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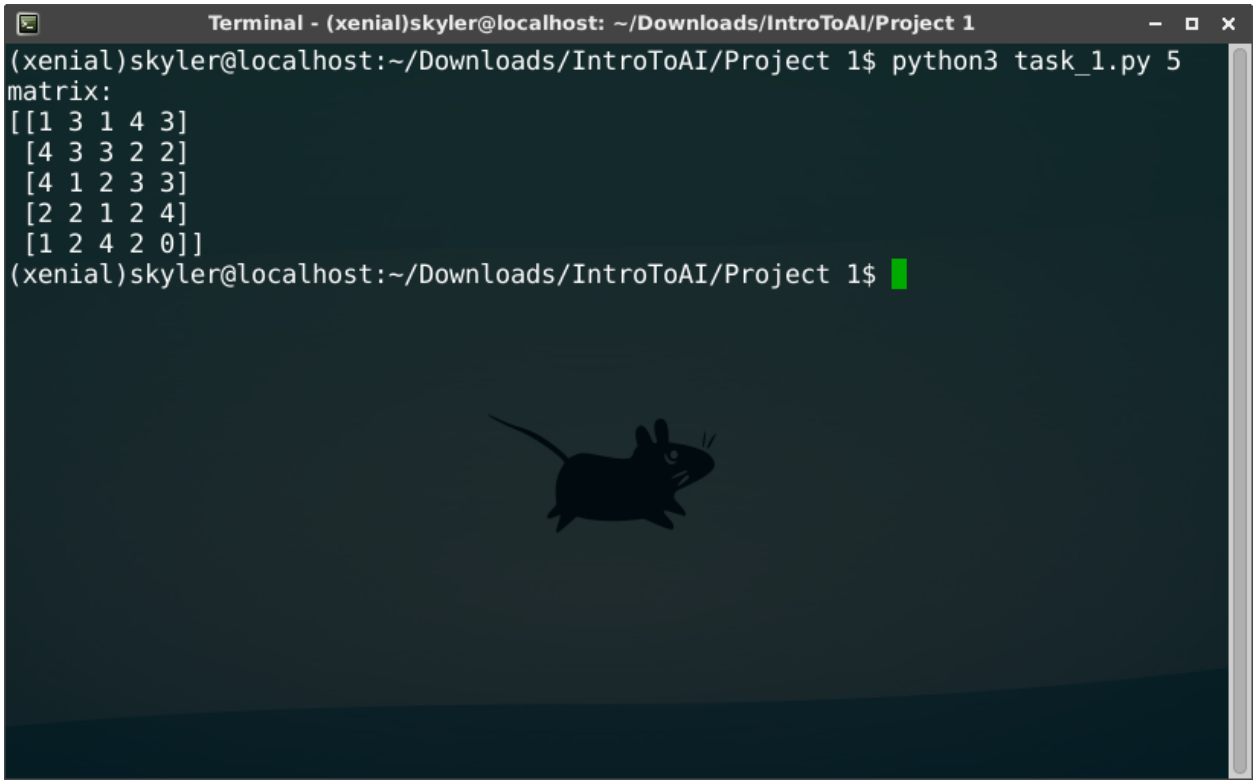
Project 1

GitHub: “https://github.com/SkylerMalinowski/IntroToAI”

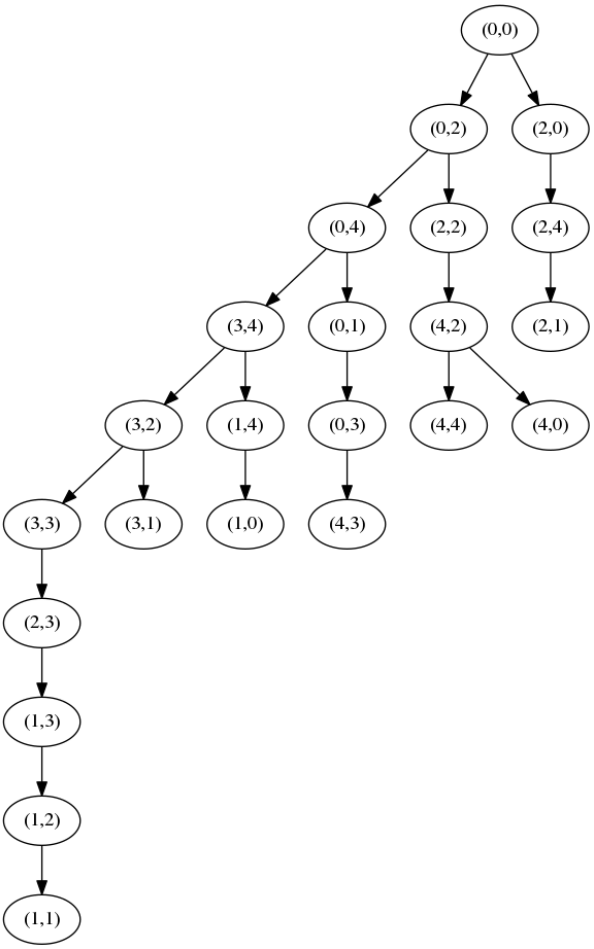
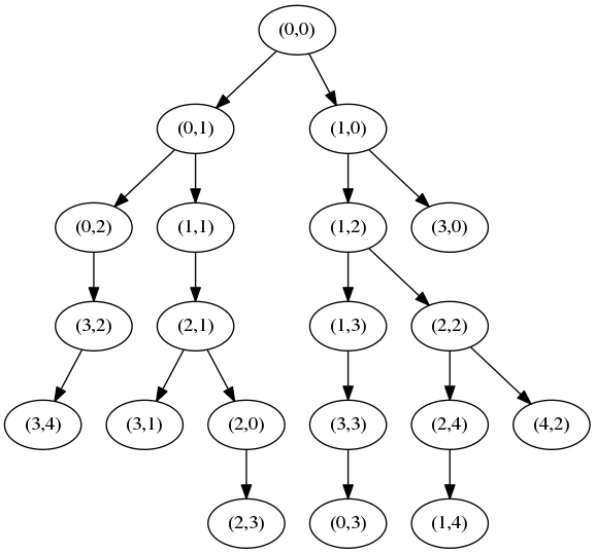
Task 1

Our GUI as of right now is in terminal, .txt files, and .png files.



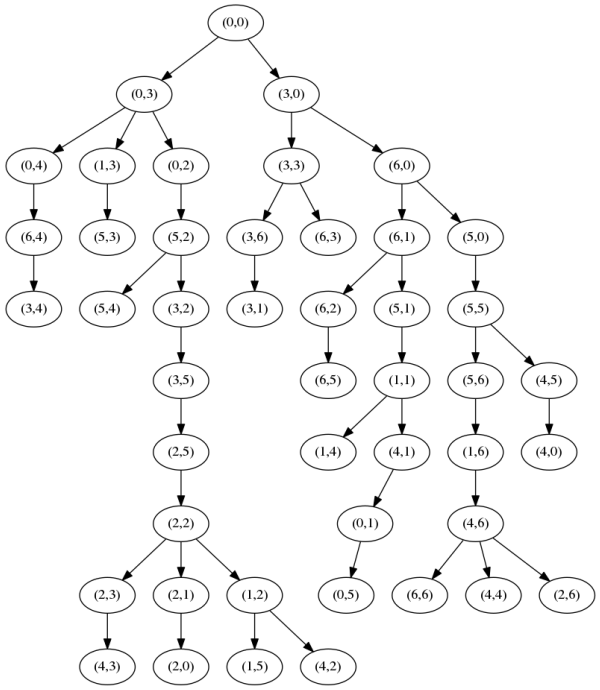
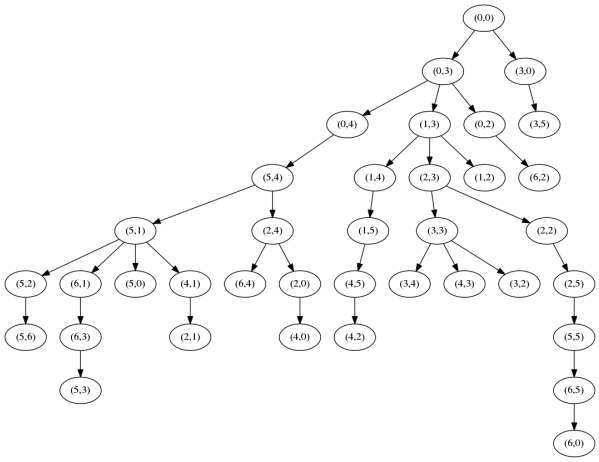
Task 2

Matrix Size = 5	
Solvable	**Unsolvable**

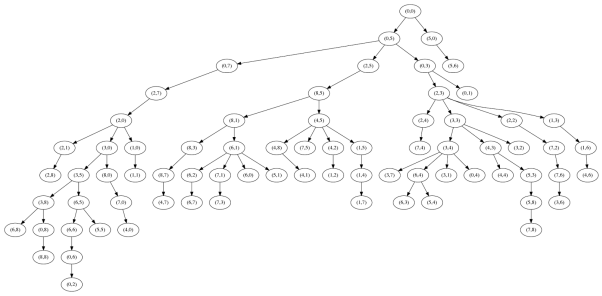
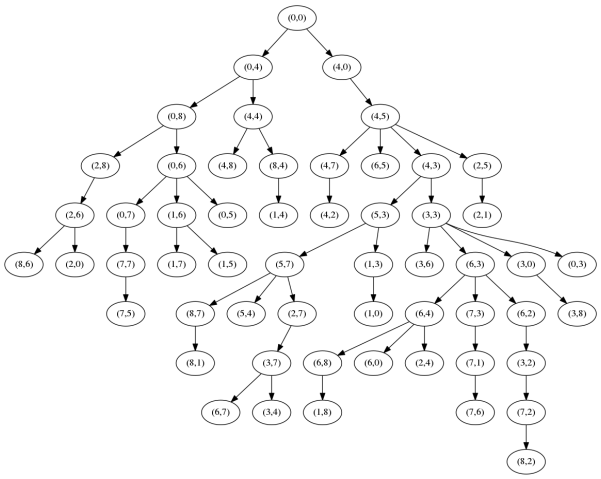
Matrix	
2 2 2 4 3 4 2 1 1 4 4 3 2 1 3 2 3 1 1 2 3 3 2 1 0	1 1 3 3 3 2 1 1 2 4 3 1 2 3 1 2 3 2 3 4 3 1 3 1 0
Evaluation Matrix	
0 3 1 4 2 5 9 8 7 4 1 3 2 6 2 -1 5 4 5 3 4 -1 3 5 4	0 1 2 5 -1 1 2 2 3 5 4 3 3 5 4 2 4 3 4 4 -1 -1 4 -1 -1
Tree	
	
