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CS 156 SPRING 2021
Professor Sanjoy Paul
Homework 4

Assignment:

- A. Tabulate the results showing
(a) Path length, (b) Path cost, (c) Number of nodes expanded and (d) Processing time
from all three searches bfs, dfs and ucs for the following scenarios:

- a. questA
- b. questB
- c. questC
- d. questD
- e. SJSU
- f. noway

- B. Which search algorithm performed the best? Why do you think so?
C. Did the performance of the algorithms vary with the type of the maze file? Why?
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SJSU.txt

	PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	33	388	758	0.0088
DFS	303	2548	325	0.0034
UCS	36	306	659	0.0092

QUEST A

	PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	7	98	76	0.001
DFS	7	98	7	0.0001
UCS	7	98	91	0.0011

QUEST B

	PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	60	631	483942	73.4645
DFS	452	3767	1339	0.0175
UCS	74	550	493477	29.434

QUEST C

PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	31	452	0.0089
DFS	315	2724	0.0085
UCS	31	452	0.0186

QUEST D

PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	31	452	0.0094
DFS	315	2724	0.0083
UCS	31	452	0.0181

QUEST E

PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	8	112	0.0016
DFS	8	112	0.0001
UCS	8	112	0.0057

QUEST F

PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	71	445	5.1255
DFS	628	5104	0.0121
UCS	73	437	2.2479

QUEST G

PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS			
DFS	663	5318	0.015
UCS	94	563	195.2317

QUEST H

PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	25	276	0.015
DFS	105	916	0.0027

UCS	32	218	1186	0.0222
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QUEST L

	PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	40	446	4441	0.0495
DFS	370	3086	548	0.007
UCS	47	299	3044	0.0442

NOWAY

	PATH LENGTH	COST	NUMBER OF EXPANED	PROCESSING TIME
BFS	20	163	315	0.0034
DFS	116	931	116	0.0018
UCS	20	163	275	0.0034

PART B:

For DFS, we can see that they will take more path length and cost than others but the number of expanded will less than other. We can say DFS has better for Space but worse for Time. I think DFS should be the best performing algorithms since from the lecture, professor said that space is more critical in search problems because memory cannot magically grow.

For BFS, we can see that it takes more number expanded (cost more space and time).

For UCS, we can see that they use space and time at worst case $O(n \log n)$, it was not too bad as the BFS but we can see they still take more time and space vs DFS.

PART C:

The performance of the algorithms vary with the type of the maze file because we can see with different algorithms, they have their strength and weakness. For DFS, they will easily find the solution if they have only one path. BFS will do better if their solution lies near the parent nodes and UCS will do the best if solution lies near the cost less than the cheapest final solution.

PART A:

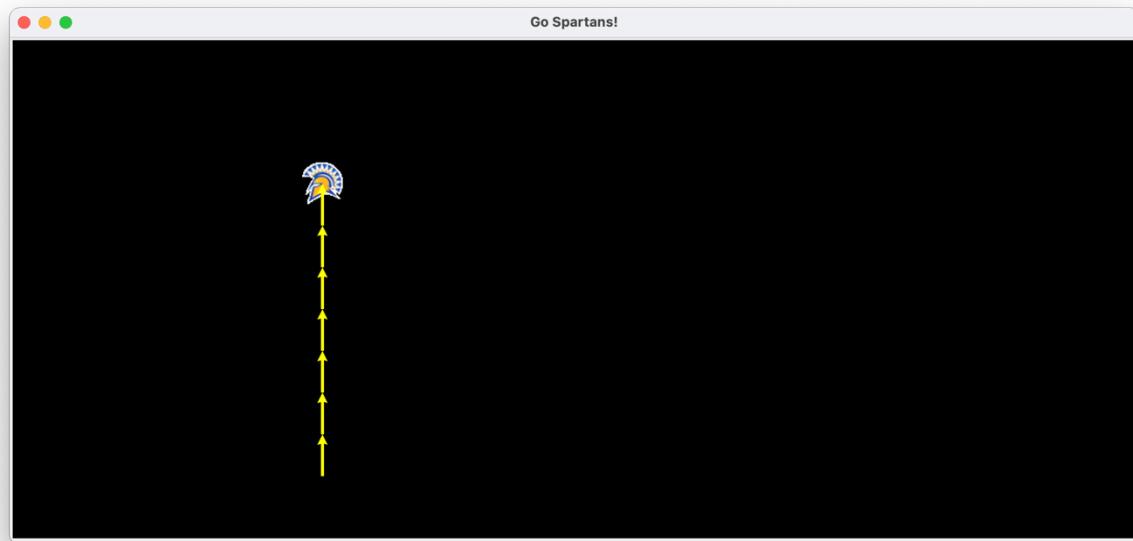
QUESTA:

BFS:

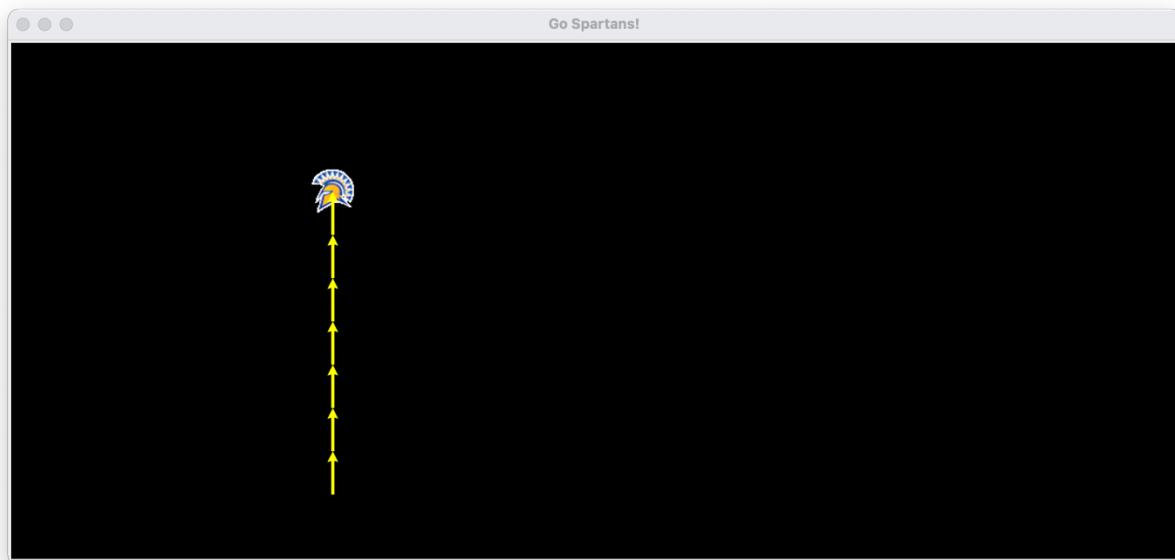
```

For more details, please visit https://support.apple.com/kb/HT208050.
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questA.txt bfs
Path length:  7
Carrots consumed:  98
Number of nodes expanded:  76
Processing time: 0.0009 (sec)

```



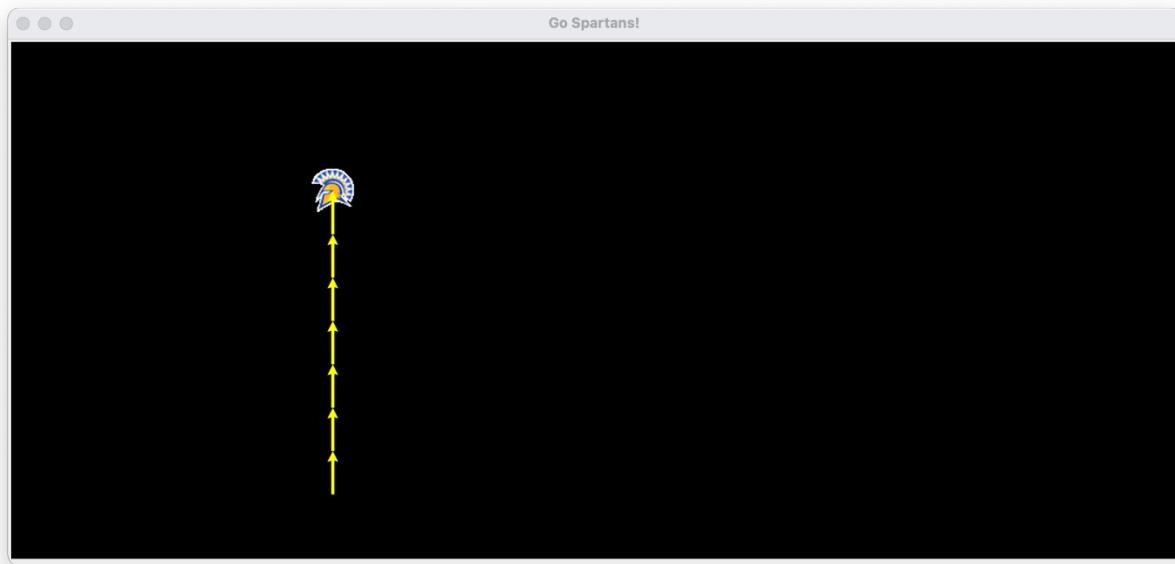
DFS:



```
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questA.txt dfs
Path length: 7
Carrots consumed: 98
Number of nodes expanded: 7
Processing time: 0.0001 (sec)
[]
```

