

Midsem Exam

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Q1

$\text{Total Time Required to Cover a Cell} = \text{Total Time to Moving Forward} + \text{Total Time of Turning}$

$\rightarrow \frac{\text{Total Distace Travelled Forward}}{\text{Forward speed}} + (\text{Number of Turns}) \times \text{Time Taken on each Turn}$

$\rightarrow \frac{\text{Total Distace Travelled Forward}}{\text{Forward speed}} + (\text{Number of Turns}) \times \frac{\pi}{2 \times \text{Rotational Speed}}$

$\text{Rotational Speed} = 4.856 \text{ rad/s}$

$\text{Forward Speed} = 0.128 \text{ m/s}$

$\text{Total Time Required to Cover a Cell} = \frac{\text{Total Distace Travelled Forward}}{0.128} + (\text{Number of Turns}) \times \frac{\pi}{9.712}$

1. Cell 0

$\text{Total Time Required to Cover Cell} = \frac{19.92}{0.128} + (18 \times \frac{\pi}{9.712})$
 $= 161.44 \text{ sec}$

2. Cell 1

$\text{Total Time Required to Cover Cell} = \frac{0.695}{0.128} + (0 \times \frac{\pi}{9.712})$
 $= 5.42 \text{ sec}$

3. Cell 2

$\text{Total Time Required to Cover Cell} = \frac{6.02}{0.128} + (6 \times \frac{\pi}{9.712})$
 $= 48.97 \text{ sec}$

4. Cell 3

$\text{Total Time Required to Cover Cell} = \frac{0.27}{0.128} + (0 \times \frac{\pi}{9.712})$
 $= 2.10 \text{ sec}$

5. Cell 4

$\text{Total Time Required to Cover Cell} = \frac{18.82}{0.128} + (36 \times \frac{\pi}{9.712})$
 $= 158.67 \text{ sec}$

6. Cell 5

$\text{Total Time Required to Cover Cell} = \frac{9.27}{0.128} + (42 \times \frac{\pi}{9.712})$
 $= 86.00 \text{ sec}$

7. Cell 6

$\text{Total Time Required to Cover Cell} = \frac{21.92}{0.128} + (20 \times \frac{\pi}{9.712})$
 $= 177.71 \text{ sec}$