Evaluation Function (k)	

k = 4	k = -5

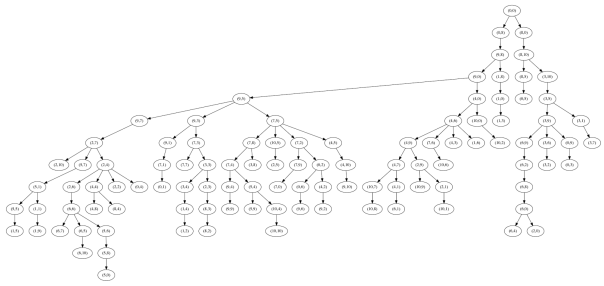
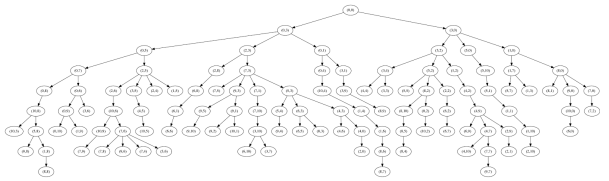
Matrix Size = 7	
Solvable	**Unsolvable**
Matrix	
3 4 5 1 6 6 4 1 3 3 4 5 4 3 3 1 1 2 3 3 5 3 4 3 3 4 1 5 6 4 3 2 4 5 2 5 4 2 5 5 1 4 1 1 3 6 3 2 0	3 2 6 1 5 4 4 4 1 5 1 1 3 2 2 4 3 1 4 3 1 5 1 3 1 4 5 6 5 2 3 4 3 3 1 6 1 4 3 3 1 6 4 2 5 1 3 5 0
Evaluation Matrix	
0 7 2 1 2 8 -1 -1 5 8 2 6 9 6 9 8 7 8 -1 6 8 1 4 4 2 4 5 3 6 6 9 9 8 5 7 3 4 3 3 4 4 5 2 3 4 3 3 5 8	0 -1 2 1 2 -1 -1 -1 -1 3 2 3 4 -1 5 6 4 3 4 5 -1 1 -1 5 4 5 2 -1 6 5 6 5 -1 5 -1 5 4 5 7 3 6 6 8 5 3 6 5 7 -1
Tree	

	
Evaluation Function (k)	
k = 8	k = -12

Matrix Size = 9	
Solvable	**Unsolvable**
Matrix	
5 8 7 2 3 2 4 2 8 1 1 2 3 3 1 3 7 4 1 7 5 1 5 6 3 7 8 5 2 1 1 3 3 4 5 3 8 5 3 1 3 3 3 4 7 6 2 3 5 1 1 6 2 2 5 1 5 2 1 1 6 3 1 3 2 4 2 5 6 4 2 3 1 2 6 4 3 4 5 4 0	4 4 8 4 4 6 1 7 2 3 3 4 3 7 1 1 3 5 8 7 5 5 3 4 6 1 2 8 3 4 3 2 2 6 3 8 5 2 5 1 4 2 4 5 8 2 7 6 4 5 2 5 3 4 5 4 3 1 4 6 2 7 5 6 5 1 2 6 7 7 2 5 8 6 5 2 7 3 7 6 0
Evaluation Matrix	
0 3 10 2 6 1 9 2 8 5 6 6 4 6 5 5 7 -1 4 5 4 3 4 2 -1 3 6	0 -1 -1 5 1 4 3 4 2 6 -1 -1 5 4 5 4 5 8 5 4 -1 -1 7 3 4 6 3

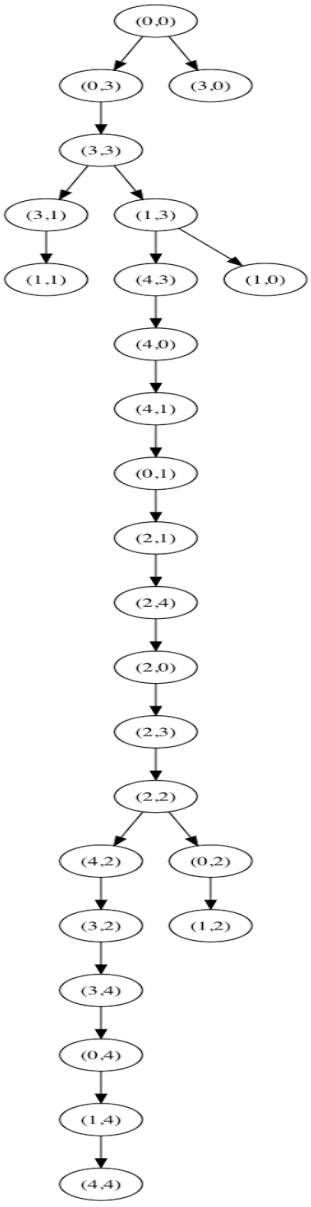
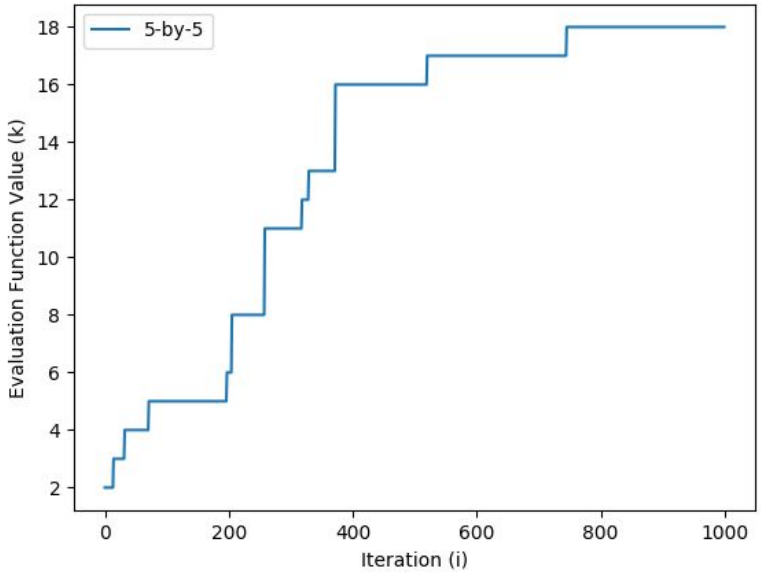
5 6 5 4 5 6 7 6 7 8 6 5 5 6 4 6 7 5 1 6 -1 6 7 8 2 -1 7 6 5 6 7 6 7 8 7 8 7 6 5 7 5 5 6 -1 8 6 4 -1 5 -1 3 -1 6 9	5 -1 7 4 8 -1 5 7 6 1 -1 4 3 2 2 -1 3 3 -1 -1 -1 4 6 -1 -1 5 -1 7 -1 6 5 6 3 -1 8 7 -1 7 8 6 -1 6 8 5 -1 -1 7 9 -1 3 -1 5 6 -1
Tree	
	
Evaluation Function (k)	
k = 9	k = -25

Matrix Size = 11	
Solvable	**Unsolvable**
Matrix	
[[8 7 4 1 7 8 9 8 9 6 7] [3 8 9 8 2 9 9 2 8 4 9] [9 8 8 6 2 7 4 3 6 8 6] [4 6 1 1 2 4 4 6 6 3 5] [6 2 5 3 4 5 3 6 5 2 5] [9 4 4 7 5 4 2 6 8 4 6] [4 6 6 2 2 5 1 7 8 7 10] [6 7 7 4 2 3 3 4 4 9 4] [10 3 2 1 1 8 7 5 6 3 5] [5 2 5 2 5 2 3 7 8 5 6] [2 10 3 9 6 8 9 1 7 3 0]]	[[3 3 10 2 10 2 3 1 10 1 8] [7 9 3 1 2 2 7 4 7 7 1] [3 4 4 5 2 1 8 7 4 8 10] [2 8 2 1 1 1 7 2 6 5 3] [2 3 7 3 1 6 6 3 5 2 3] [10 4 3 1 4 2 5 6 4 9 9] [7 5 5 2 2 4 1 5 7 6 3] [2 9 8 2 6 7 2 2 2 3 4] [1 9 8 7 6 1 1 1 1 8 5] [1 1 1 2 7 5 4 4 8 9 8] [4 1 6 2 9 6 3 7 5 3 0]]

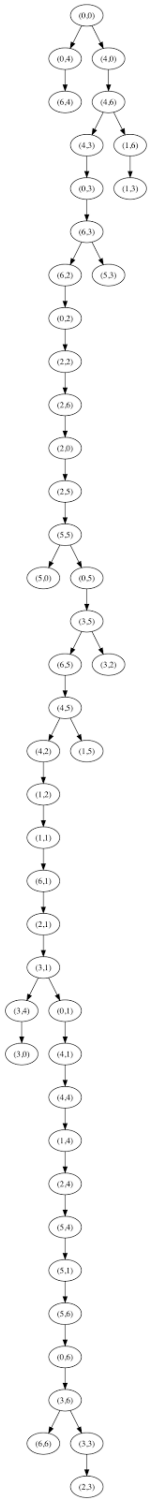
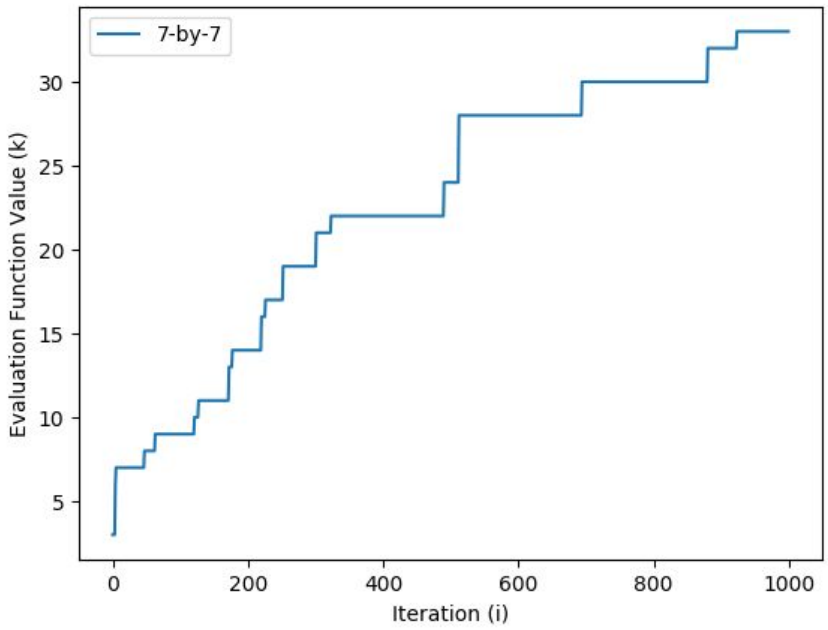
Evaluation Matrix	
[[0 8 7 7 8 4 8 -1 1 6 -1] [4 9 10 5 9 10 6 -1 3 10 -1] [10 8 8 8 7 7 8 6 -1 7 7] [-1 5 7 7 8 4 6 6 7 5 3] [4 8 8 6 8 6 5 7 9 6 7] [12 8 -1 -1 8 9 10 7 11 9 -1] [9 9 7 -1 10 10 9 10 8 6 11] [8 7 6 6 7 5 6 7 6 7 -1] [1 -1 10 9 9 3 -1 -1 -1 -1 2] [3 6 9 5 8 4 9 5 2 9 8] [5 9 6 -1 9 6 7 8 9 8 10]]	[[0 2 5 1 3 2 4 3 4 5 6] [2 5 3 4 5 4 6 3 7 6 6] [7 7 4 2 4 3 4 -1 3 6 7] [1 3 2 4 3 4 5 7 -1 4 6] [6 -1 4 5 4 5 6 6 -1 5 7] [2 4 3 4 5 4 7 4 6 -1 3] [6 5 5 5 -1 6 6 6 4 6 7] [4 4 5 3 7 4 6 7 7 7 5] [3 4 4 6 7 6 7 8 8 5 5] [4 5 6 4 6 5 7 8 7 -1 6] [5 6 6 6 4 6 5 -1 5 6 -1]]
Tree	
	
