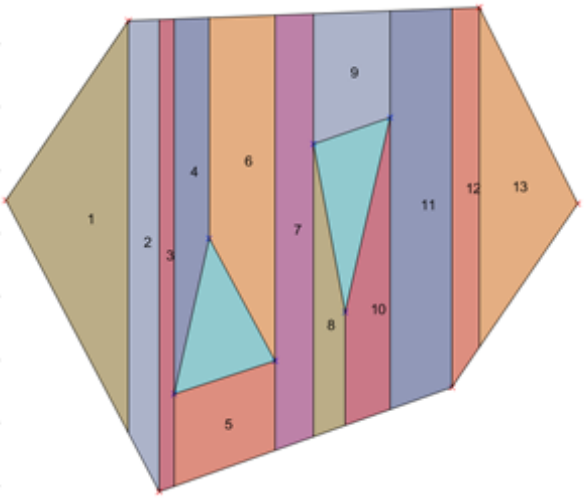
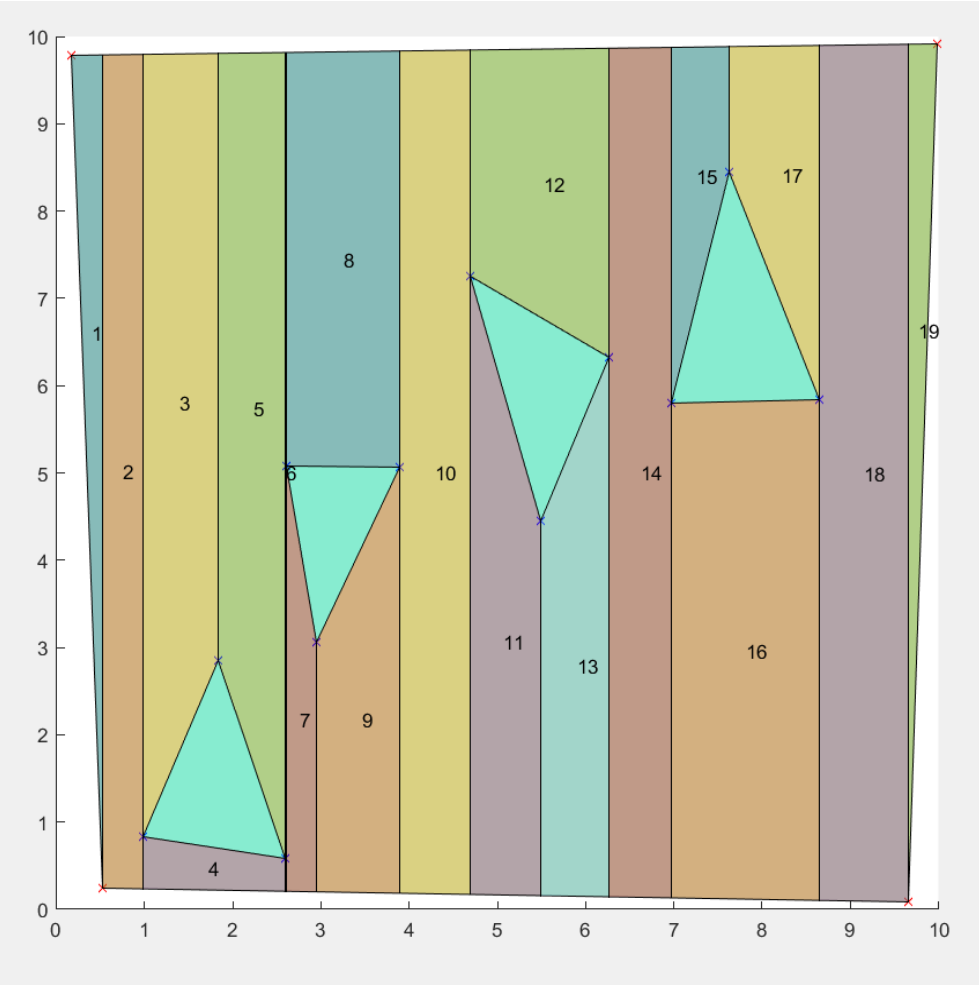


ROBOT MOTION PLANNING

Cell Decomposition-Matlab



ADITYA SHAH

#IndianByHeart

#MechatronicsEnthusiast

#NatureLover

#Wanderer

1.Matlab Implementation:-

A.Write a condition to ensure that the X coordinates of the vertices are unique.