UCS:

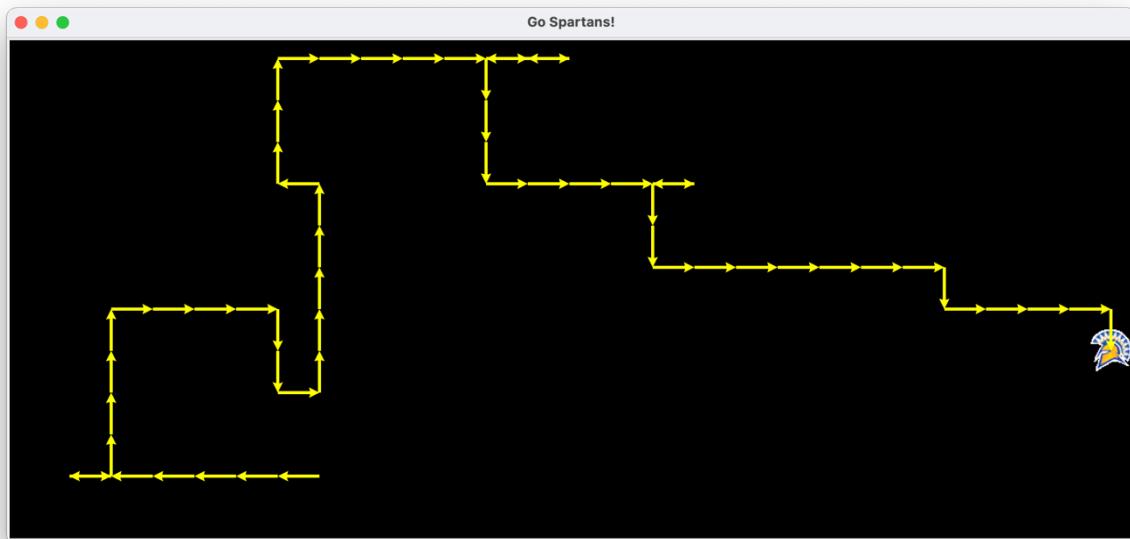
```
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questA.txt ucs
Path length: 7
Carrots consumed: 98
Number of nodes expanded: 91
Processing time: 0.0011 (sec)
(base) TGs-MacBook-Pro:HW3 GiangDuong$
```



QUEST B:

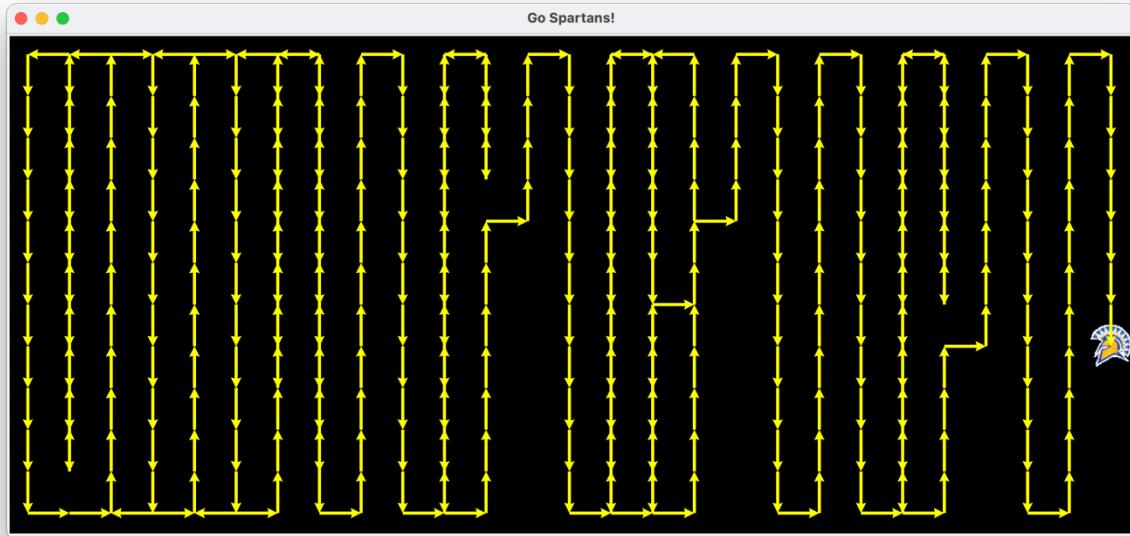
BFS:

```
For more details, please visit https://support.apple.com/kb/HT208050.
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questB.txt bfs
Path length: 60
Carrots consumed: 631
Number of nodes expanded: 483942
Processing time: 73.4645 (sec)
```

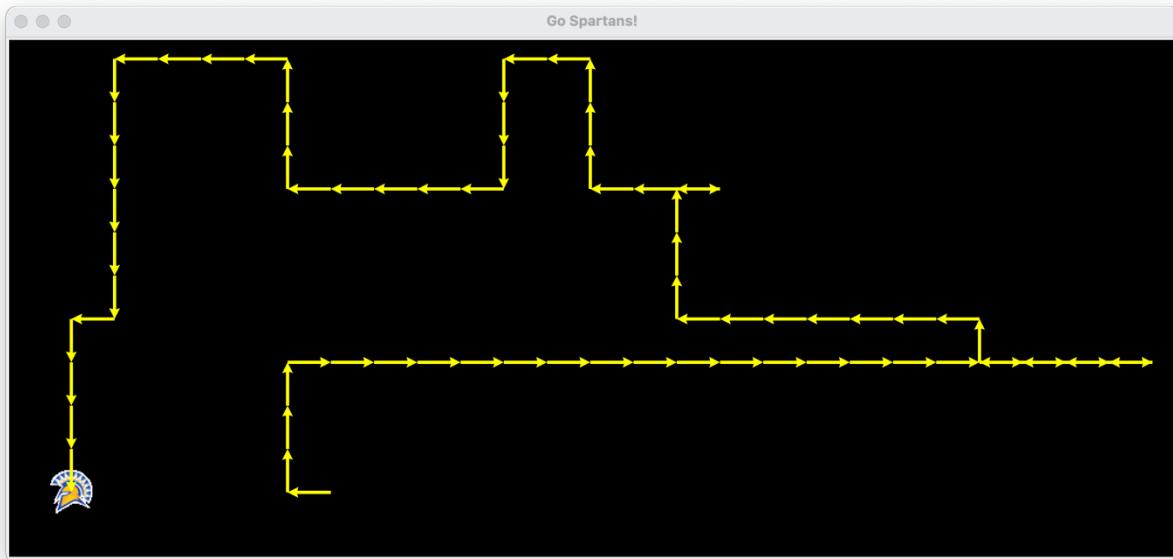


DFS:

```
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questB.txt dfs
Path length: 452
Carrots consumed: 3767
Number of nodes expanded: 1339
Processing time: 0.0175 (sec)
```