Evaluation Function (k)	
k = 10	k = -9

Task 3

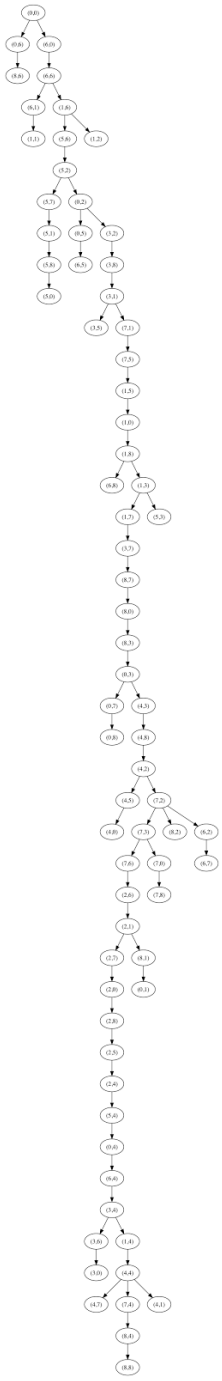
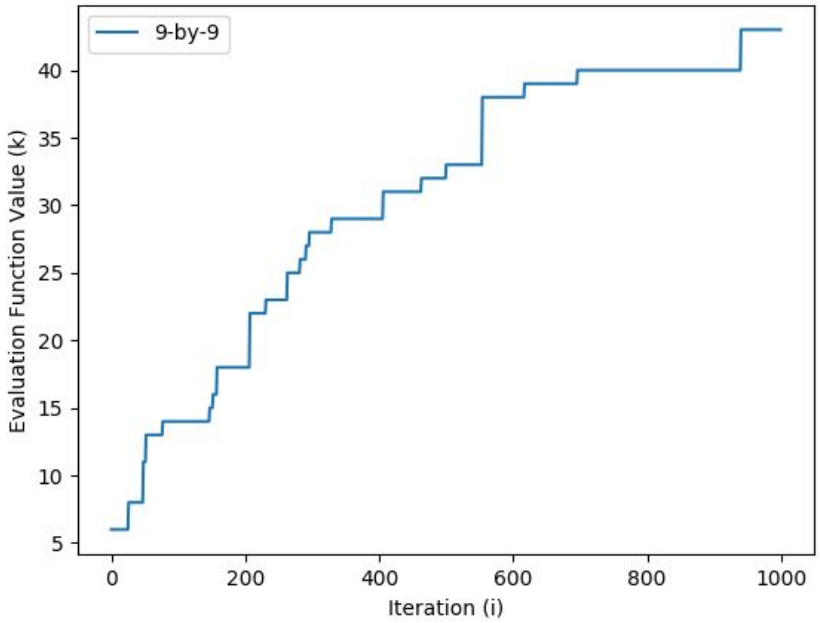
Matrix Size = 5

Final Matrix	
3 2 1 3 1 3 2 3 3 3 3 3 2 1 4 3 2 2 2 3 1 4 1 3 0	
Graph	
	
Value Function (k)	
K = 18	

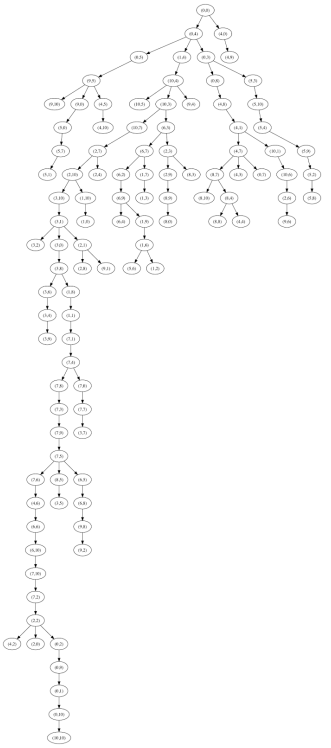
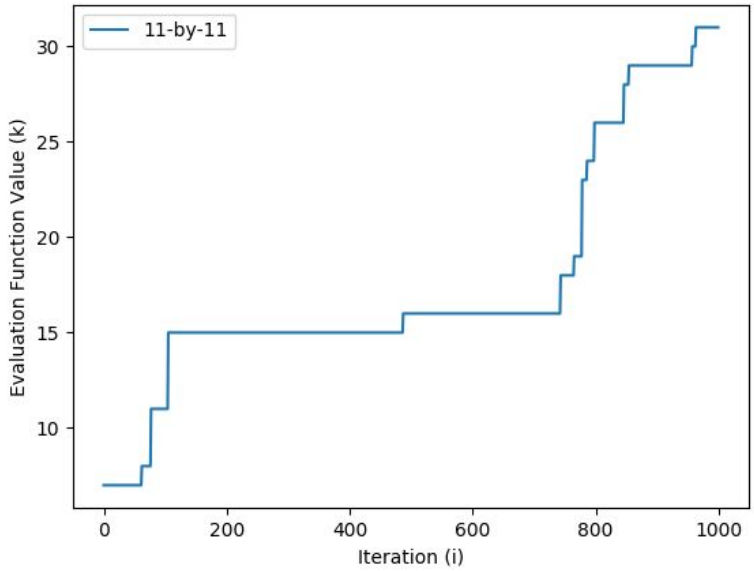
Matrix Size = 7

Final Matrix	
4 4 2 6 6 3 3 6 5 1 5 1 2 3 5 1 4 3 3 3 6 5 3 3 1 4 3 3 6 3 3 4 3 3 3 3 5 1 4 3 5 5 2 4 6 1 6 2 0	
Graph	
	
Value Function (k)	
k = 33	

Matrix Size = 9

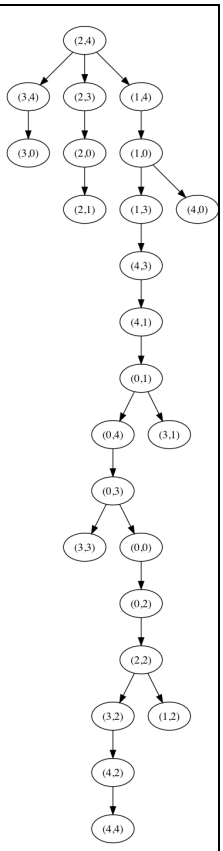
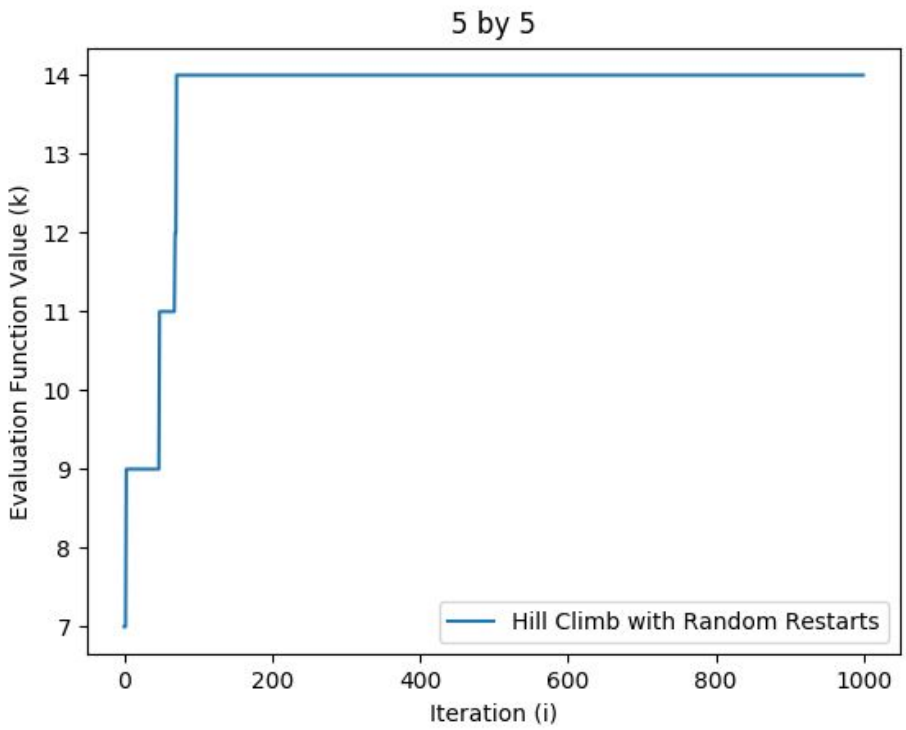
Final Matrix	
6 2 3 4 6 6 8 1 5 8 5 4 4 3 5 4 2 5 8 6 2 1 3 1 5 7 3 1 4 6 3 2 3 6 5 7 8 1 3 5 3 5 1 2 6 8 7 5 4 5 3 4 6 8 6 5 5 6 3 6 5 6 7 8 4 1 3 1 6 5 2 7 3 8 8 8 4 1 8 7 0	
Graph	
	
Value Function (k)	
k = 43	

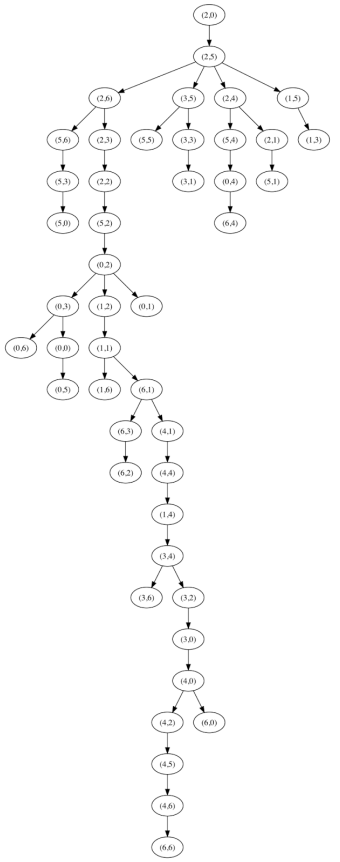
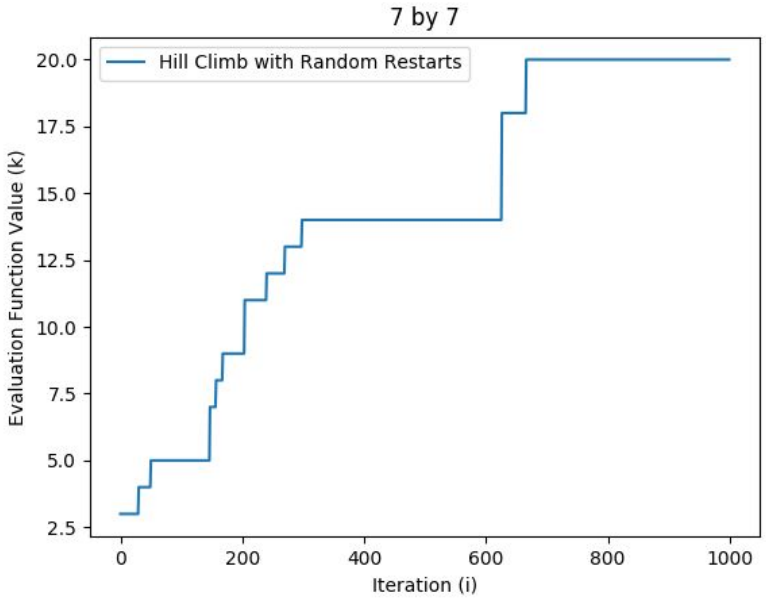
Matrix Size = 11