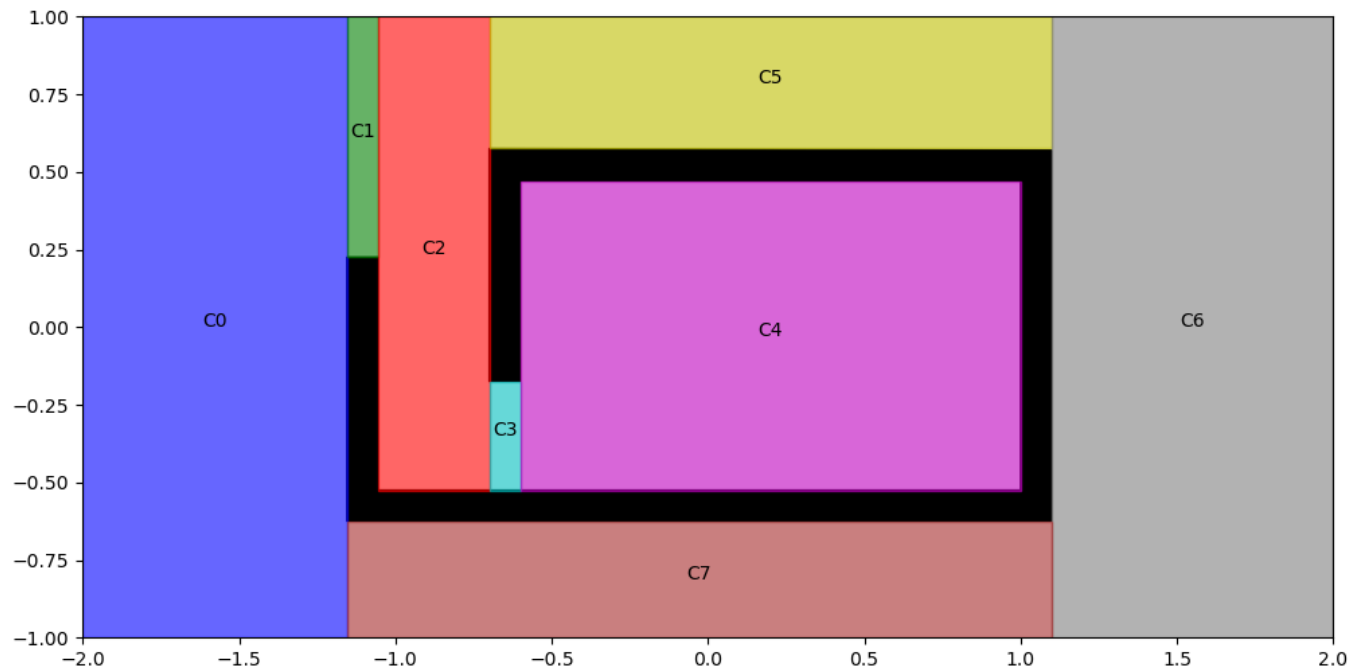
8. Cell 7

$\text{Total Time Required to Cover Cell} = \frac{10.42}{0.128} + (54 \times \frac{\pi}{9.712})$
 $= 98.87 \text{ sec}$

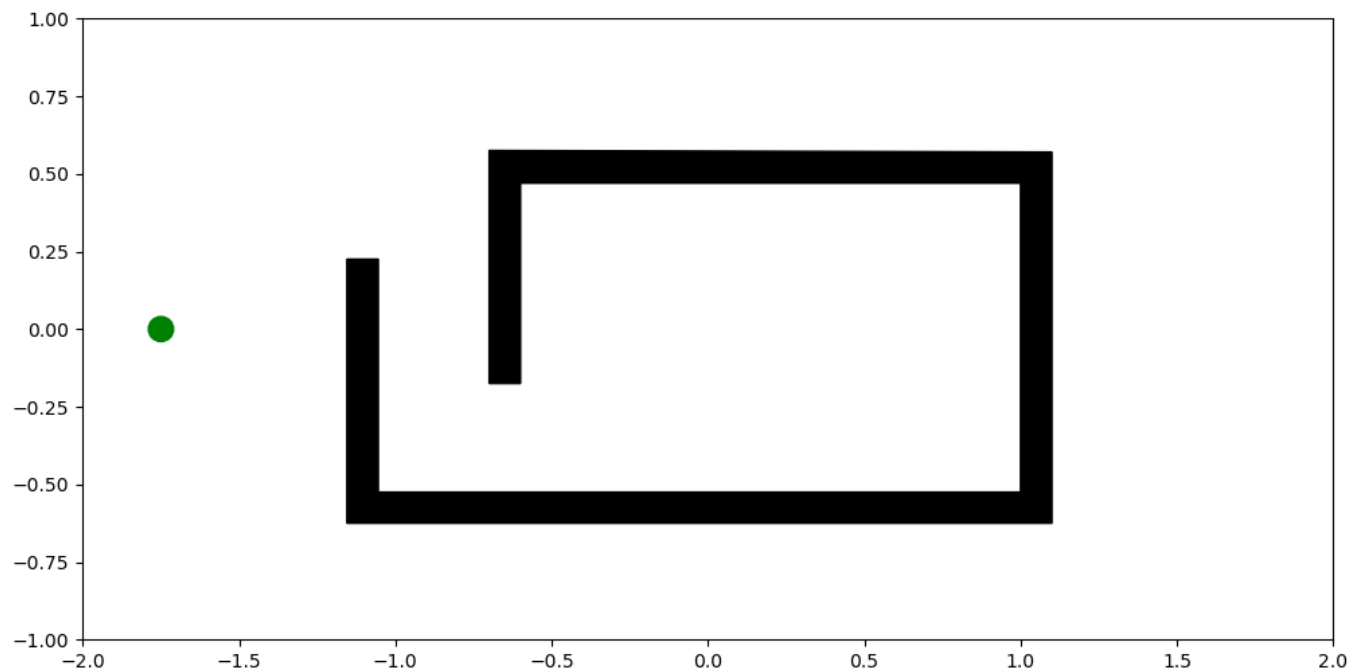
$$\text{\text{Total Time to cover all cells}} = 161.44 + 5.42 + 48.97 + 2.10 + 158.67 + 86.00 + 177.71 + 98.87$$
$$= 739.18 \text{ sec}$$
$$= 12.31 \text{ min}$$