B.Perform cell decomposition using Naïve approach. Store the cells in a suitable datastructure.

C.Improve the cell decomposition code.

D.Compare the time taken for cell decomposition using both Naïve and Optimized approaches using tic and toc in matlab.

Solution:-

1.A:

For →Configuration Space:

```
if ismember(round(x,2),round(config_sp(:,1),2))

    x=x +double(0.5);
end
```

For→Obstacles:

```
 if ismember(round(x,2),round(vertices(:,1),2))

            x=x +double(0.5);
       end
```

If any X coordinate repeats ,then we are just perturbating it by 0.5 unit in x axis. So no vertices has same X coordinate .Round function is used to round the decimal to 2 places.(because it's a double type)

Inference's: Each X coordinate is unique for every vertices .

B.

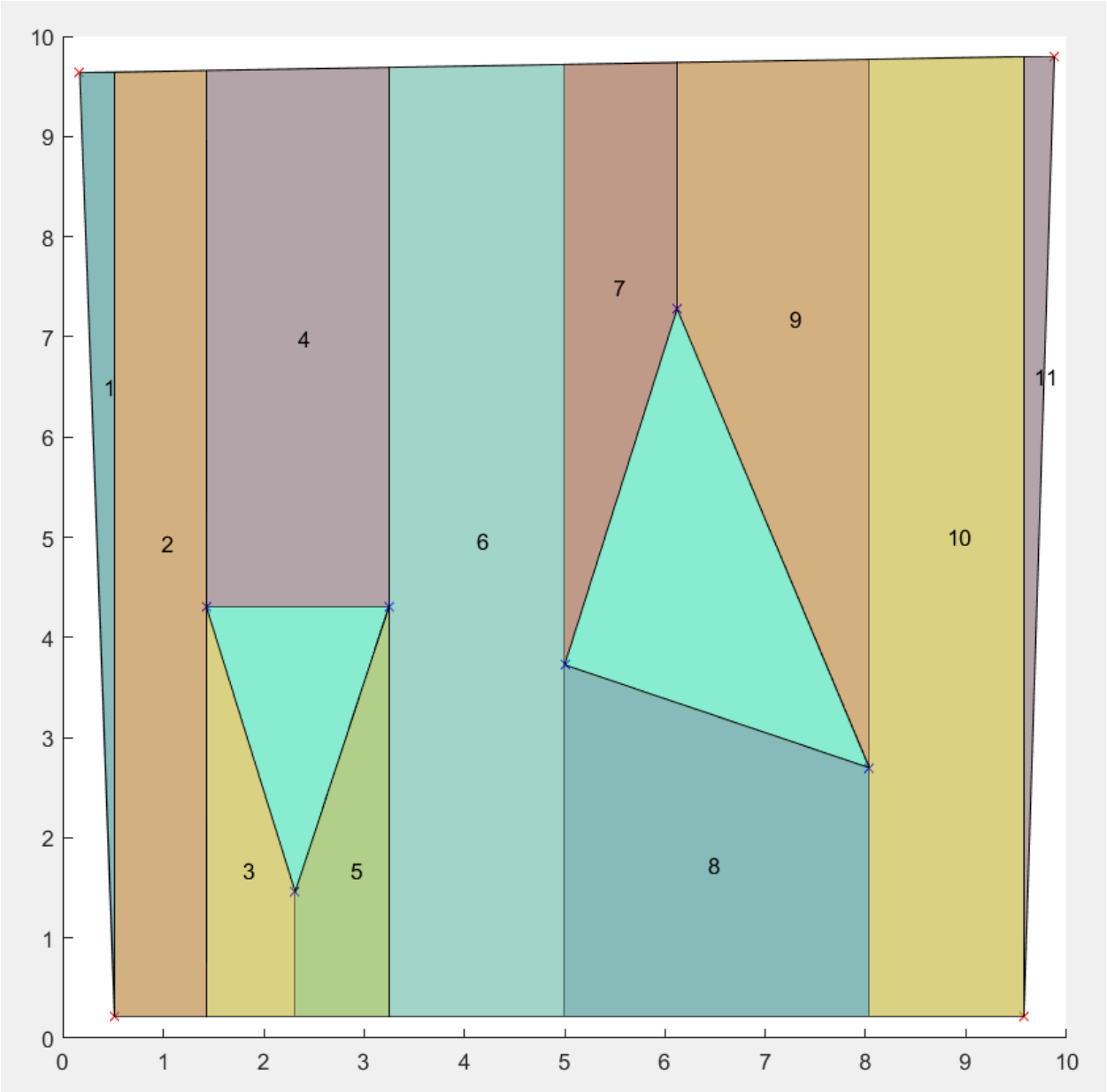
CODE-Cell Decomposition using Naïve approach