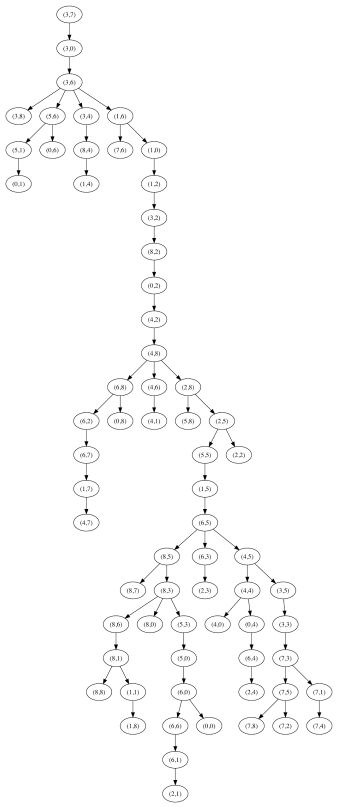
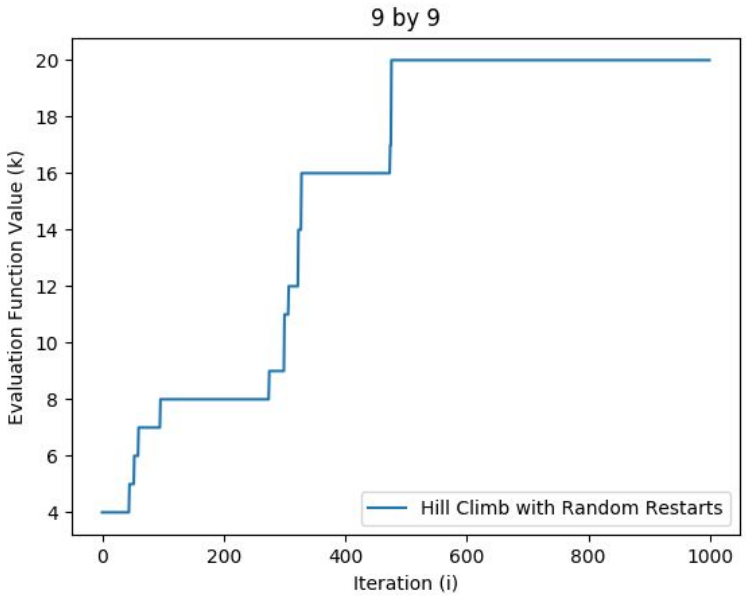
Final Matrix	
4 9 7 5 1 9 4 8 4 8 10 7 6 5 4 9 9 4 4 7 3 10 6 7 2 6 7 6 7 3 1 6 1 8 1 8 3 5 7 2 5 2 8 9 9 6 1 6 6 5 2 4 7 9 9 7 6 6 7 5 2 6 6 6 7 6 3 1 7 4 5 3 4 5 3 5 1 7 3 5 6 4 1 3 4 5 4 8 9 6 3 6 4 5 6 3 8 9 10 4 4 3 7 9 5 7 4 6 9 10 4 5 9 4 1 10 8 8 10 10 0	
Graph	
	
Value Function (k)	
k = 31	

Task 4

Matrix Size = 5

Final Matrix	
2 3 2 3 1 3 2 2 3 4 1 3 1 3 1 4 3 1 2 4 3 4 2 2 0	
Graph	
	
Value Function (k)	
k = 14	

Matrix Size = 7	
Final Matrix	
5 1 1 3 6 2 5 4 5 1 4 2 2 1 5 3 3 1 3 1 3 1 4 2 2 2 2 5 2 3 3 4 3 1 2 3 2 5 3 5 2 3 3 2 5 1 6 1 0	
Graph	
	
Value Function (k)	
k = 20	

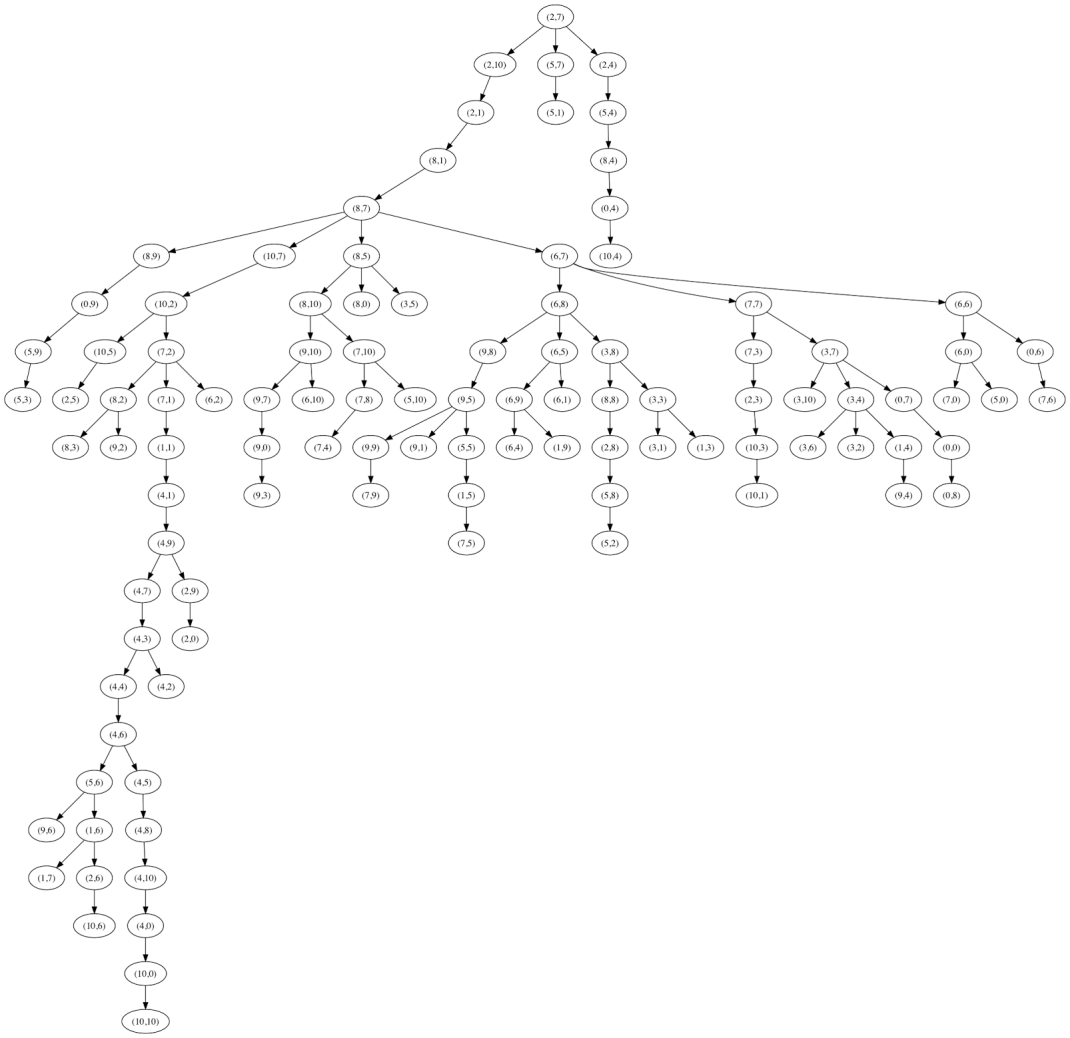
Matrix Size = 9	
Final Matrix	
8 5 4 3 6 4 7 8 2 2 7 2 5 2 5 6 3 8 6 4 6 6 1 3 5 3 3 6 5 5 4 5 2 2 7 8 7 7 6 3 4 1 5 5 2 1 5 1 3 1 4 5 1 7 6 4 5 4 4 2 5 5 6 4 3 6 2 7 3 7 6 2 7 7 8 3 7 2 5 2 0	
Graph	
	
Value Function (k)	
k = 20	

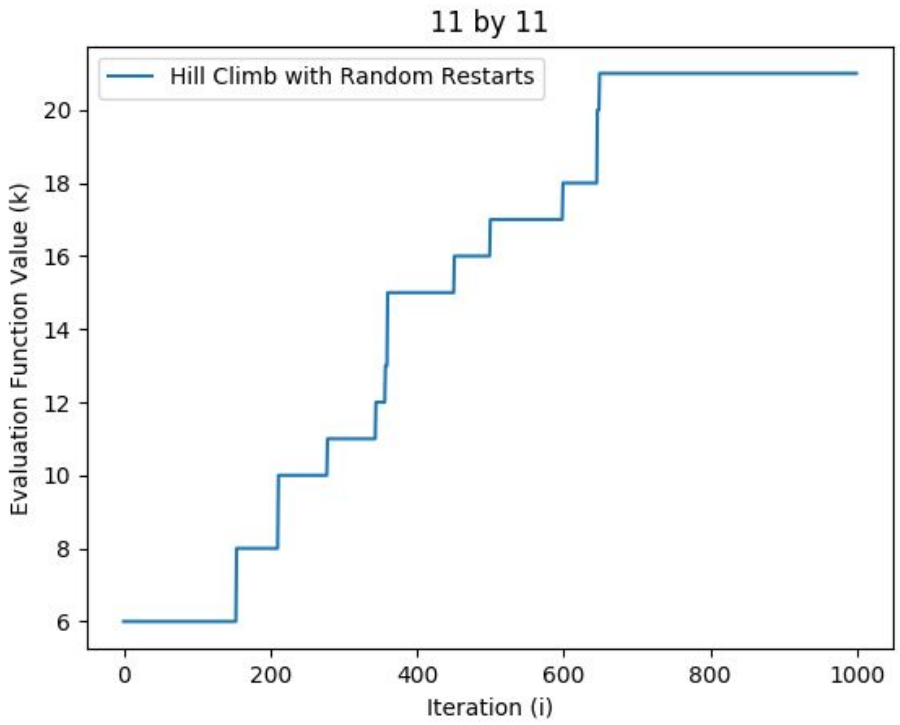
Matrix Size = 11

Final Matrix

8 1 3 10 10 5 7 7 9 5 3
10 3 4 6 8 6 1 4 6 5 5
5 6 5 8 3 7 8 3 3 9 9
9 6 4 2 2 7 4 3 5 2 6
6 8 7 1 2 3 1 4 2 2 10
7 3 8 6 3 4 4 6 6 6 9
1 9 7 6 5 4 6 1 3 5 9
10 6 1 5 4 6 4 4 4 7 2
9 6 1 6 8 5 5 2 6 8 1
3 7 3 8 9 4 2 7 3 2 3
10 2 3 2 8 8 8 5 6 9 0

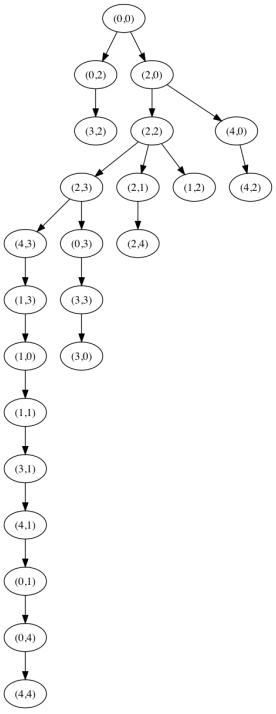
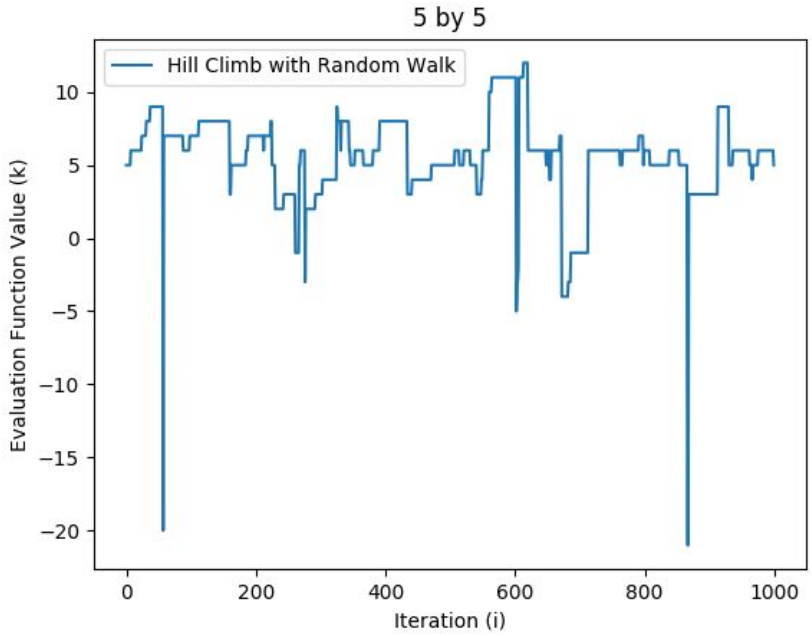
Tree