Q2

Cells:

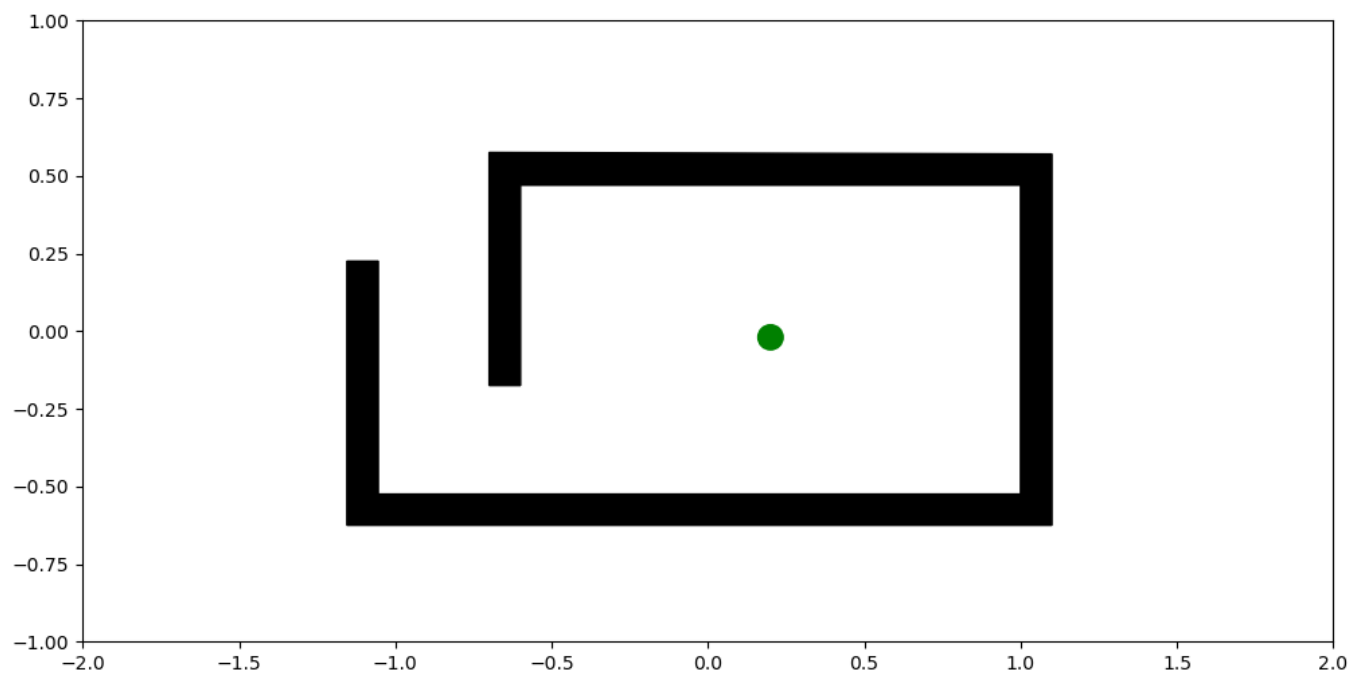


Old Start Location:



In this Case the path followed is $C0 \rightarrow C1 \rightarrow C2 \rightarrow C3 \rightarrow C4 \rightarrow C3 \rightarrow C2 \rightarrow C5 \rightarrow C6 \rightarrow C7$

New Start Location:

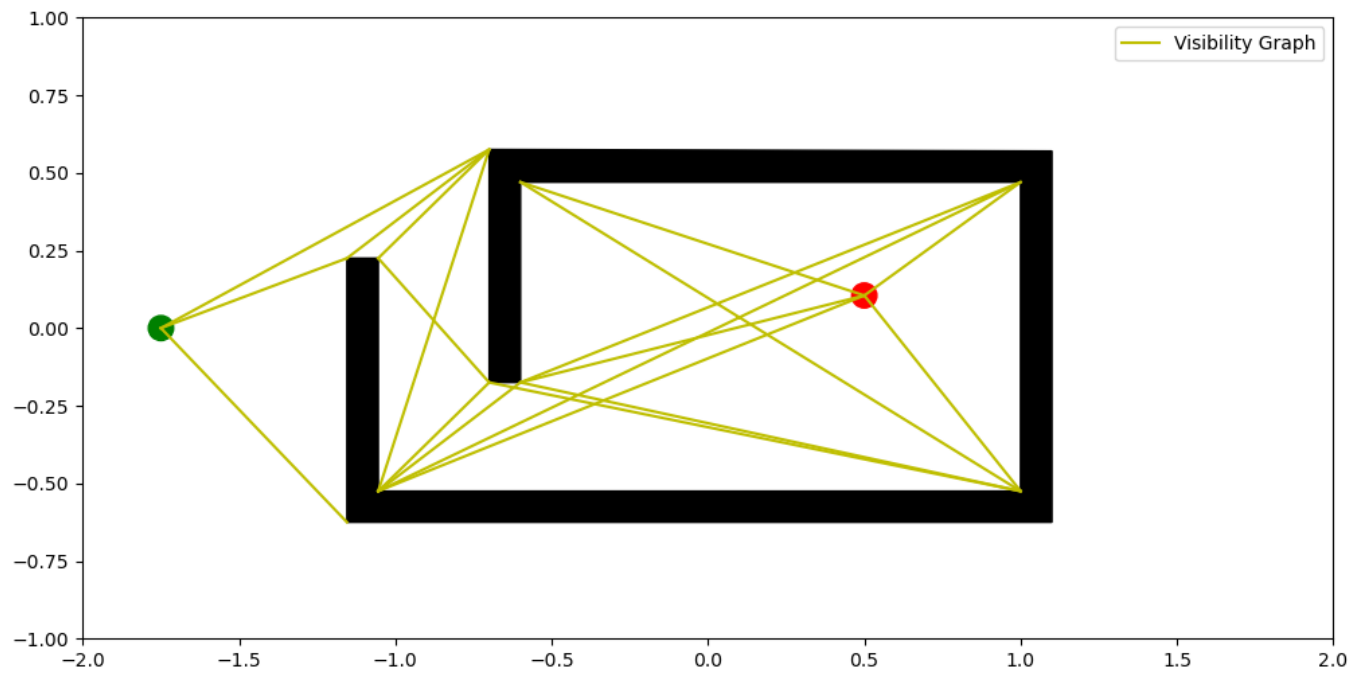


In this Case the path followed is \$ C4 \to C3 \to C2 \to C5 \to C6 \to C7 \to C0\$