1. Contact @ adityashah2310@gmail.com

INPUT

```
Command Window
>> ADITYA_SHAH_2011MT02_naive
Input the number of vertices of the 2D configuration space: 4
Input the number of obstacles: 2
Input the number of vertices in obstacle no.13
Input the number of vertices in obstacle no.23
```

Output:

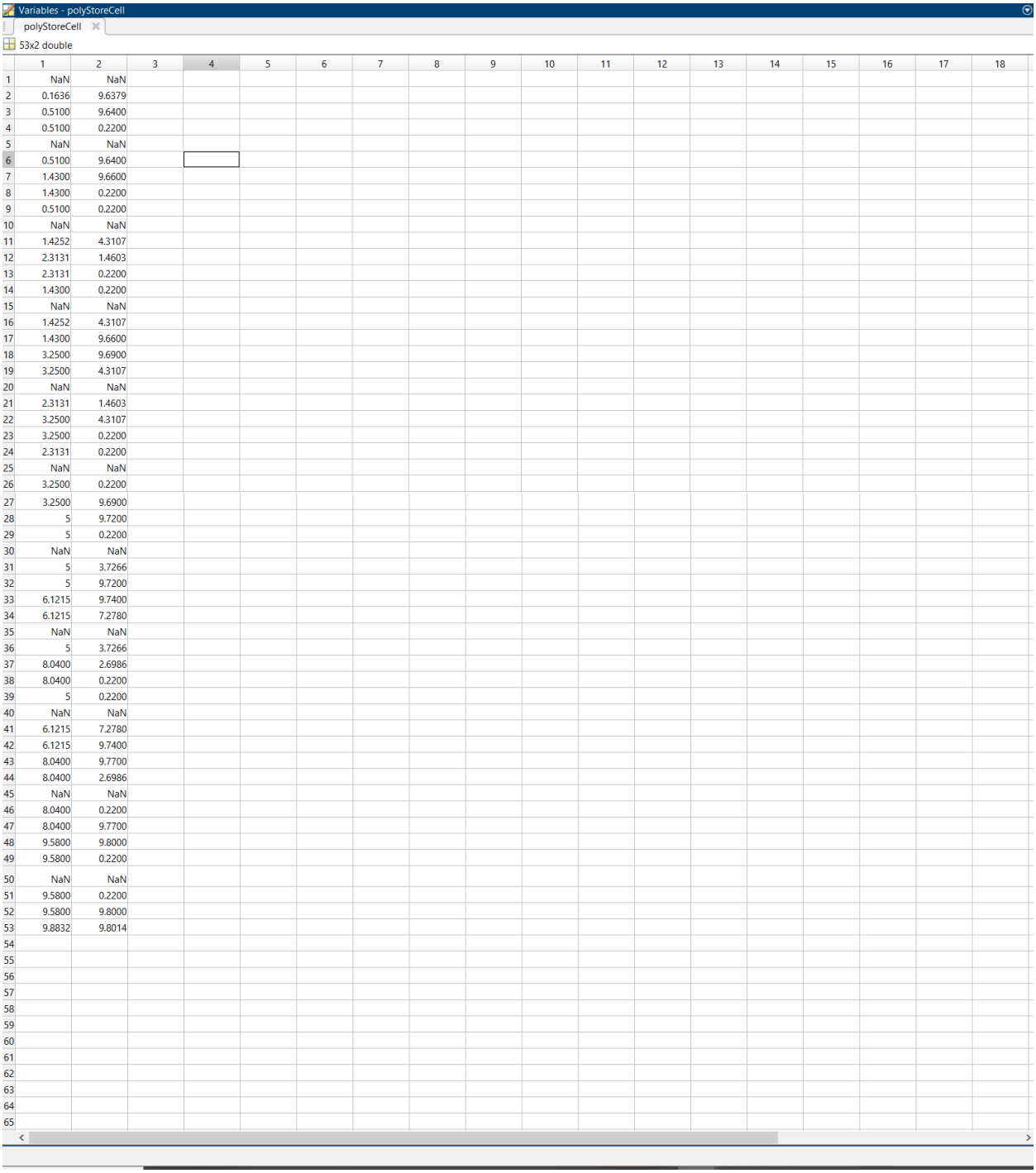


Cell's data structure:Saved in polyStoreCell

	NaN	NaN
1	0.163551	9.63785
	0.51	9.64
	0.51	0.22
	NaN	NaN
2	0.51	9.64
	1.43	9.66
	1.43	0.22
	0.51	0.22
	NaN	NaN
3	1.425234	4.310748
	2.313084	1.46028
	2.313084	0.22
	1.43	0.22
	NaN	NaN
4	1.425234	4.310748
	1.43	9.66
	3.25	9.69
	3.25	4.310748
	NaN	NaN
5	2.313084	1.46028
	3.25	4.310748
	3.25	0.22
	2.313084	0.22
	NaN	NaN
6	3.25	0.22
	3.25	9.69
	5	9.72
	5	0.22
	NaN	NaN
7	5	3.726636
	5	9.72
	6.121495	9.74
	6.121495	7.278037
	NaN	NaN
8	5	3.726636
	8.04	2.698598
	8.04	0.22
	5	0.22
	NaN	NaN
9	6.121495	7.278037
	6.121495	9.74

	8.04	9.77
	8.04	2.698598
	NaN	NaN
10	8.04	0.22
	8.04	9.77
	9.58	9.8
	9.58	0.22
	NaN	NaN
11	9.58	0.22
	9.58	9.8
	9.883178	9.801402

MATLAB FILE:Variables-polyStoreCell


Variables - polyStoreCell

polyStoreCell

53x2 double

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	NaN	NaN																
2	0.1636	9.6379																
3	0.5100	9.6400																
4	0.5100	0.2200																
5	NaN	NaN																
6	0.5100	9.6400																
7	1.4300	9.6600																
8	1.4300	0.2200																
9	0.5100	0.2200																
10	NaN	NaN																
11	1.4252	4.3107																
12	2.3131	1.4603																