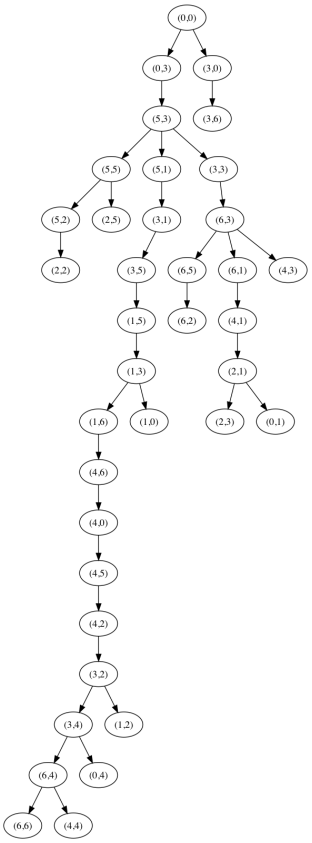
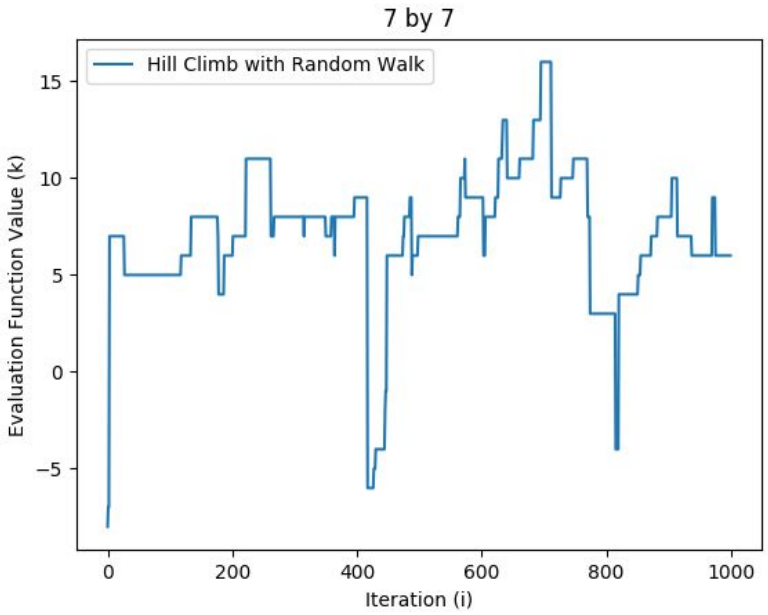
Graph

Value Function (k)
k = 21

Task 5

Matrix Size = 5

Final Matrix	
2 3 3 3 4 1 2 3 3 4 2 3 1 2 3 3 1 3 3 2 2 4 4 3 0	
Graph	
	
Value Function (k)	
k = 12	

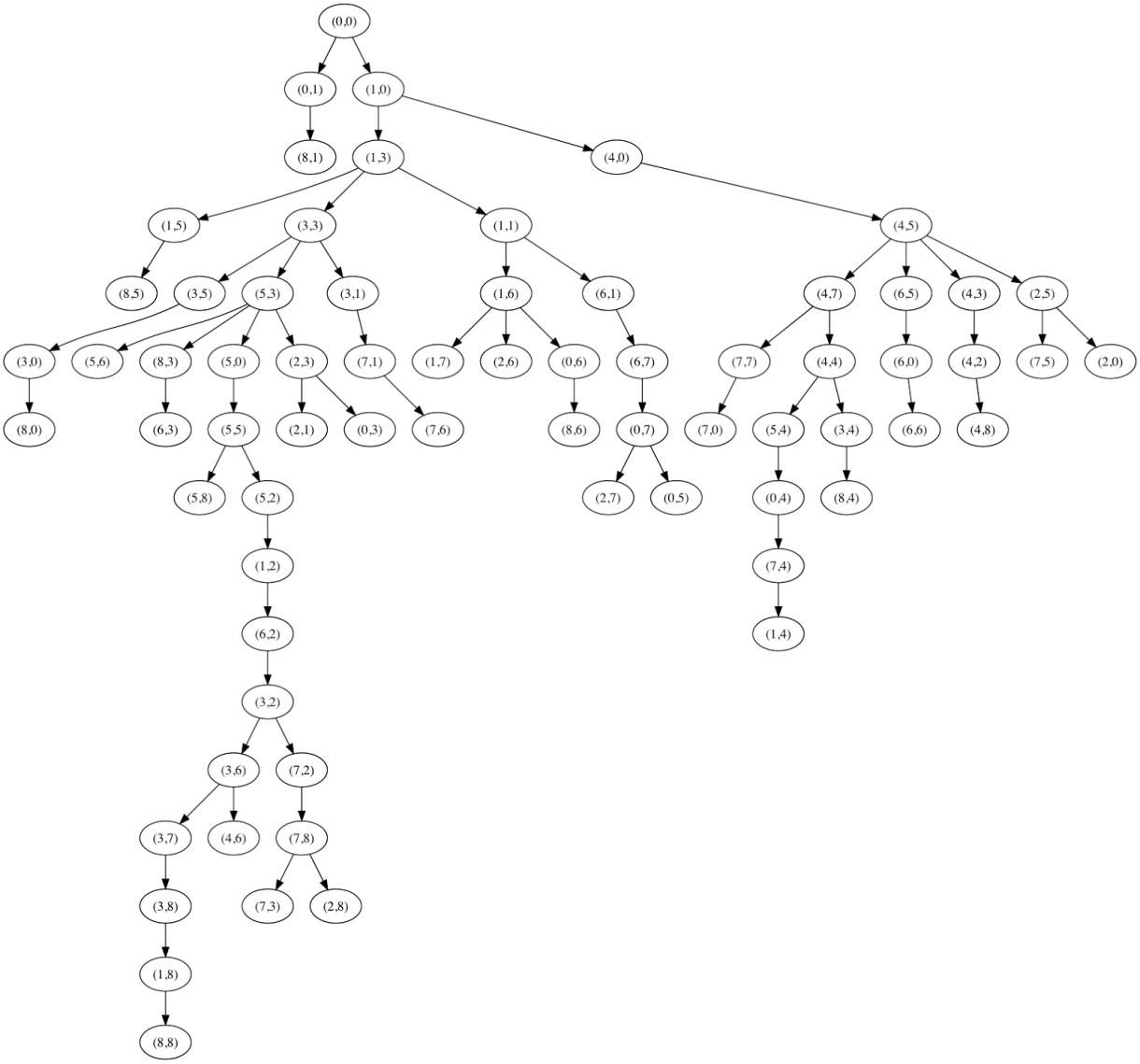
Matrix Size = 7

Final Matrix	
3 2 1 5 4 4 1 6 1 5 3 3 2 3 4 2 3 4 3 3 5 6 4 2 3 3 2 6 5 2 1 4 4 3 6 4 2 3 2 2 3 5 4 2 1 2 2 3 0	
Graph	
	
Value Function (k)	
k = 16	

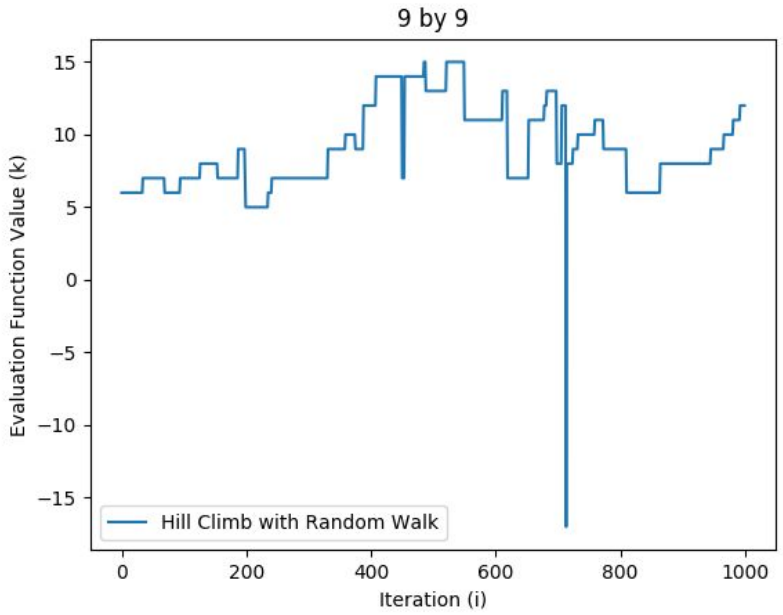
Matrix Size = 9
Final Matrix
1 8 6 4 7 6 8 2 5 3 5 5 2 3 7 1 6 7 6 4 4 2 3 5 3 4 8 5 4 4 2 5 5 1 1 2 5 6 6 1 1 2 6 3 6 5 4 4 3 5 3 6 4 6

6 6 3 3 5 5 5 6 2
6 5 6 1 6 4 1 7 5
3 8 2 2 8 6 7 5 0

Tree



Graph



Value Function (k)

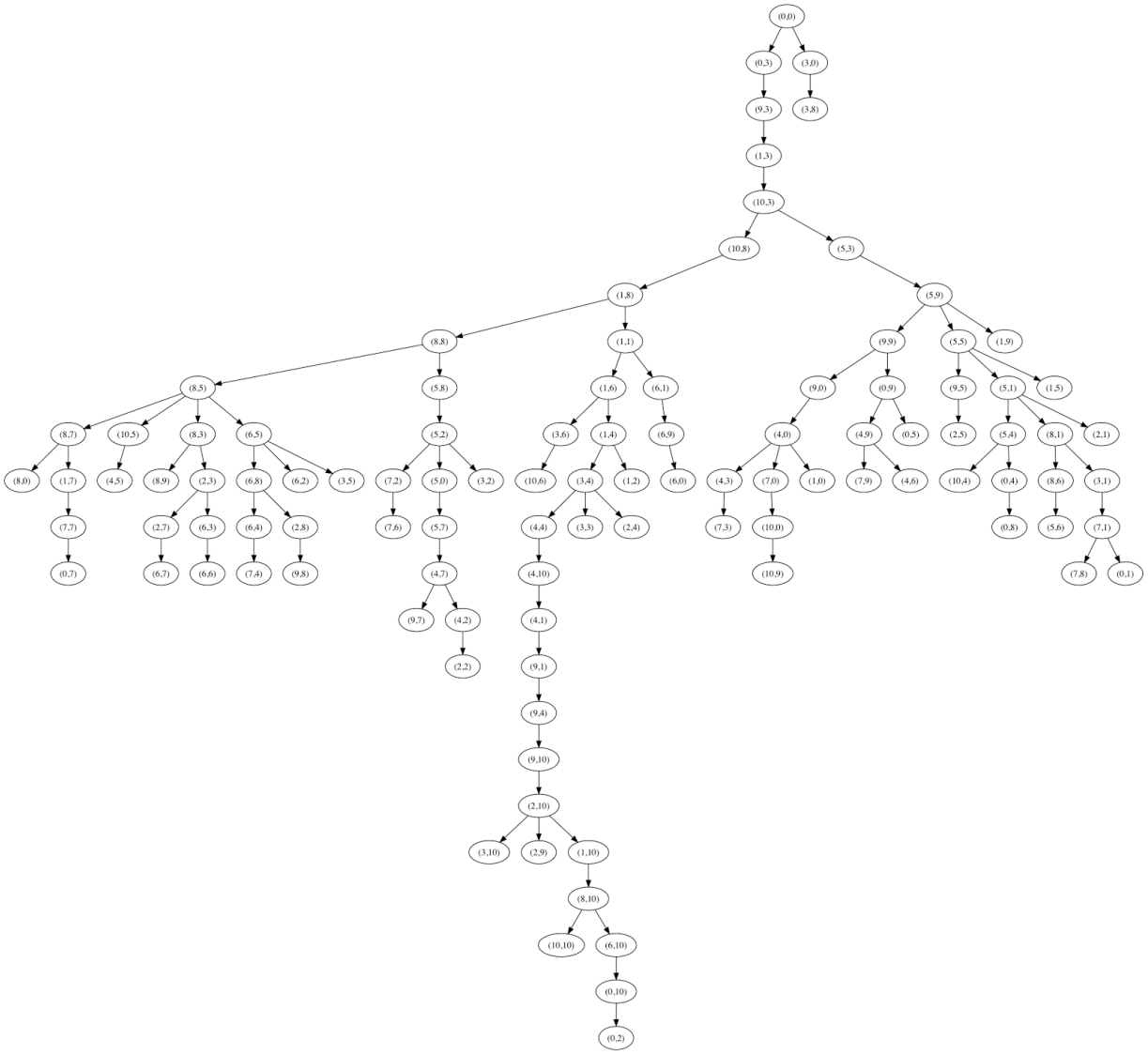
k = 15

Matrix Size = 11

Final Matrix

3 2 2 9 4 6 8 7 1 4 8
5 5 4 9 2 7 2 6 7 4 7
5 4 1 4 8 6 8 4 7 2 1
8 4 2 2 1 6 7 7 8 2 6
3 5 2 3 6 6 3 5 5 3 9
7 3 2 6 5 4 1 1 6 4 1
9 8 7 3 1 3 5 6 4 9 6
3 7 4 6 3 5 6 7 8 7 3
3 5 8 6 2 2 3 7 3 3 2
5 3 6 8 6 7 9 2 9 9 7
9 5 9 5 8 6 9 5 9 10 0

