potential field for which a robot will not encounter push back forces along its path. Explain your reasoning for your choice of paths.

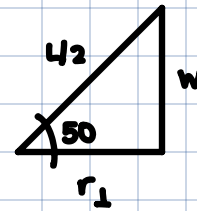
2) Will the robot arm that was discussed in Lecture (slide 17) eventually reach its final position?

FIRST PATH :

ROW \ COL	1	2	3	4	5	6	7
1	1	1	1	1	1	2	2
2	1	2	2	1	1	2	2
3	1	2	2	1	1	3	3
4	1	1	1	1	1	3	3
5	-1	-1	1	1	1	1	1
6	-1	-1	3	3	-1	-2	-2
7	-2	-2	3	3	-1	-2	-2

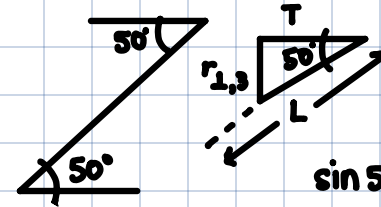
SECOND PATH :

ROW \ COL	1	2	3	4	5	6	7
1	1	1	1	1	1	2	2
2	1	2	2	1	1	2	2
3	1	2	2	1	1	3	3
4	1	1	1	1	1	3	3
5	-1	-1	1	1	1	1	1
6	-1	-1	3	3	-1	-2	-2
7	-2	-2	3	3	-1	-2	-2



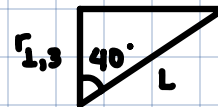
$$\cos 50^\circ = \frac{r_1}{L/2}$$

$$r_1 = (L/2) \cos 50^\circ$$



$$\sin 50^\circ = \frac{r_{1,3}}{L}$$

$$r_{1,3} = L \sin 50^\circ$$



$$\cos 40^\circ = \frac{r_{1,3}}{L}$$

$$r_{1,3} = L \cos 40^\circ$$

These paths are the shortest path. The reason is that the potential must either be same or goes down.

2. Yes, by making $F_{total,2}$ going down with $(-3,-3)$

$$\tau_1 + \tau_2 = \tau_T$$

$$r_{1,1}W_1 + r_{1,2}W_2 = r_{1,3}T$$

$$(\cancel{1/2} \cos 50^\circ)W_1 + (\cancel{1} \cos 50^\circ)W_2 = (\cancel{1} \sin 50^\circ)T$$