13	2.3131	0.2200																
14	1.4300	0.2200																
15	NaN	NaN																
16	1.4252	4.3107																
17	1.4300	9.6600																
18	3.2500	9.6900																
19	3.2500	4.3107																
20	NaN	NaN																
21	2.3131	1.4603																
22	3.2500	4.3107																
23	3.2500	0.2200																
24	2.3131	0.2200																
25	NaN	NaN																
26	3.2500	0.2200																
27	3.2500	9.6900																
28	5	9.7200																
29	5	0.2200																
30	NaN	NaN																
31	5	3.7266																
32	5	9.7200																
33	6.1215	9.7400																
34	6.1215	7.2780																
35	NaN	NaN																
36	5	3.7266																
37	8.0400	2.6986																
38	8.0400	0.2200																
39	5	0.2200																
40	NaN	NaN																
41	6.1215	7.2780																
42	6.1215	9.7400																
43	8.0400	9.7700																
44	8.0400	2.6986																
45	NaN	NaN																
46	8.0400	0.2200																
47	8.0400	9.7700																
48	9.5800	9.8000																
49	9.5800	0.2200																
50	NaN	NaN																
51	9.5800	0.2200																
52	9.5800	9.8000																
53	9.8832	9.8014																
54																		
55																		
56																		
57																		
58																		
59																		
60																		
61																		
62																		
63																		
64																		
65																		

1.C:

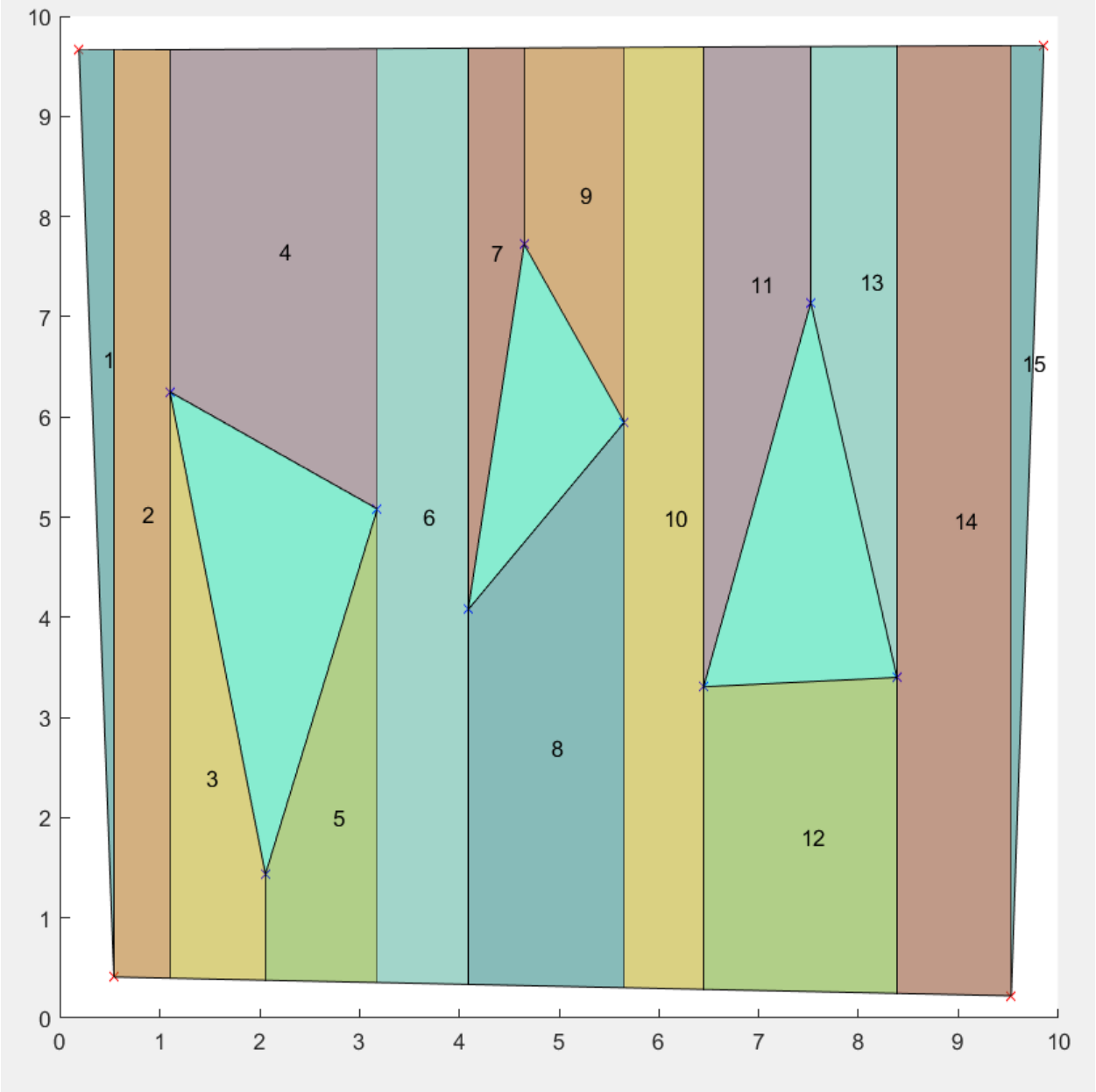
CODE-Cell Decomposition Optimized

1. Contact @ adityashah2310@gmail.com
2.

INPUT:

```
Command Window
>> ADITYA_SHAH_2011MT02_OPTIMZED
Input the number of vertices of the 2D configuration space: 4
Input the number of obstacles: 3
Input the number of vertices in obstacle no.13
Input the number of vertices in obstacle no.23
Input the number of vertices in obstacle no.33
```

OUTPUT:

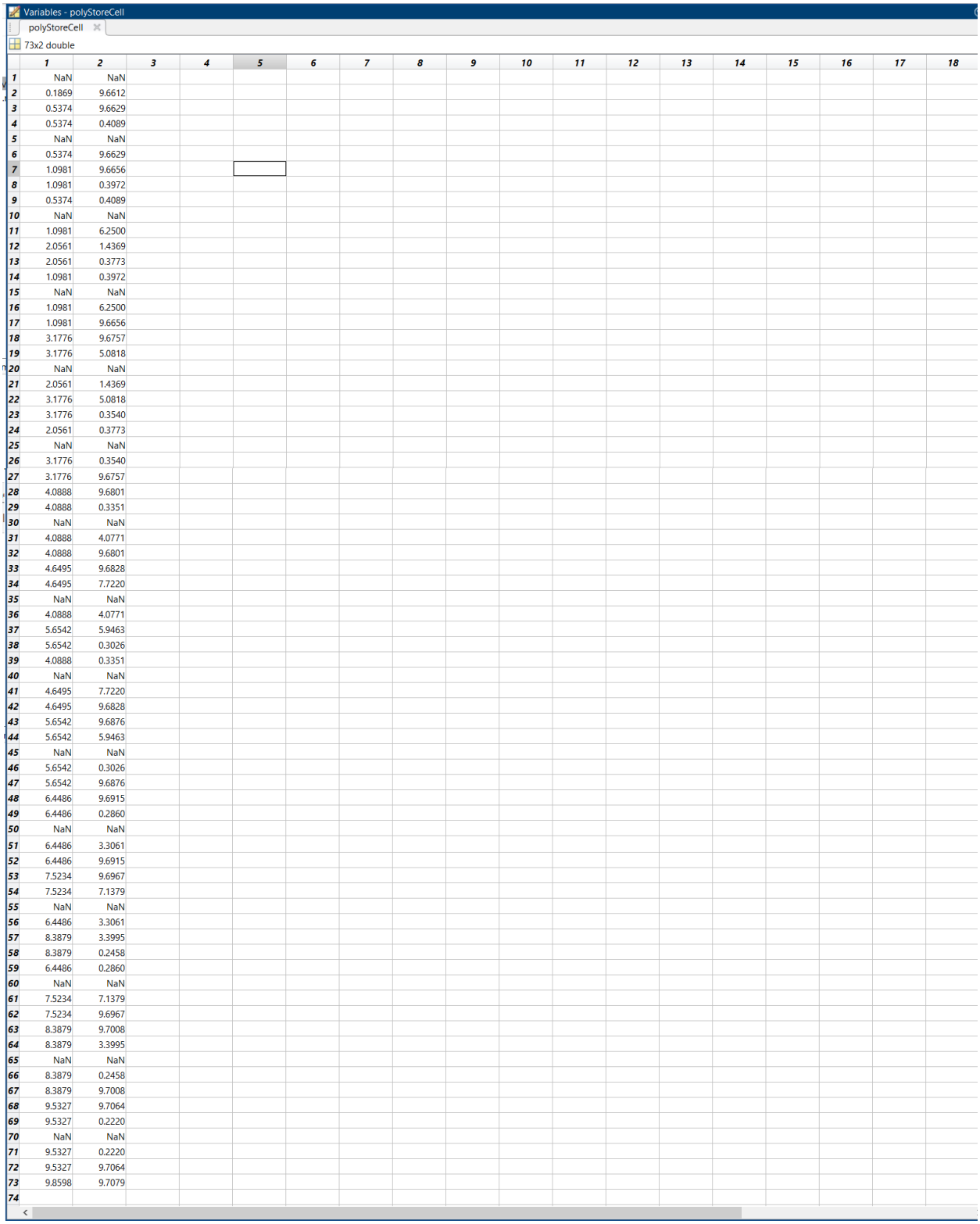


Cell's data structure: Saved in polyStoreCell

	NaN	NaN
1	0.186916	9.661215
	0.537383	9.662908
	0.537383	0.408879
	NaN	NaN
2	0.537383	9.662908
	1.098131	9.665617
	1.098131	0.397227
	0.537383	0.408879
	NaN	NaN
3	1.098131	6.25
	2.056075	1.436916
	2.056075	0.377321
	1.098131	0.397227
	NaN	NaN
4	1.098131	6.25
	1.098131	9.665617
	3.17757	9.675663
	3.17757	5.081776
	NaN	NaN
5	2.056075	1.436916
	3.17757	5.081776
	3.17757	0.354017
	2.056075	0.377321
	NaN	NaN
6	3.17757	0.354017
	3.17757	9.675663
	4.088785	9.680065
	4.088785	0.335083
	NaN	NaN
7	4.088785	4.077103
	4.088785	9.680065
	4.649533	9.682773
	4.649533	7.721963
	NaN	NaN
8	4.088785	4.077103
	5.654206	5.946262
	5.654206	0.302555
	4.088785	0.335083
	NaN	NaN
9	4.649533	7.721963