Tree


(0,0)
(0,3)
(3,0)
(9,3)
(3,8)
(1,3)
(10,3)
(10,8)
(5,3)
(1,8)
(5,9)
(8,8)
(1,1)
(9,9)
(5,5)
(1,9)
(8,5)
(5,8)
(1,6)
(6,1)
(9,0)
(0,9)
(9,5)
(5,1)
(1,5)
(8,7)
(10,5)
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(6,5)
(5,2)
(3,6)
(1,4)
(6,9)
(4,0)
(4,9)
(0,5)
(2,5)
(5,4)
(8,1)
(2,1)
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(2,8)
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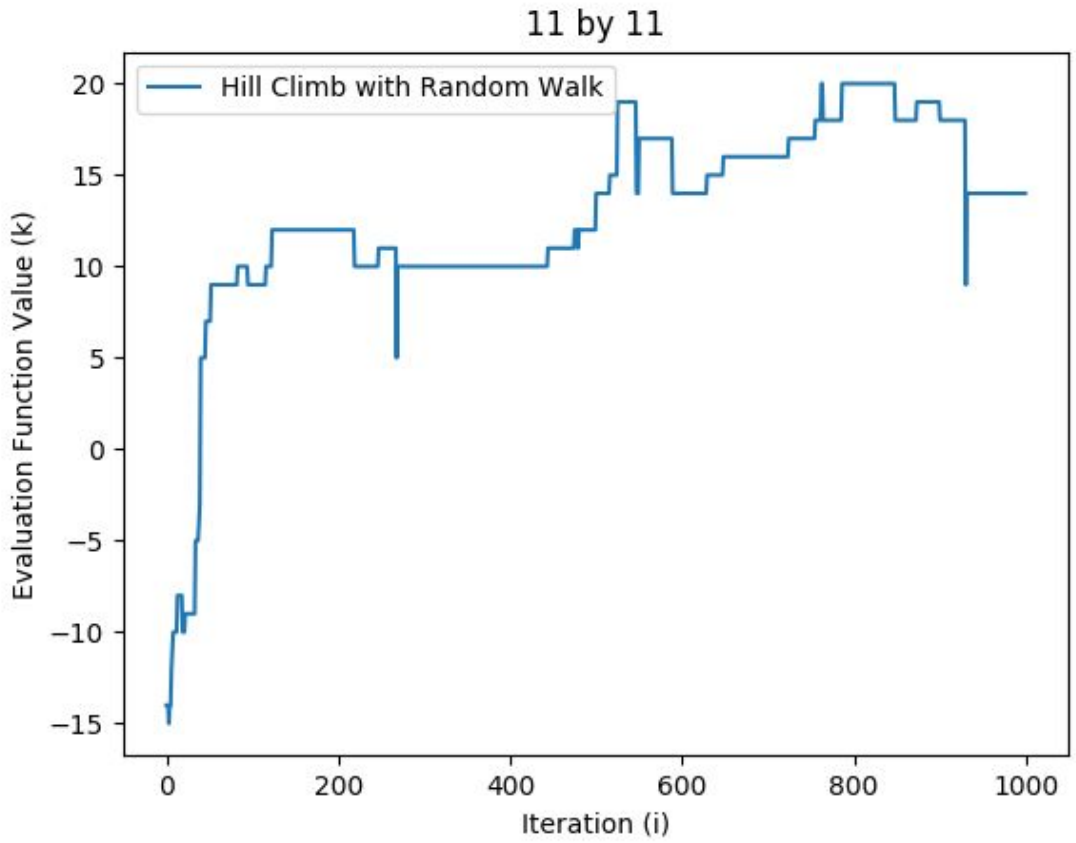
(9,1)
(9,4)
(9,10)
(2,10)
(3,10)
(2,9)
(1,10)
(8,10)
(10,10)
(6,10)
(0,10)
(0,2)

Graph

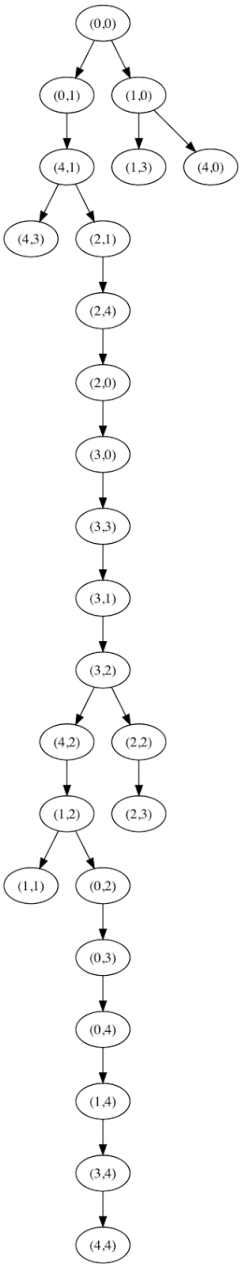
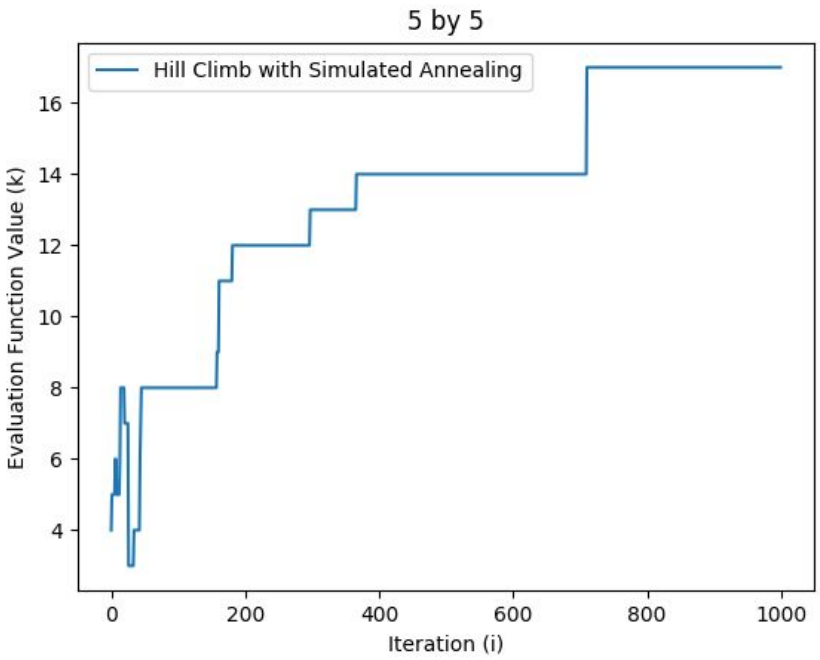


Value Function (k)

k = 20

Task 6

Matrix Size = 5

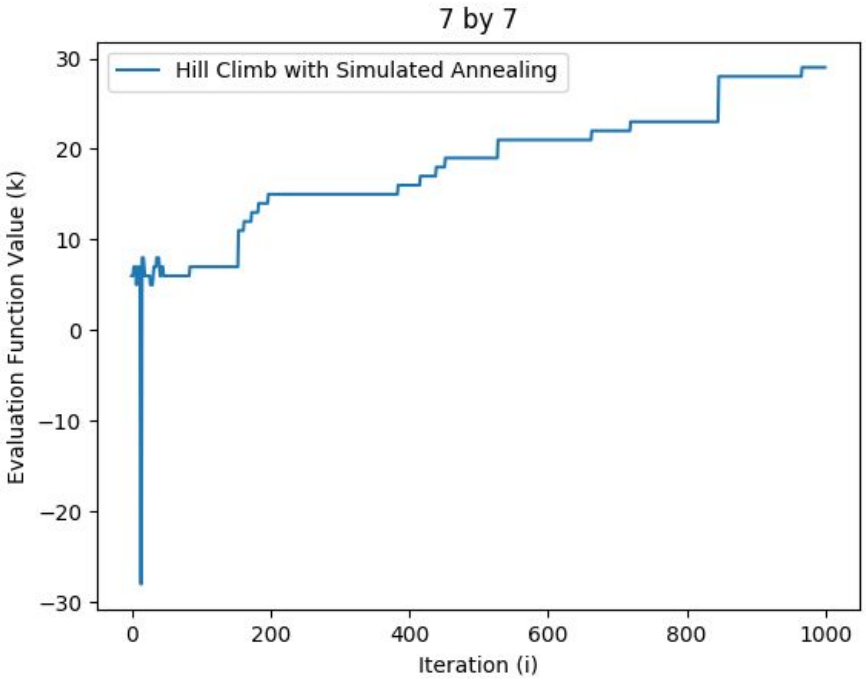
Final Matrix	
1 4 1 1 1 3 2 1 3 2 1 3 1 1 4 3 1 1 2 1 3 2 3 3 0	
Graph	
	
Value Function (k)	
k = 17	

Matrix Size = 7

Final Matrix

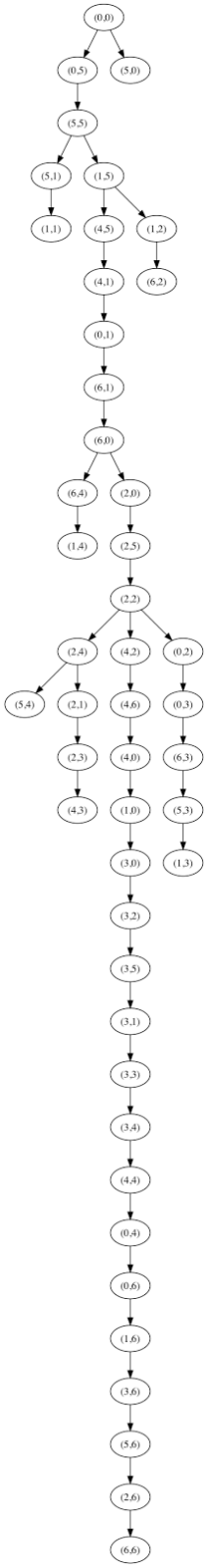
5 6 1 6 2 5 1
2 4 5 4 5 3 2
5 2 2 2 3 3 4
2 2 3 1 1 4 2
3 4 4 2 4 4 6
5 4 1 4 4 4 3
4 1 5 1 5 3 0