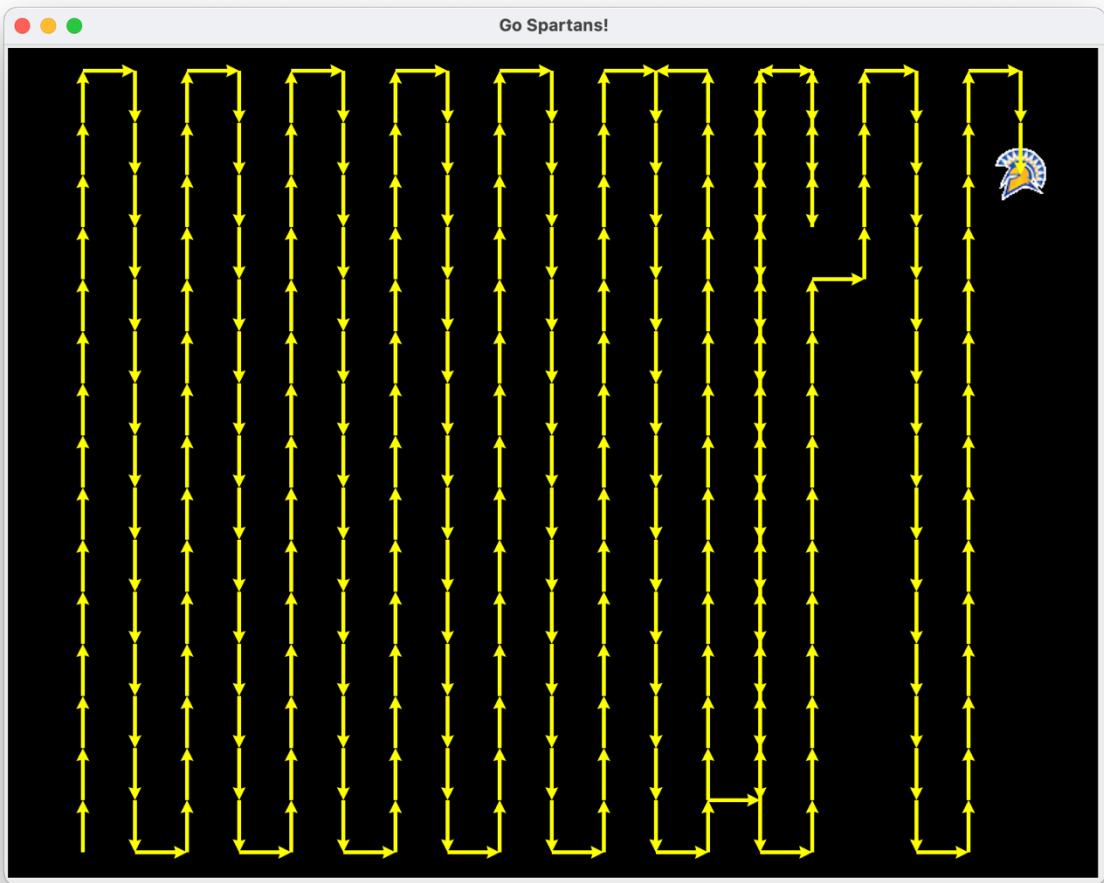
UCS:



QUEST C:

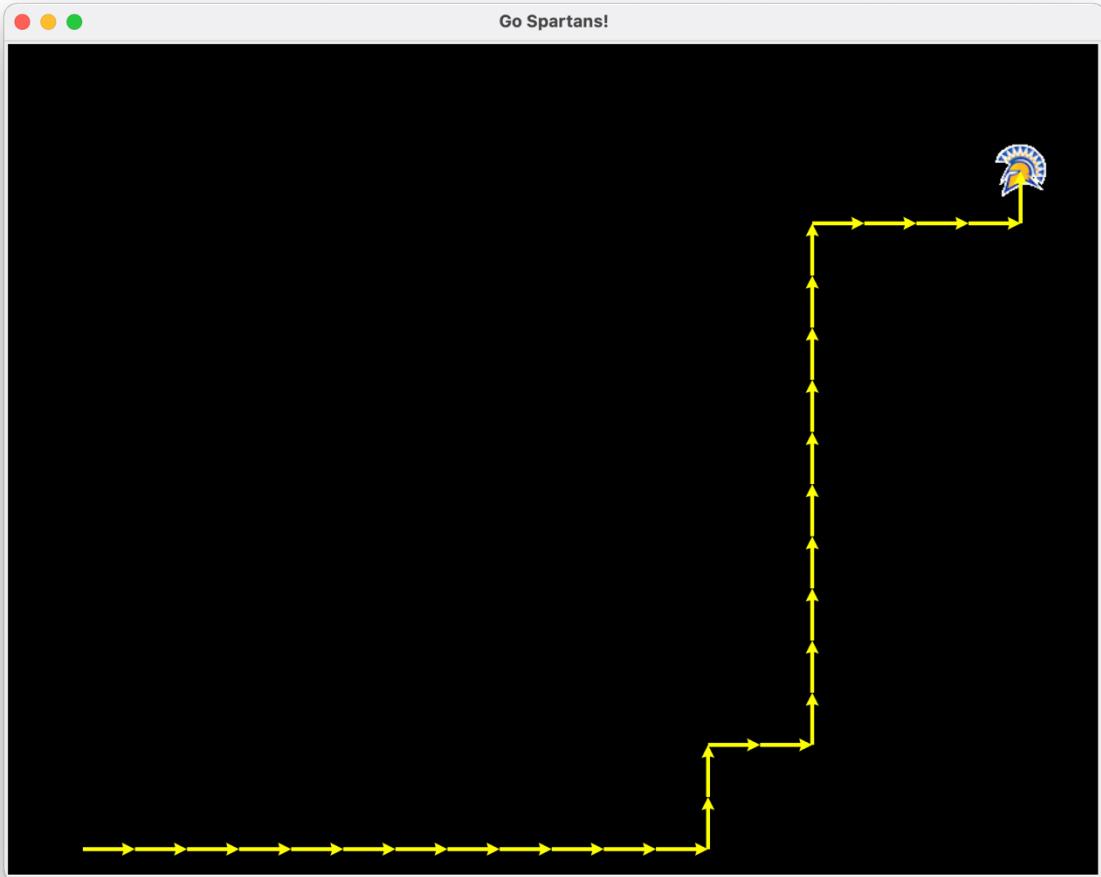
BFS:

```
For more details, please visit https://support.apple.com/kb/HT208050.
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questC.txt dfs
Path length: 315
Carrots consumed: 2724
Number of nodes expanded: 758
Processing time: 0.0085 (sec)
```



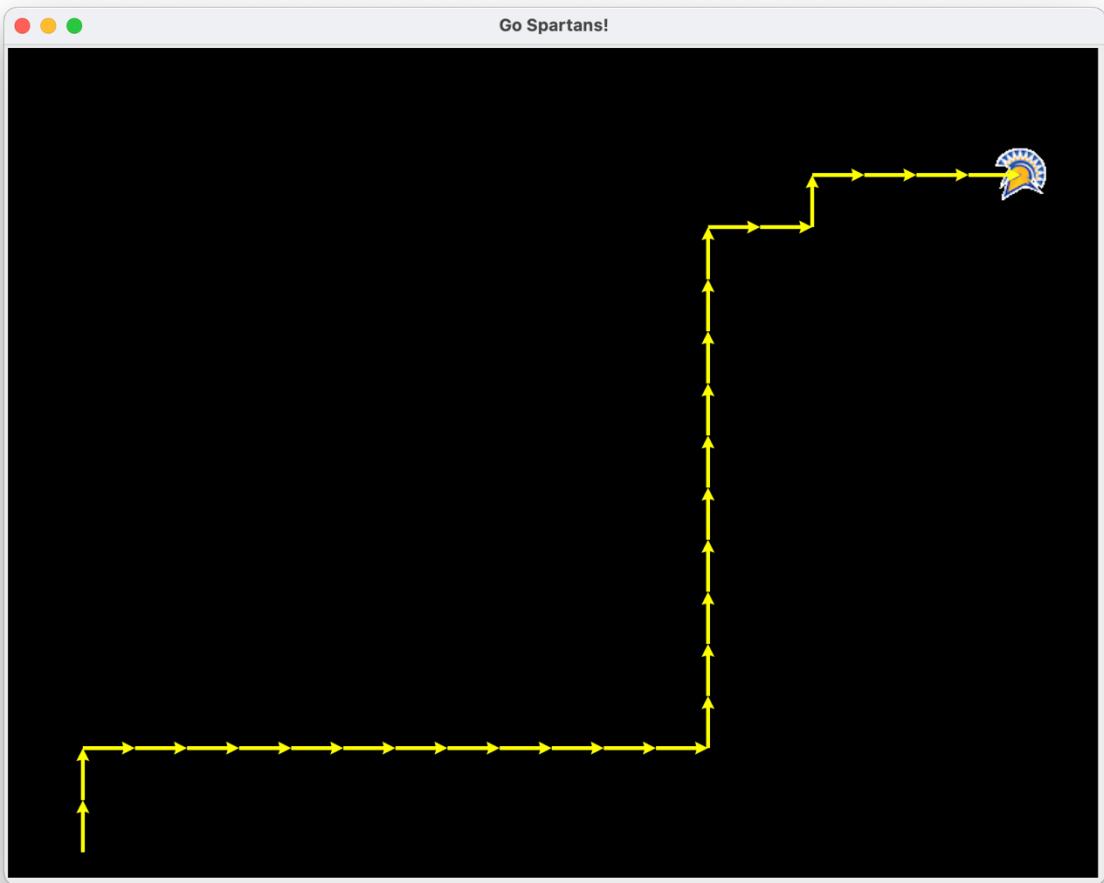
DFS:

```
For more details, please visit https://support.apple.com/kb/HT208050.
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questC.txt bfs
Path length: 31
Carrots consumed: 452
Number of nodes expanded: 701
Processing time: 0.0089 (sec)
```



UCS:

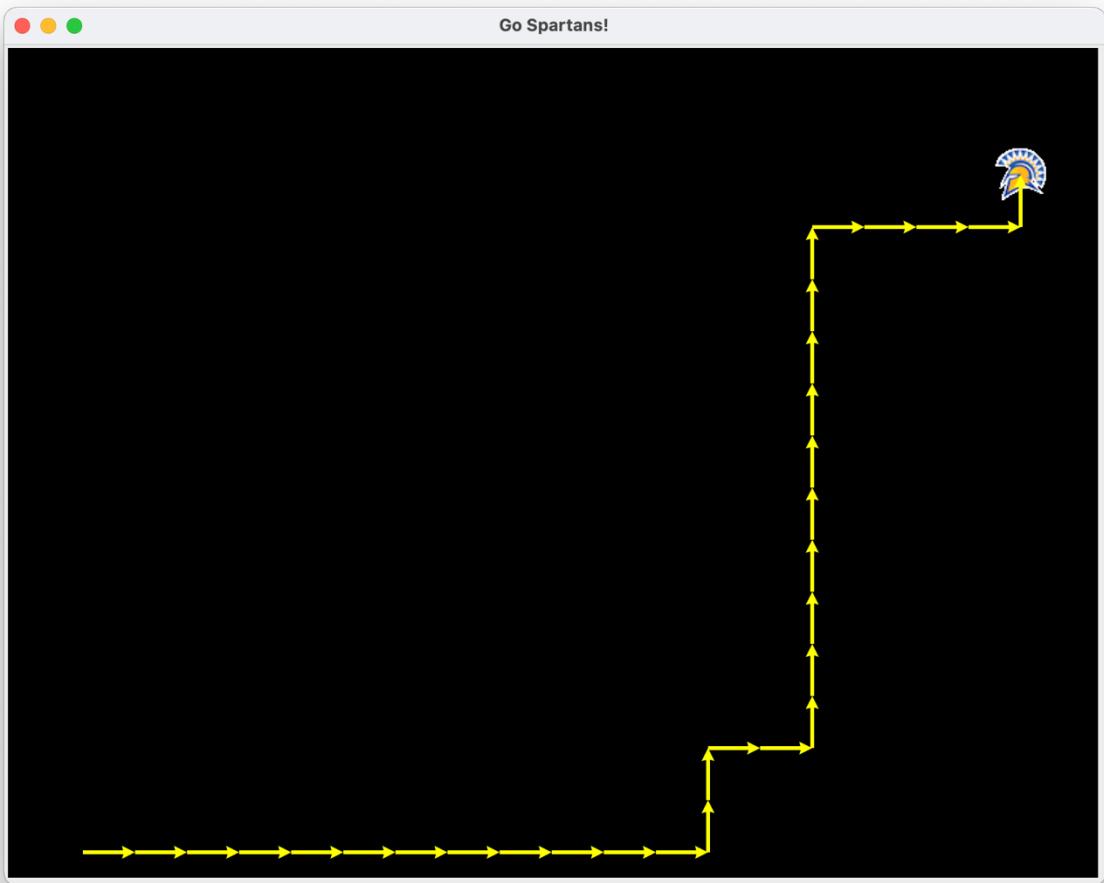
```
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questC.txt ucs
Path length: 31
Carrots consumed: 452
Number of nodes expanded: 1275
Processing time: 0.0186 (sec)
[]
```



QUEST D:

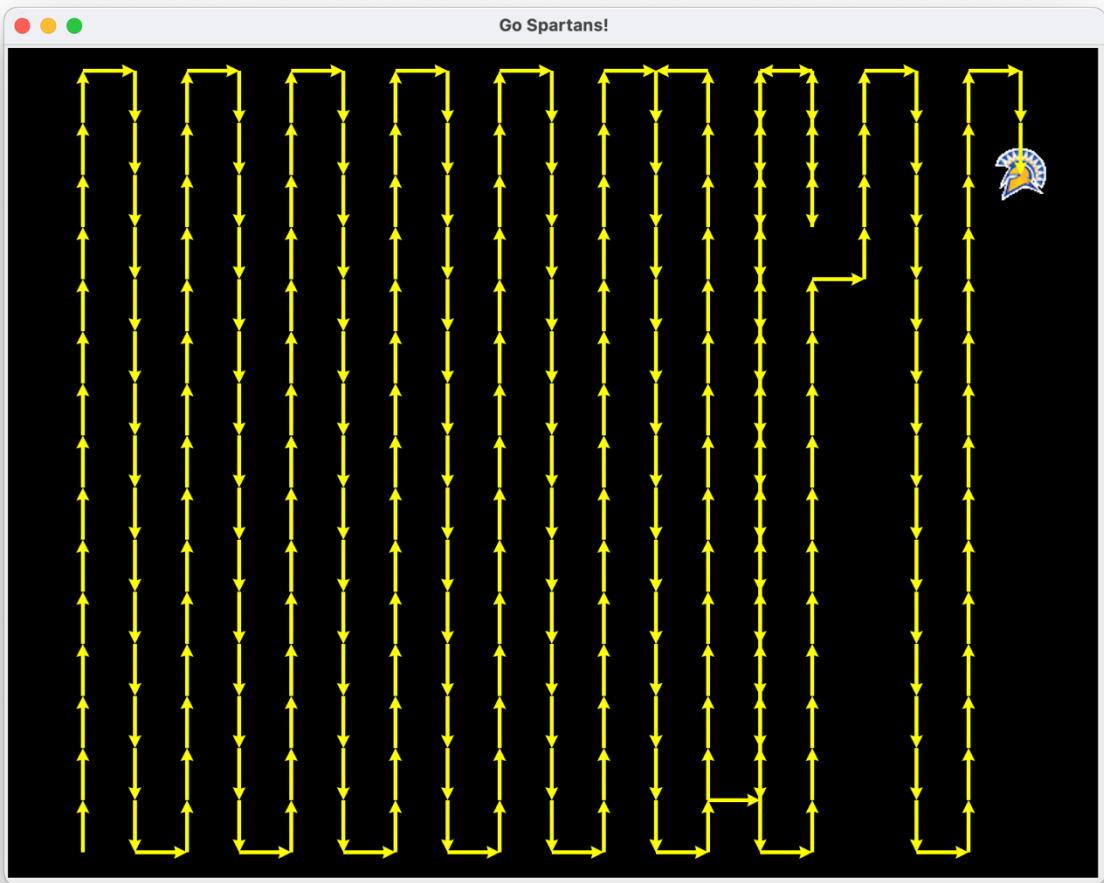
BFS:

```
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questD.txt bfs
Path length: 31
Carrots consumed: 452
Number of nodes expanded: 701
Processing time: 0.0094 (sec)
[]
```



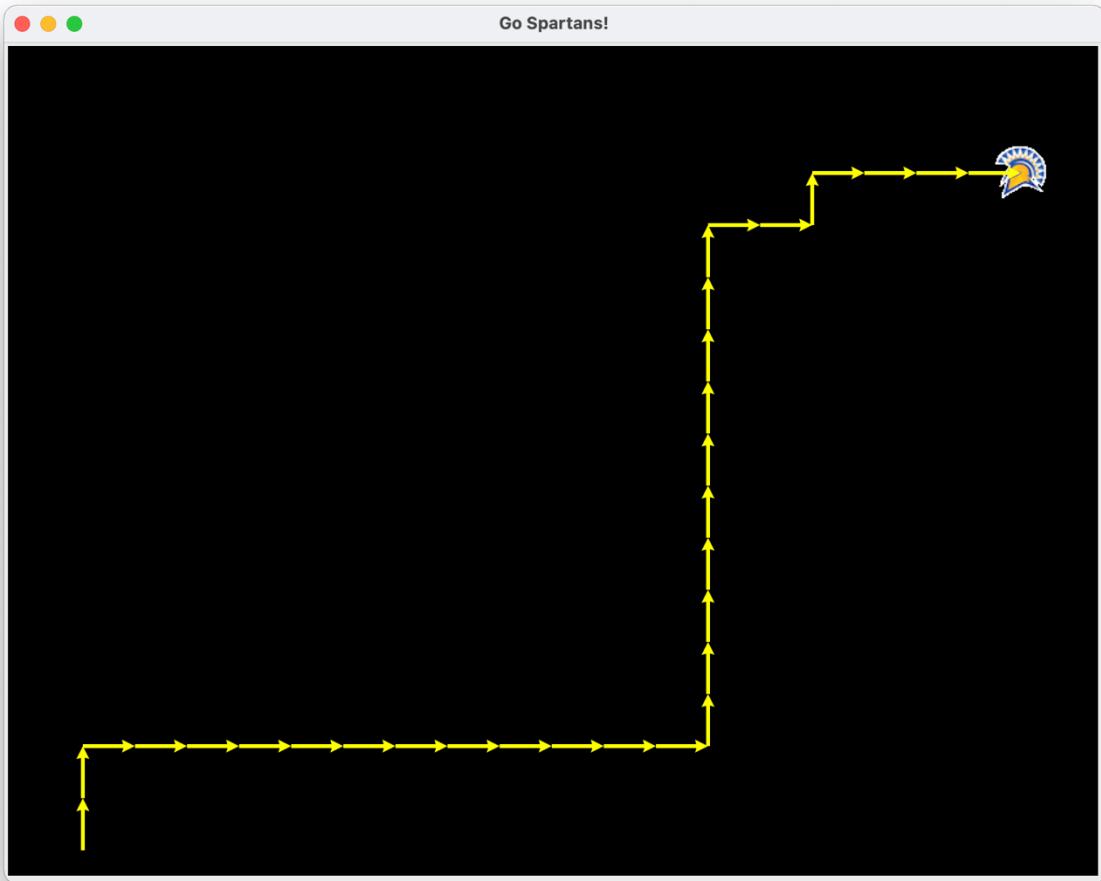
DFS:

```
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questD.txt dfs
Path length: 315
Carrots consumed: 2724
Number of nodes expanded: 758
Processing time: 0.0083 (sec)
[]
```