	4.649533	9.682773
	5.654206	9.687627
	5.654206	5.946262
	NaN	NaN
10	5.654206	0.302555
	5.654206	9.687627
	6.448598	9.691465
	6.448598	0.286048
	NaN	NaN
11	6.448598	3.306075
	6.448598	9.691465
	7.523364	9.696657
	7.523364	7.13785
	NaN	NaN
12	6.448598	3.306075
	8.38785	3.399533
	8.38785	0.245752
	6.448598	0.286048
	NaN	NaN
13	7.523364	7.13785
	7.523364	9.696657
	8.38785	9.700833
	8.38785	3.399533
	NaN	NaN
14	8.38785	0.245752
	8.38785	9.700833
	9.53271	9.706364
	9.53271	0.221963
	NaN	NaN
15	9.53271	0.221963
	9.53271	9.706364
	9.859813	9.707944

MATLAB FILE:Variables-polyStoreCell



Variables - polyStoreCell

polyStoreCell

73x2 double

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	NaN	NaN																
2	0.1869	9.6612																
3	0.5374	9.6629																
4	0.5374	0.4089																
5	NaN	NaN																
6	0.5374	9.6629																
7	1.0981	9.6656																
8	1.0981	0.3972																
9	0.5374	0.4089																
10	NaN	NaN																
11	1.0981	6.2500																
12	2.0561	1.4369																
13	2.0561	0.3773																
14	1.0981	0.3972																
15	NaN	NaN																
16	1.0981	6.2500																
17	1.0981	9.6656																
18	3.1776	9.6757																
19	3.1776	5.0818																
20	NaN	NaN																
21	2.0561	1.4369																
22	3.1776	5.0818																
23	3.1776	0.3540																
24	2.0561	0.3773																
25	NaN	NaN																
26	3.1776	0.3540																
27	3.1776	9.6757																
28	4.0888	9.6801																
29	4.0888	0.3351																
30	NaN	NaN																
31	4.0888	4.0771																
32	4.0888	9.6801																
33	4.6495	9.6828																
34	4.6495	7.7220																
35	NaN	NaN																
36	4.0888	4.0771																
37	5.6542	5.9463																
38	5.6542	0.3026																
39	4.0888	0.3351																
40	NaN	NaN																
41	4.6495	7.7220																
42	4.6495	9.6828																
43	5.6542	9.6876																
44	5.6542	5.9463																
45	NaN	NaN																
46	5.6542	0.3026																
47	5.6542	9.6876																
48	6.4486	9.6915																
49	6.4486	0.2860																
50	NaN	NaN																
51	6.4486	3.3061																
52	6.4486	9.6915																
53	7.5234	9.6967																
54	7.5234	7.1379																
55	NaN	NaN																
56	6.4486	3.3061																
57	8.3879	3.3995																
58	8.3879	0.2458																
59	6.4486	0.2860																
60	NaN	NaN																
61	7.5234	7.1379																
62	7.5234	9.6967																
63	8.3879	9.7008																
64	8.3879	3.3995																
65	NaN	NaN																
66	8.3879	0.2458																
67	8.3879	9.7008																
68	9.5327	9.7064																
69	9.5327	0.2220																
70	NaN	NaN																
71	9.5327	0.2220																
72	9.5327	9.7064																
73	9.8598	9.7079																
74																		