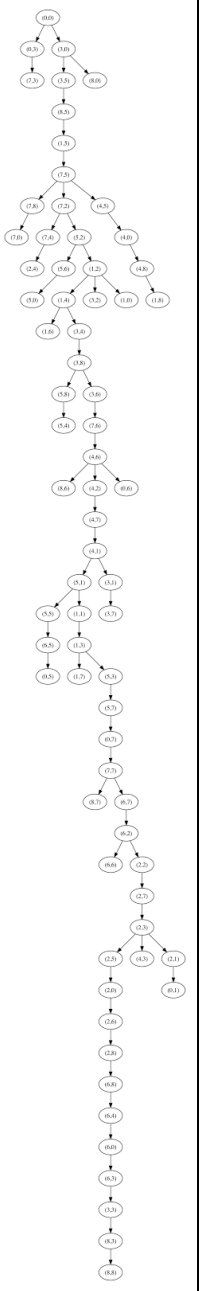
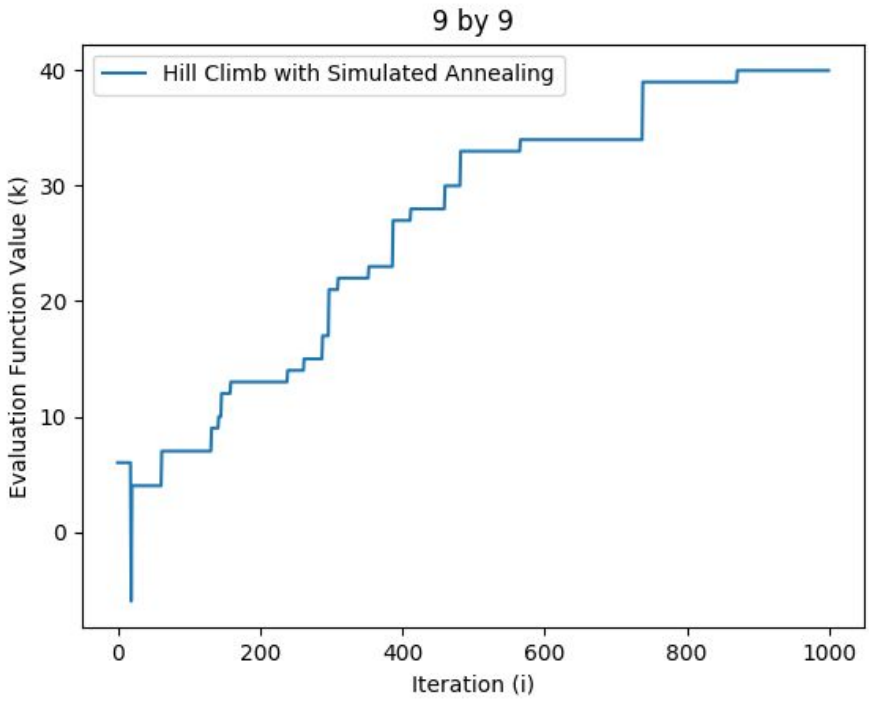
Graph



Value Function (k)

k = 29



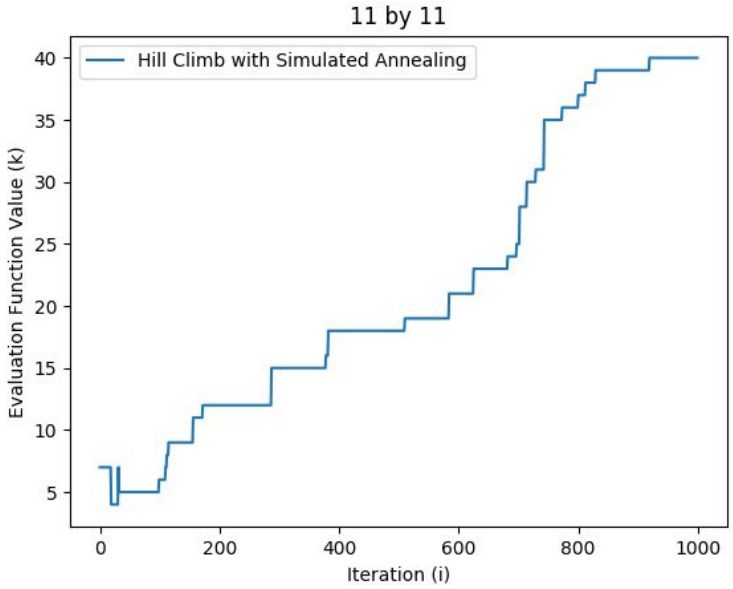
Matrix Size = 9	
Final Matrix	
3 4 4 7 2 7 3 7 1 8 2 2 4 2 6 4 3 8 6 2 5 2 5 5 2 4 4 5 6 2 5 4 5 4 6 2 8 1 5 5 3 5 4 6 3 6 4 4 4 2 1 6 5 4 3 1 4 3 4 6 1 5 4 3 3 2 7 5 3 3 1 8 5 5 3 5 6 7 8 7 0	
Graph	
	
Value Function (k)	
k = 40	

Matrix Size = 11

Final Matrix

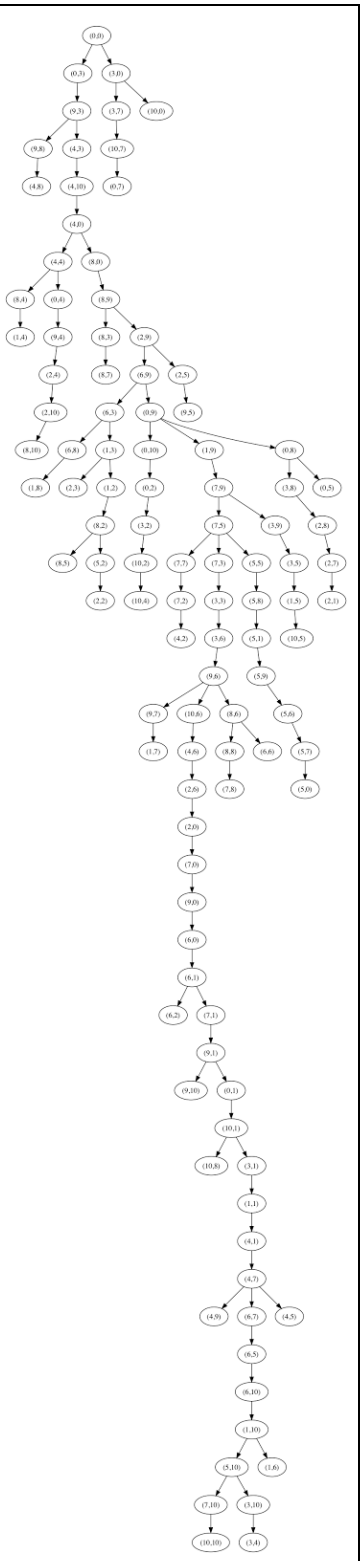
3 10 3 9 9 2 2 10 3 1 8
7 3 7 1 8 9 7 9 5 6 4
5 9 8 6 6 7 6 6 1 4 6
7 2 7 3 1 2 6 7 1 4 6
4 6 6 7 4 3 2 2 5 9 10
7 8 3 2 4 3 1 7 7 3 2
1 1 1 5 2 5 3 2 5 6 5
2 2 3 4 3 2 3 5 1 4 3
9 8 3 4 7 8 2 8 1 6 6
3 9 9 5 7 7 1 8 5 4 9
7 7 2 8 8 10 6 10 4 8 0

Graph

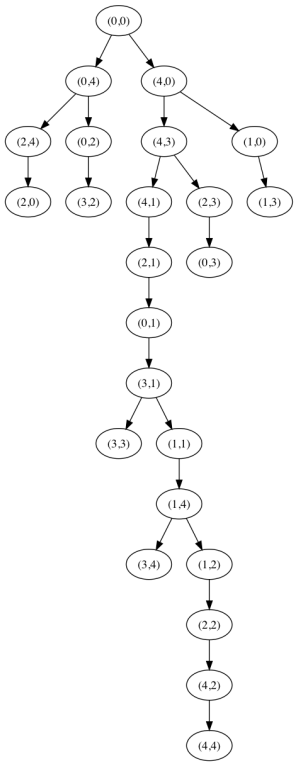
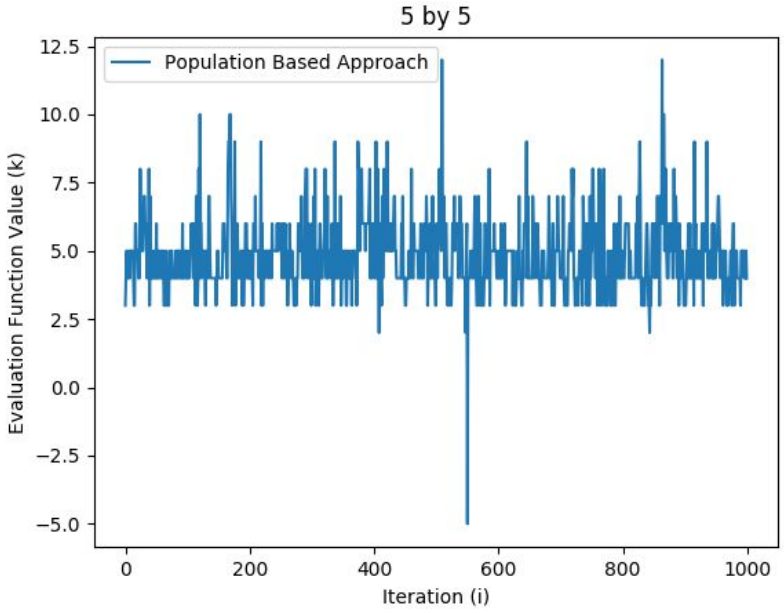


Value Function (k)

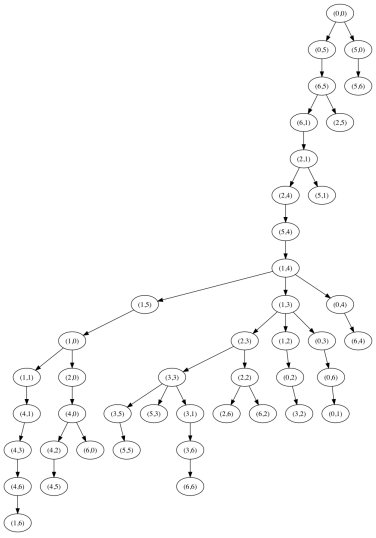
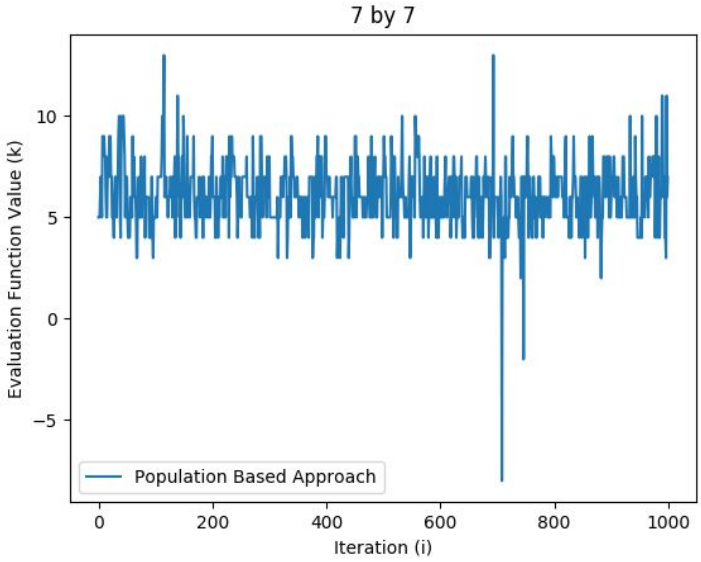
k = 40