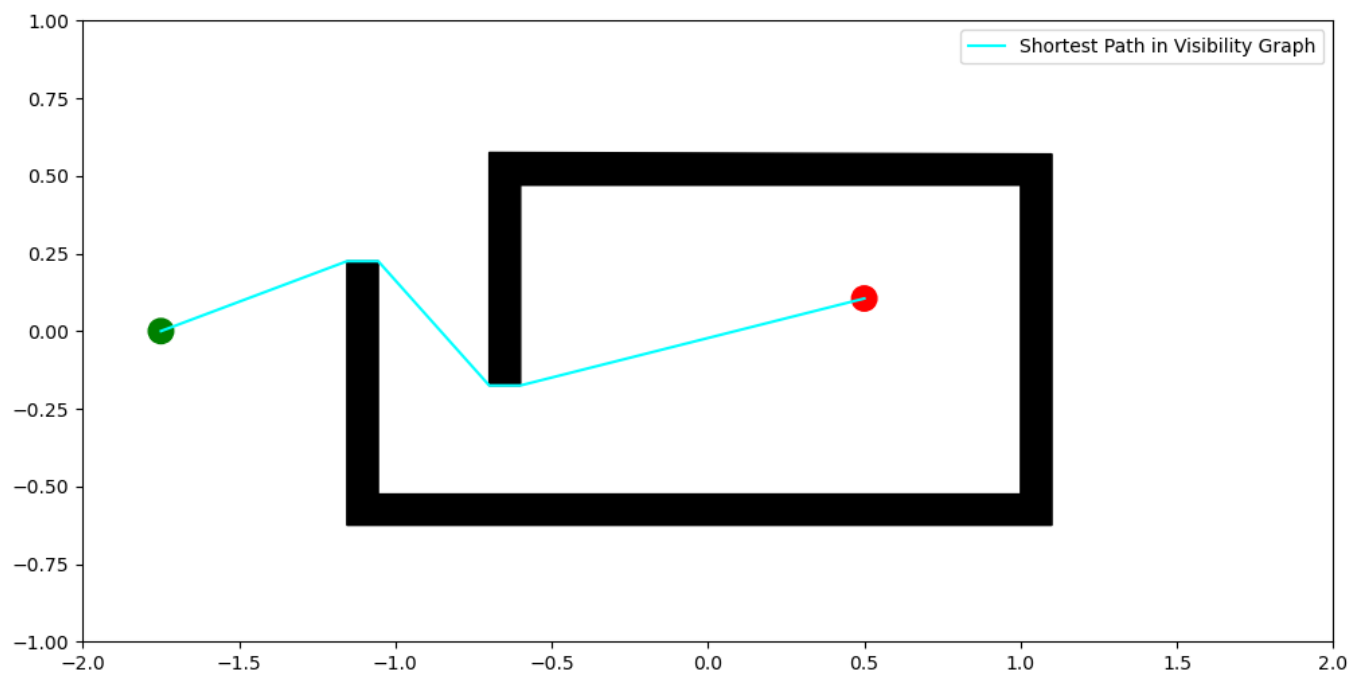
Therefore, the time for completion is lowered with this new start point.

Q3

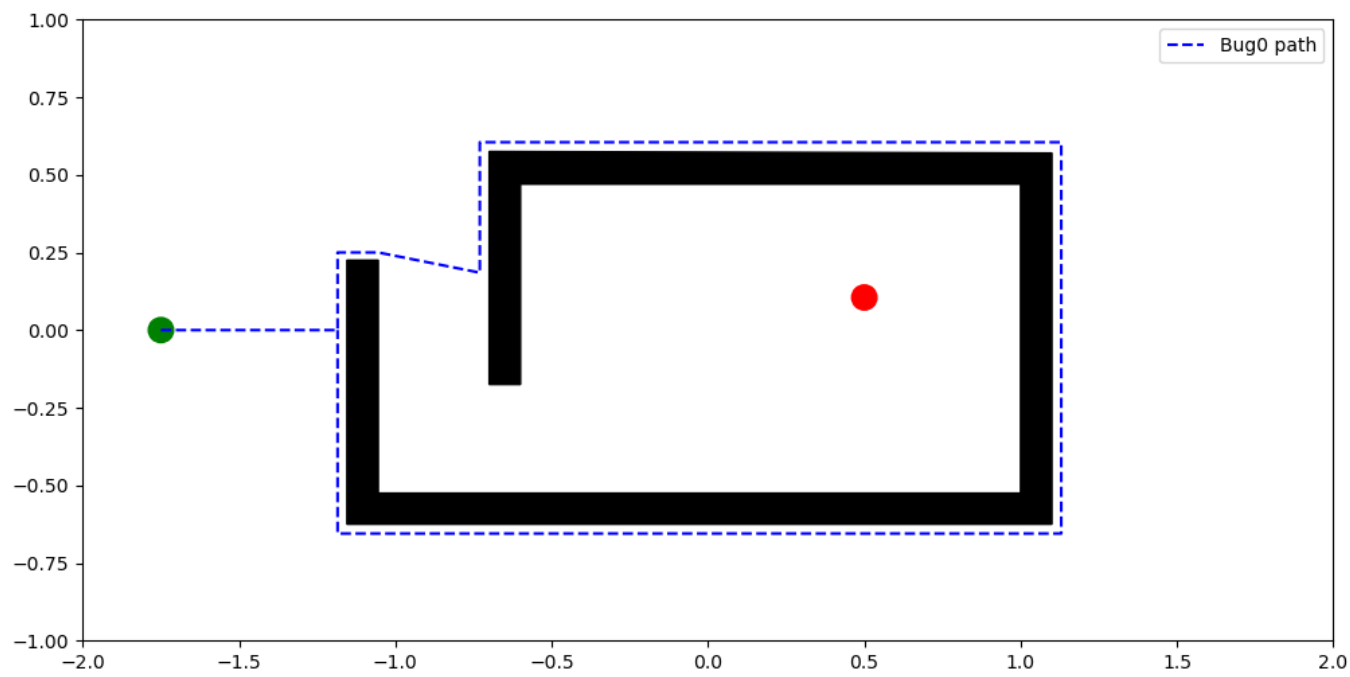
Visibility Graph:



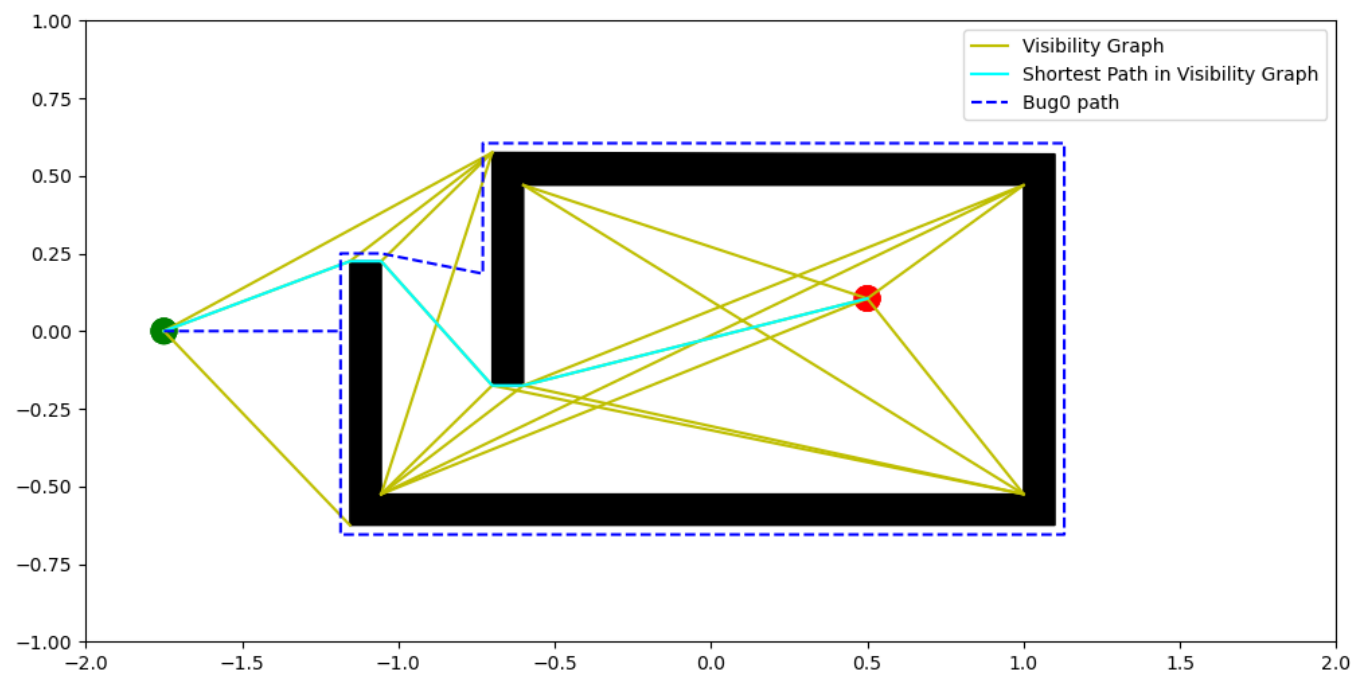
Manual Shortest Path on Visibility Graph:



Bug0 Path:



All Together:



Q4

Parameters Used: $\alpha = 50$, $\beta = 50$, $s = 7$, $r = 2$