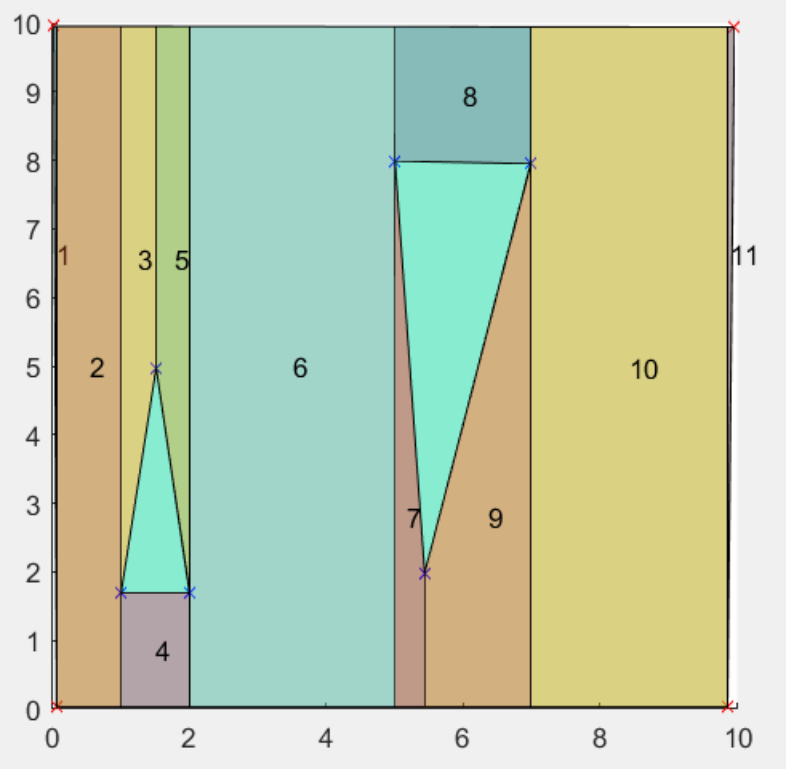
1.D)

INPUT:

Command Window

```
>> ADITYA_SHAH_2011MT02_OPTIMZED
Input the number of vertices of the 2D configuration space: 4
Input the number of obstacles: 2
Input the number of vertices in obstacle no.13
Input the number of vertices in obstacle no.23
```

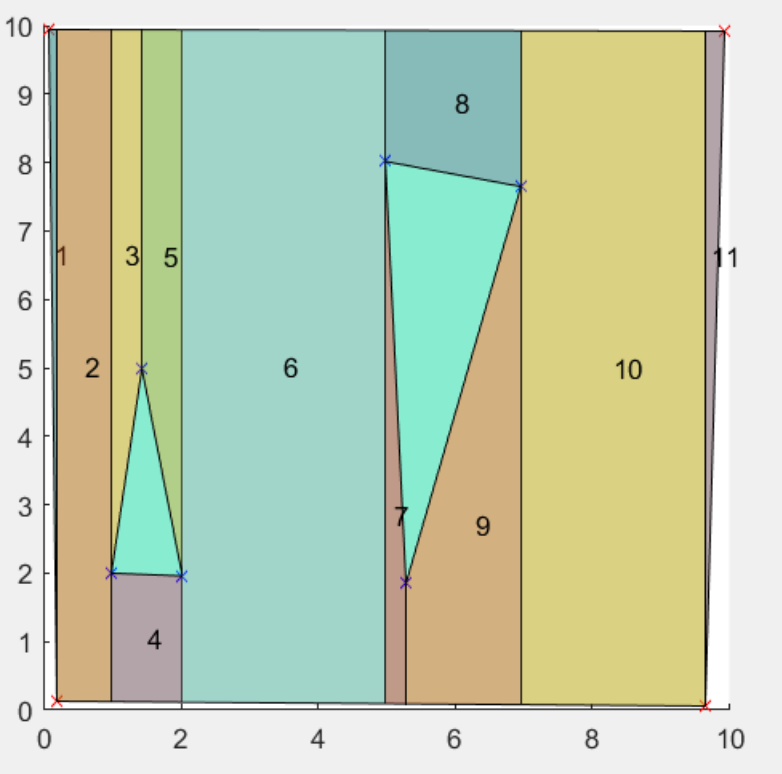
Naïve OUTPUT:




```
Elapsed time is 0.306474 seconds.
fx >>
```

SLOWER

Optimed Code OUTPUT:




```
Elapsed time is 0.160855 seconds.
>>
```

FASTER