Task 7

Matrix Size = 5	
Final Matrix	
4 3 3 2 2 3 3 1 3 2 3 2 2 2 4 2 2 2 1 4 1 3 2 2 0	
Graph	
	
Value Function (k)	
k = 12	

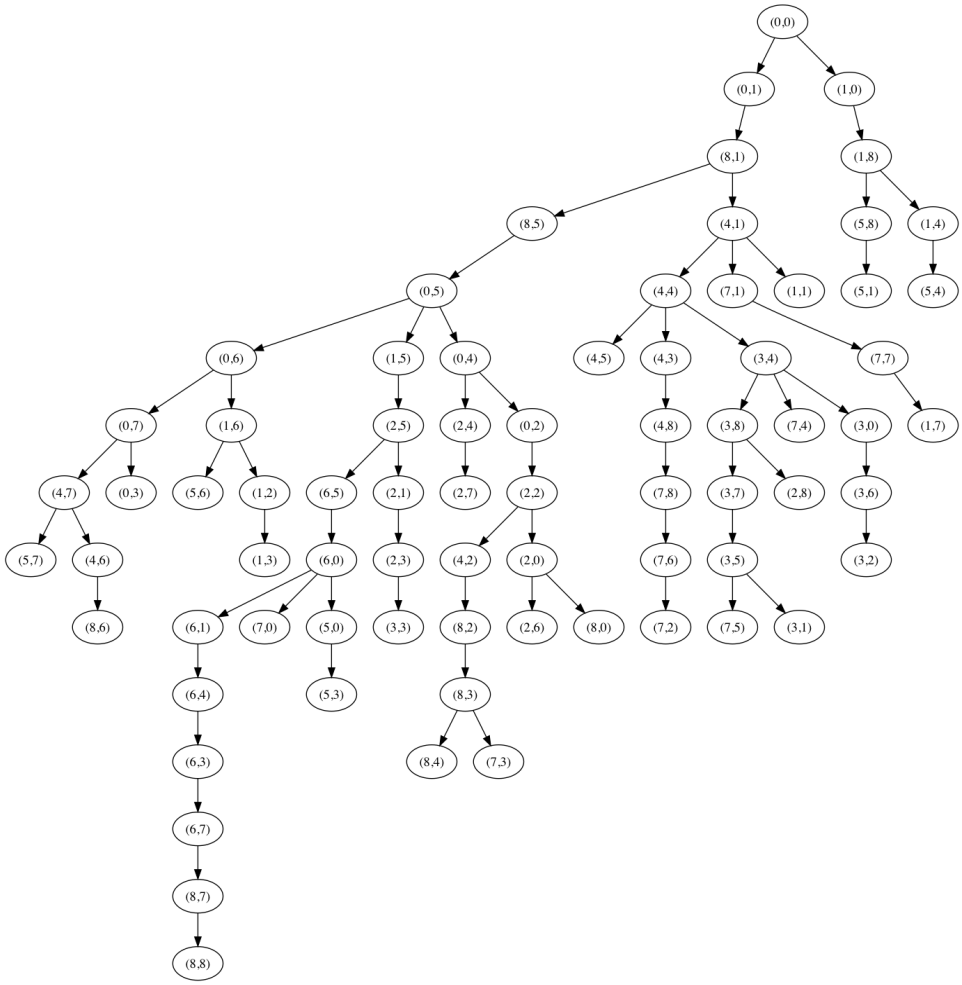
Matrix Size = 7

Final Matrix	
5 3 3 3 6 6 5 1 3 1 1 1 5 2 2 3 4 1 3 4 5 3 5 1 3 3 2 4 5 4 4 3 1 4 3 6 3 2 3 4 4 6 4 4 2 2 6 4 0	
Graph	
	
Value Function (k)	
k = 13	

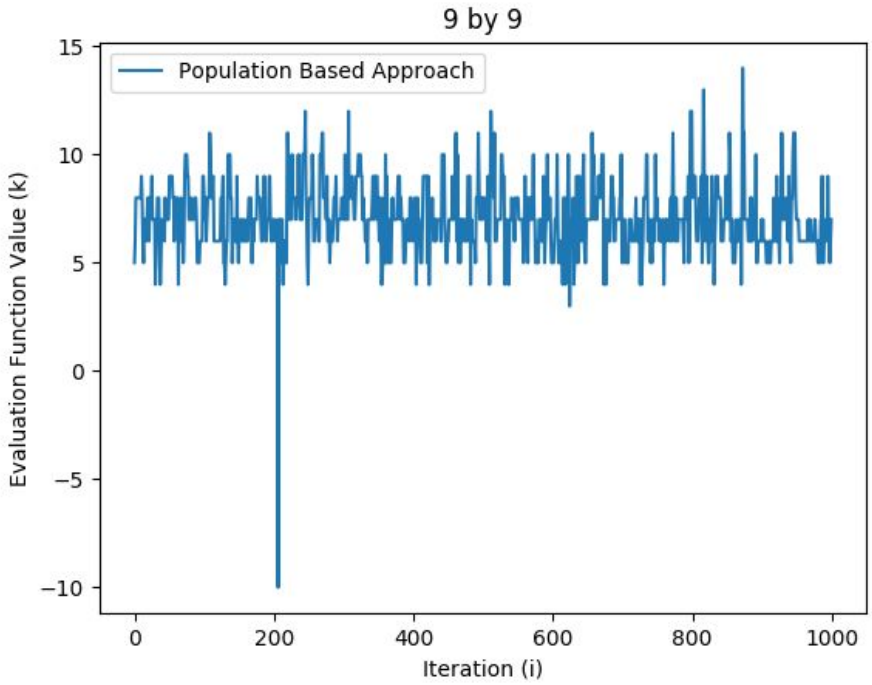
Matrix Size = 9
Final Matrix
7 3 7 4 1 1 1 4 2 8 3 1 3 4 1 4 1 4 6 2 2 1 3 4 2 2 1 6 3 1 2 4 4 4 2 1 2 5 5 4 2 4 4 1 3 3 7 1 3 5 2 5 6 7 8 5 4 1 1 5 2 2 1

2 6 7 7 7 1 4 6 2
5 4 1 1 1 8 7 1 0

Tree



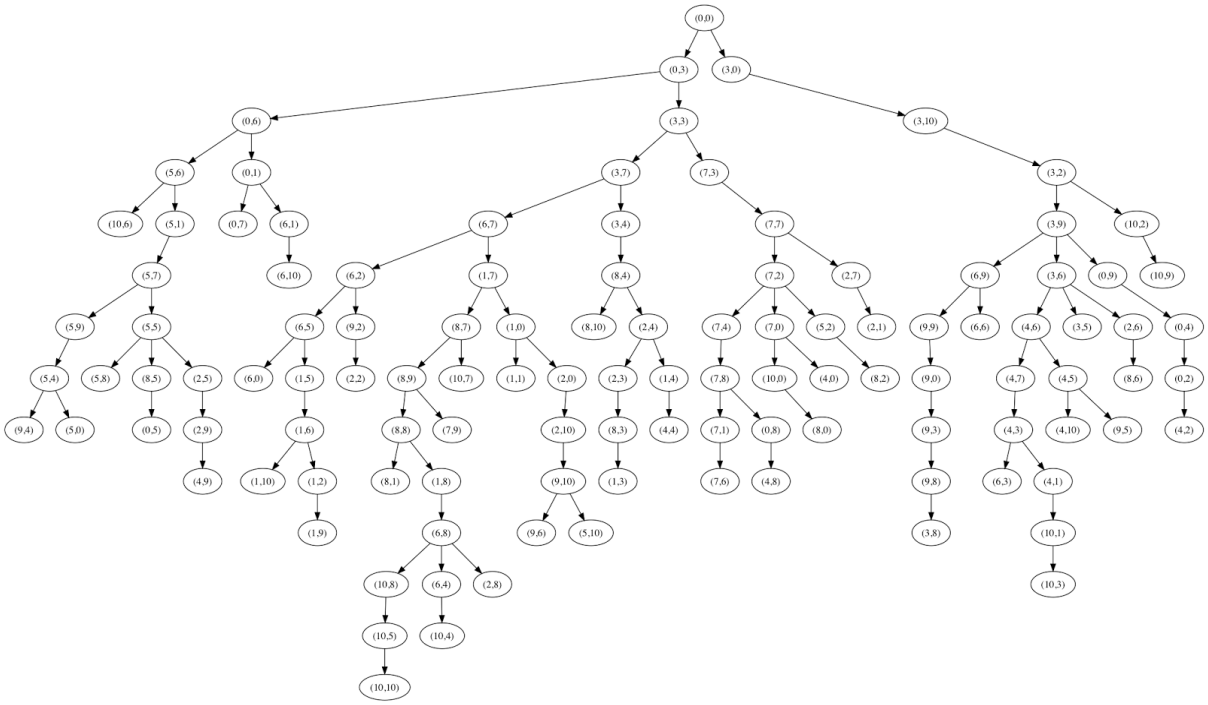
Graph



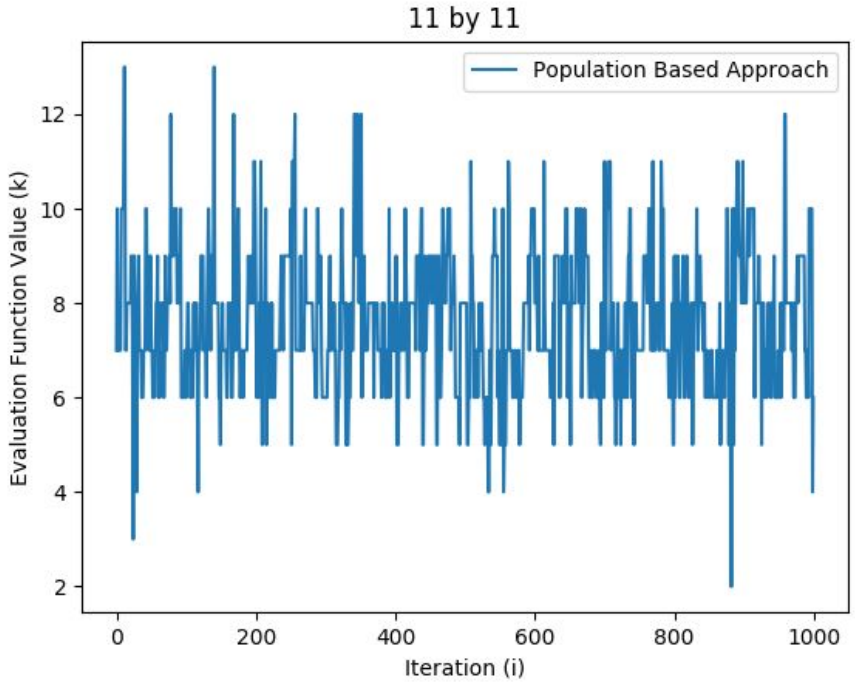
Value Function (k)

k = 14

Matrix Size = 11
Final Matrix
3 6 4 3 2 3 5 6 4 5 8 1 4 7 7 3 1 4 7 5 4 5 10 3 4 6 1 4 6 6 8 2 7 10 7 7 4 5 2 1 3 4 3 8 4 6 7 2 5 5 1 4 8 1 7 1 6 3 1 4 3 5 2 6 5 9 1 9 3 7 4 5 6 5 4 3 9 3 5 2 4 4 1 2 5 7 2 5 10 3 8 7 6 8 6 2 7 1 5 3 7 7 5 7 3 7 8 6 9 4 2 2 7 10 3 5 10 7 3 7 0
Tree



Graph



Value Function (k)

k = 13

Task 8

Largest and Most Complex Puzzle

Matrix Size = 500
Final Matrix
Too large for document. See external text file (“n500_k16.txt”).
Value Function (k)
k = 16