UCS:

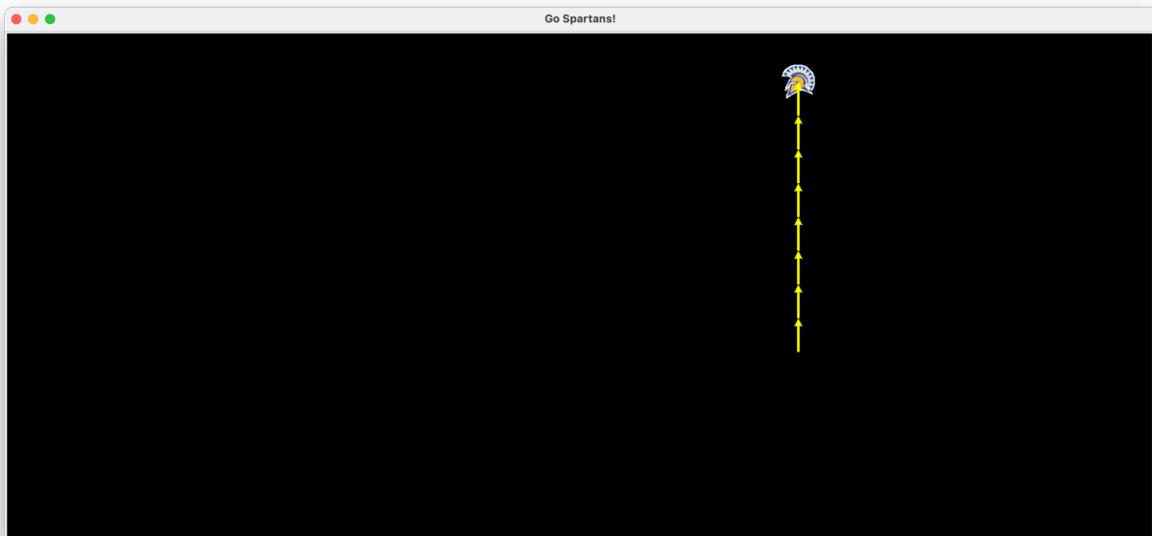
```
(base) T6s-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questD.txt ucs
Path length: 31
Carrots consumed: 452
Number of nodes expanded: 1275
Processing time: 0.0181 (sec)
```



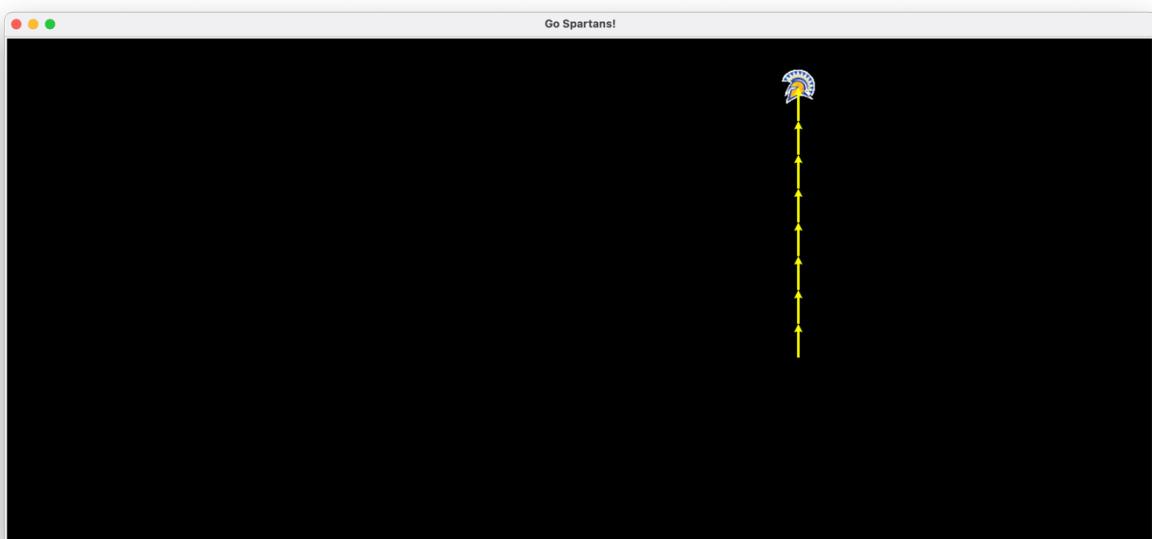
QUEST E:

```
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questE.txt bfs
Path length: 8
Carrots consumed: 112
Number of nodes expanded: 135
Processing time: 0.0016 (sec)
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questE.txt dfs
Path length: 8
Carrots consumed: 112
Number of nodes expanded: 8
Processing time: 0.0001 (sec)
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questE.txt ucs
Path length: 8
Carrots consumed: 112
Number of nodes expanded: 363
Processing time: 0.0057 (sec)
```

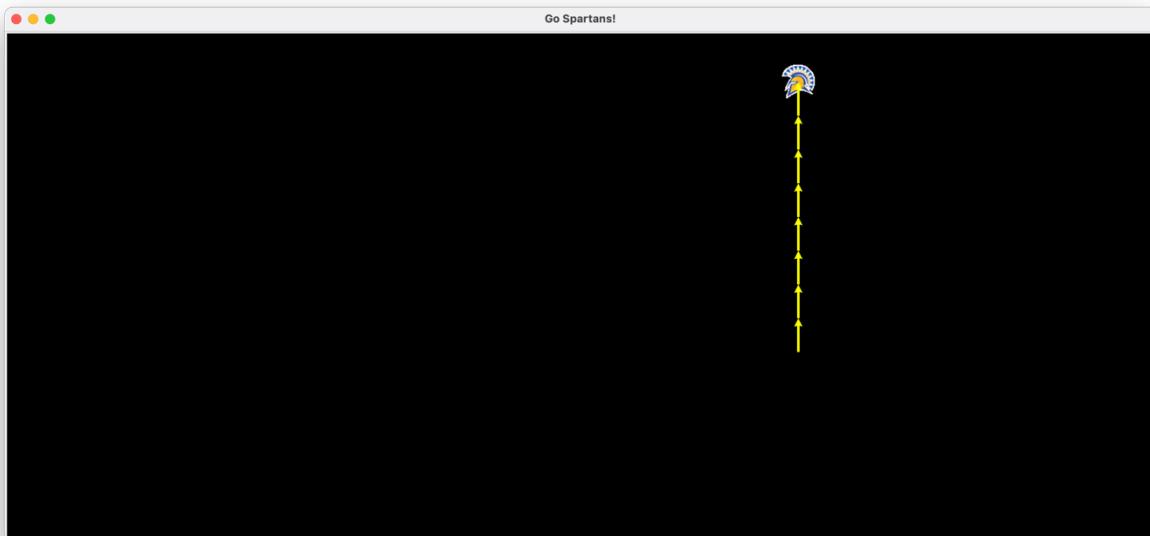
BFS:



DFS:



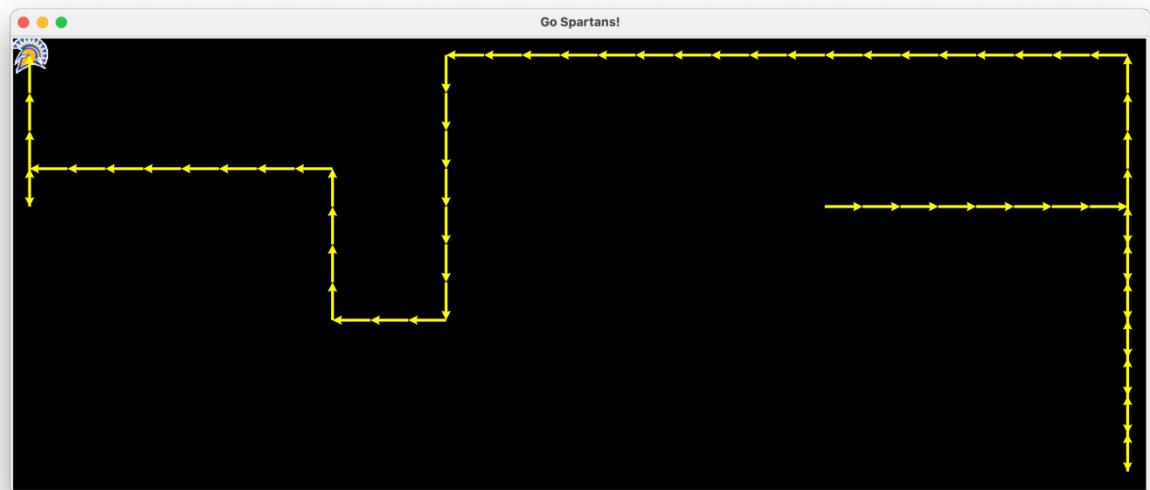
UCS:



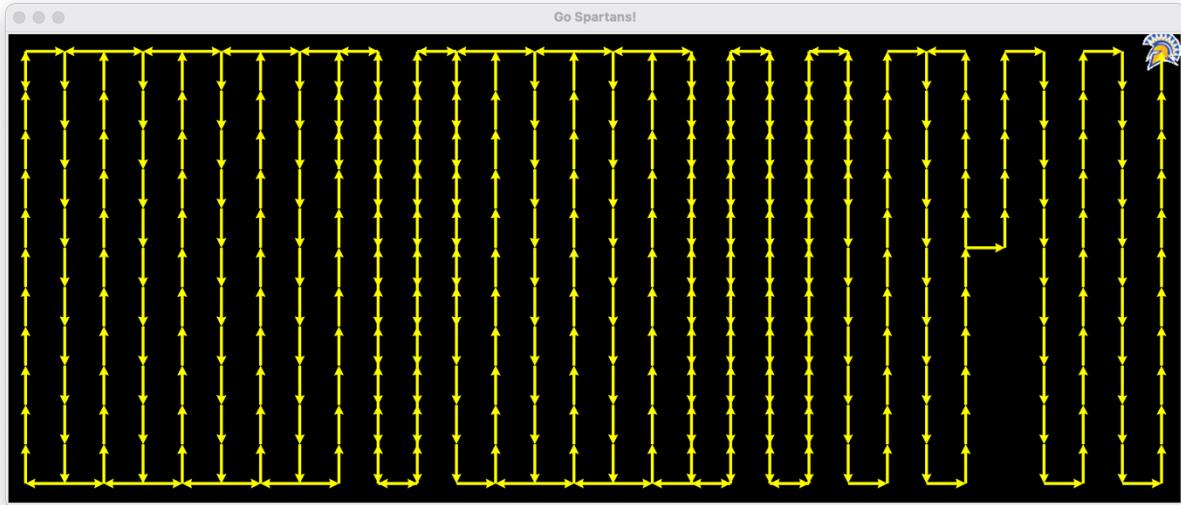
QUEST F:

```
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questF.txt ucs
Path length: 73
Carrots consumed: 437
Number of nodes expanded: 81689
Processing time: 2.2479 (sec)
^[[A(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questF.txt bfs
Path length: 71
Carrots consumed: 445
Number of nodes expanded: 120050
Processing time: 5.1255 (sec)
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questF.txt dfs
Path length: 628
Carrots consumed: 5104
Number of nodes expanded: 920
Processing time: 0.0121 (sec)
```

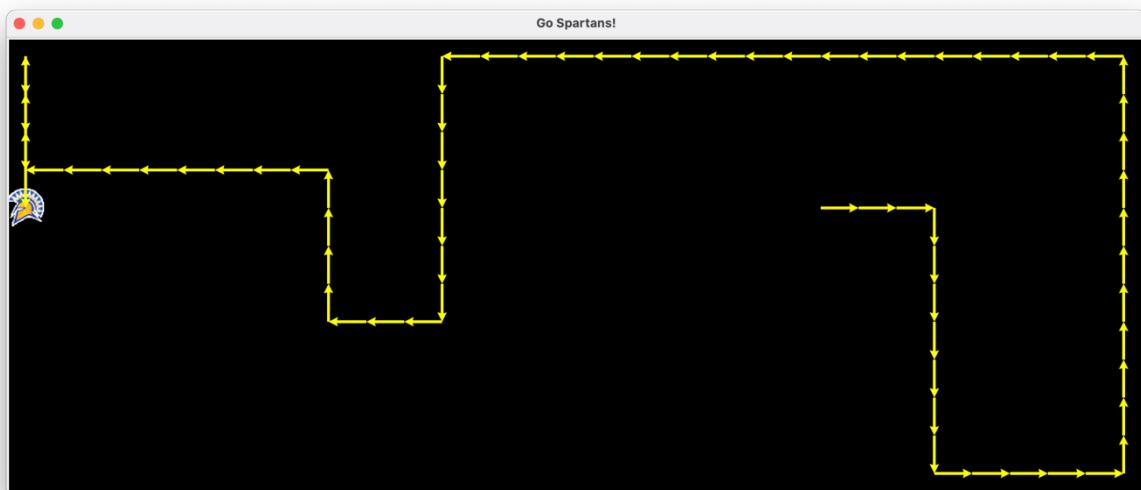
BFS:



DFS:



UCS:

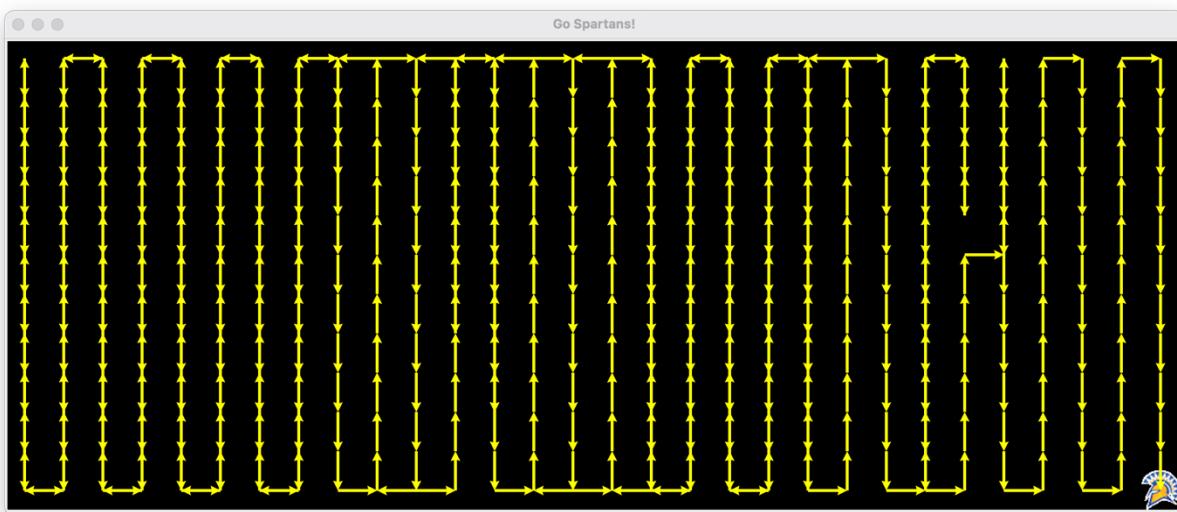


QUEST G:

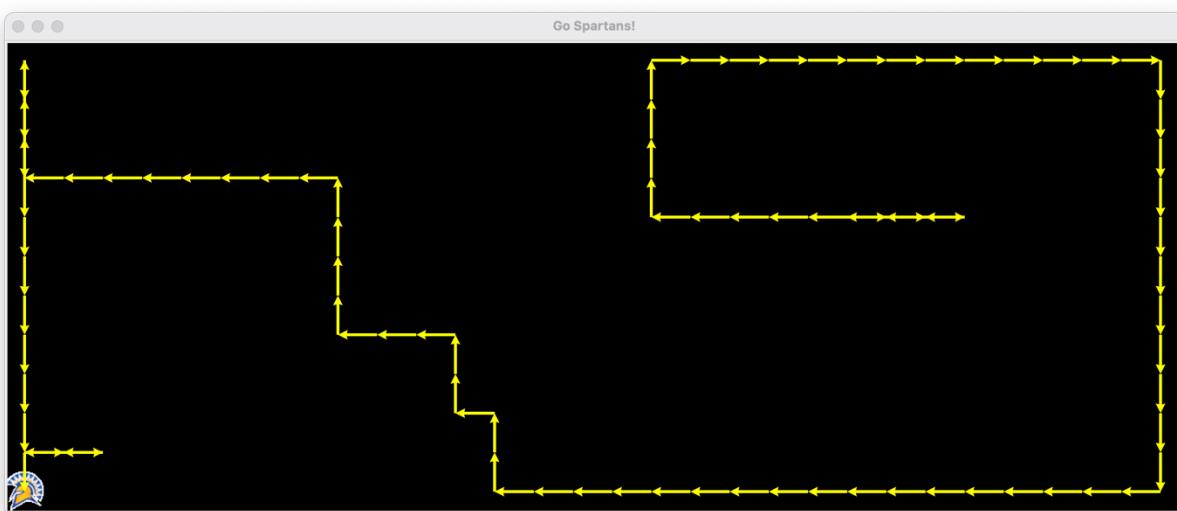
```
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questG.txt ucs
Path length:  94
Carrots consumed:  563
Number of nodes expanded:  2748632
Processing time: 195.2317 (sec)
```

BFS:

DFS:



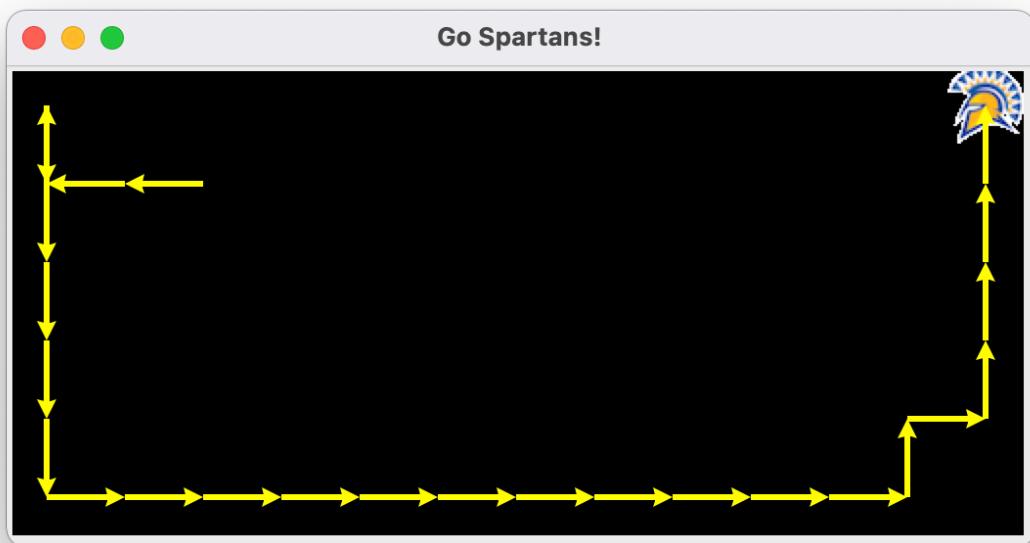
UCS:



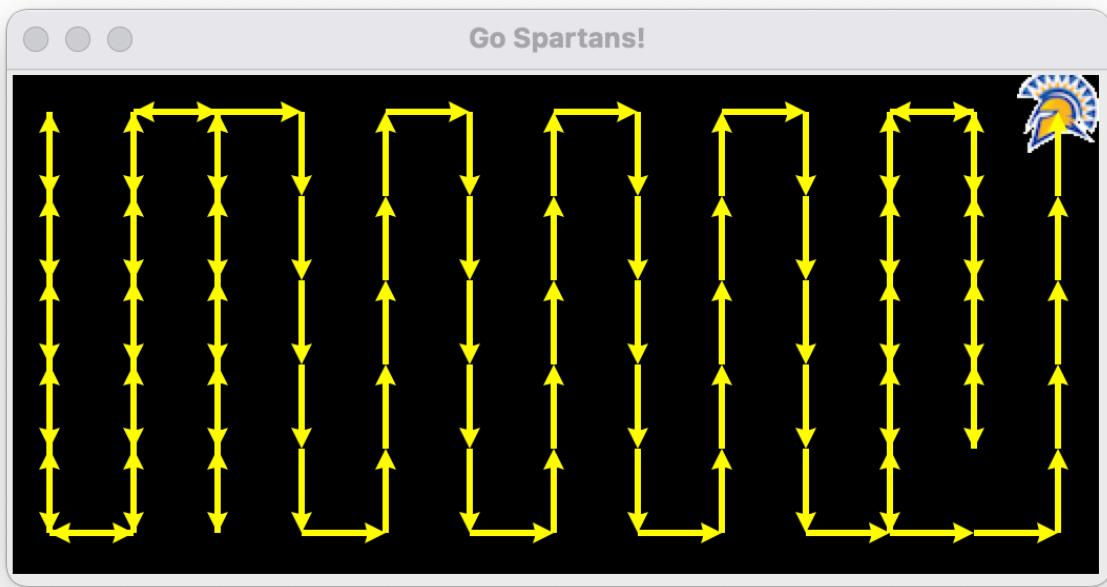
QUEST H:

```
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questH.txt bfs
Path length: 25
Carrots consumed: 276
Number of nodes expanded: 1233
Processing time: 0.0142 (sec)
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questH.txt ucs
Path length: 32
Carrots consumed: 218
Number of nodes expanded: 1186
Processing time: 0.0222 (sec)
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questH.txt dfs
Path length: 105
Carrots consumed: 916
Number of nodes expanded: 177
Processing time: 0.0027 (sec)
```

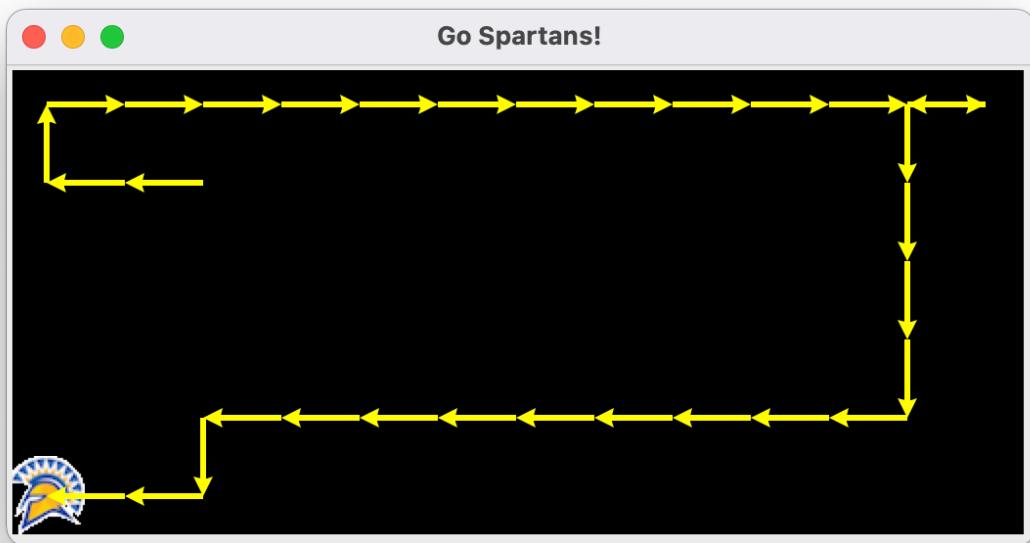
BFS:



DFS:



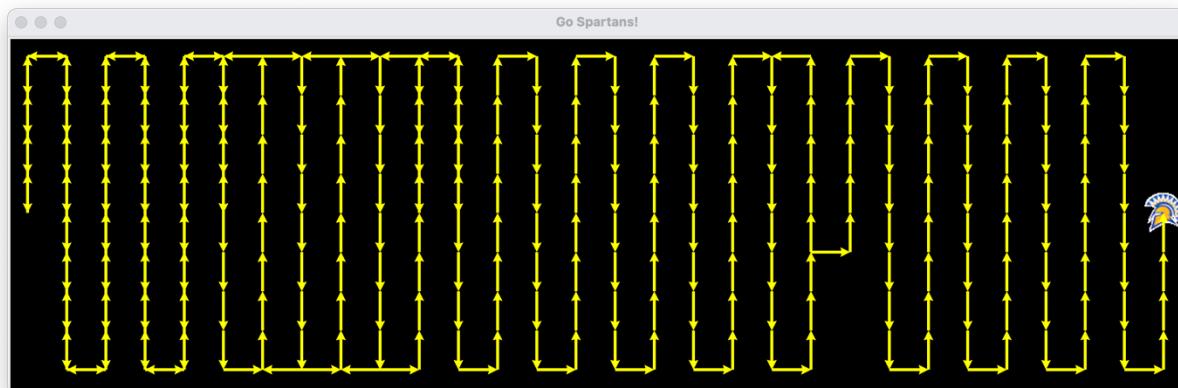
UCS:



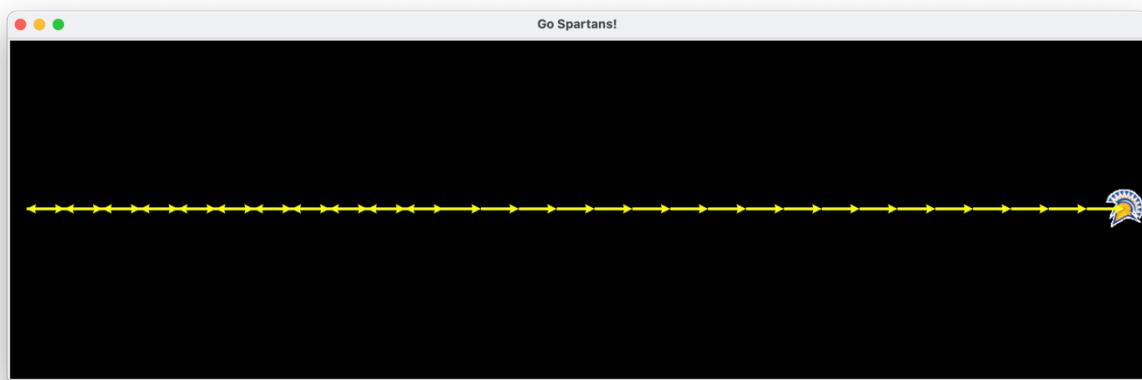
QUEST L:

```
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questL.txt dfs
Path length: 370
Carrots consumed: 3086
Number of nodes expanded: 548
Processing time: 0.0070 (sec)
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questL.txt bfs
Path length: 40
Carrots consumed: 446
Number of nodes expanded: 4441
Processing time: 0.0495 (sec)
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py questL.txt ucs
Path length: 47
Carrots consumed: 299
Number of nodes expanded: 3044
Processing time: 0.0442 (sec)
(base) TGs-MacBook-Pro:HW3 GiangDuong$
```

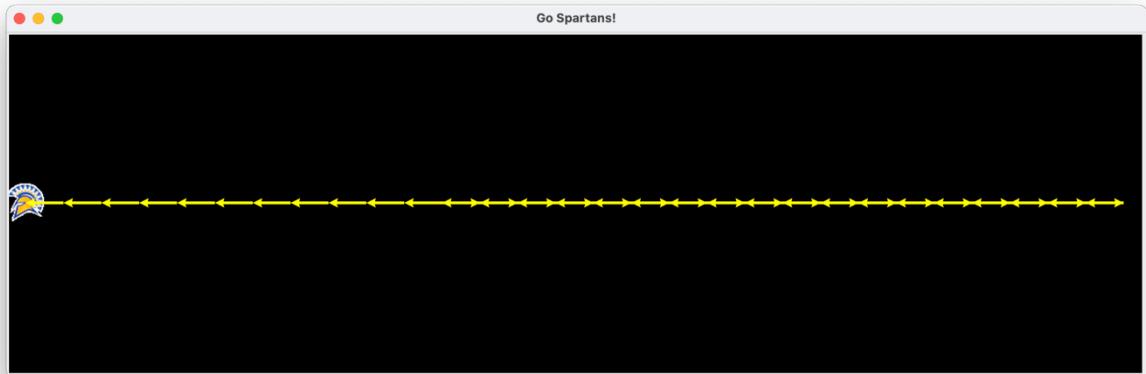
BFS:



DFS:



UCS:

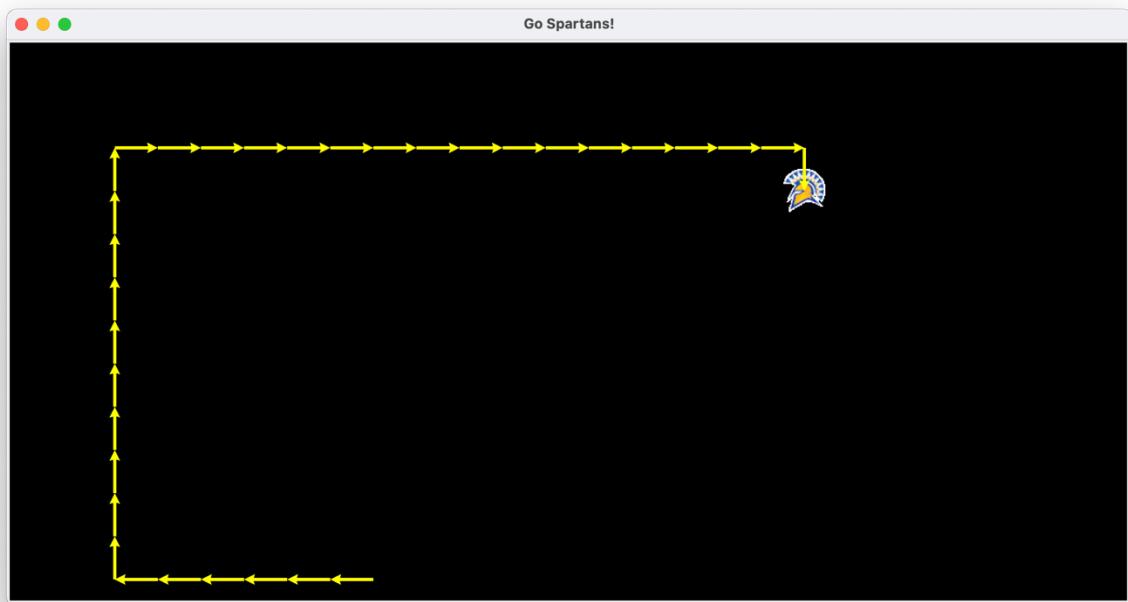


SJSU:

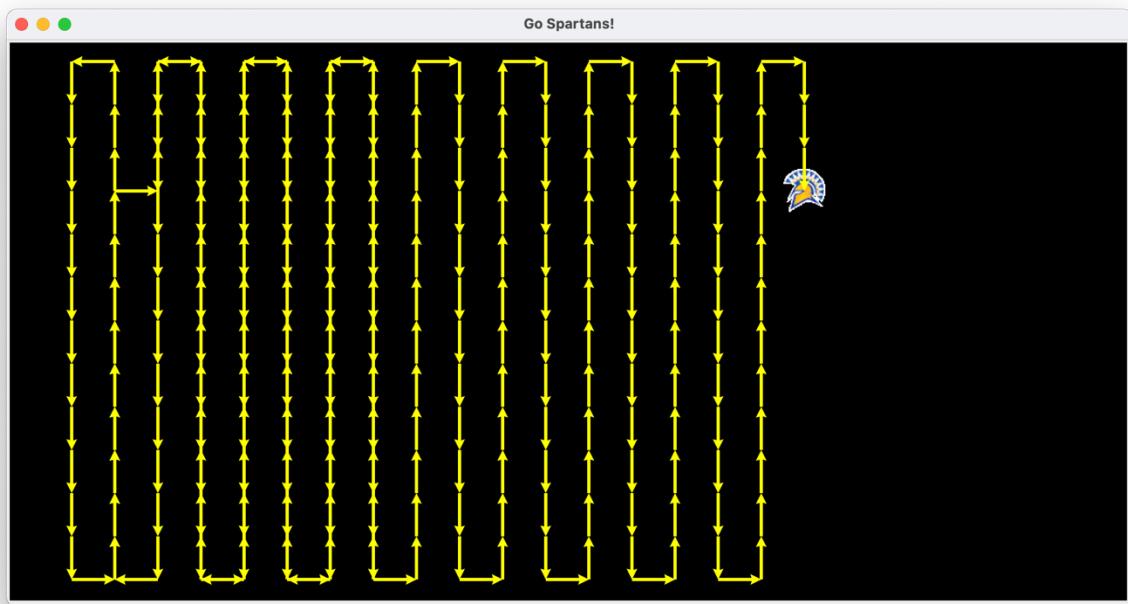
```
Processing time: 0.0442 (sec)
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py SJSU.txt ucs
Path length: 36
Carrots consumed: 306
Number of nodes expanded: 659
Processing time: 0.0092 (sec)

(base) TGs-MacBook-Pro:HW3 GiangDuong$
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py SJSU.txt bfs
Path length: 33
Carrots consumed: 388
Number of nodes expanded: 758
Processing time: 0.0088 (sec)
(base) TGs-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py SJSU.txt dfs
Path length: 303
Carrots consumed: 2548
Number of nodes expanded: 325
Processing time: 0.0034 (sec)
```

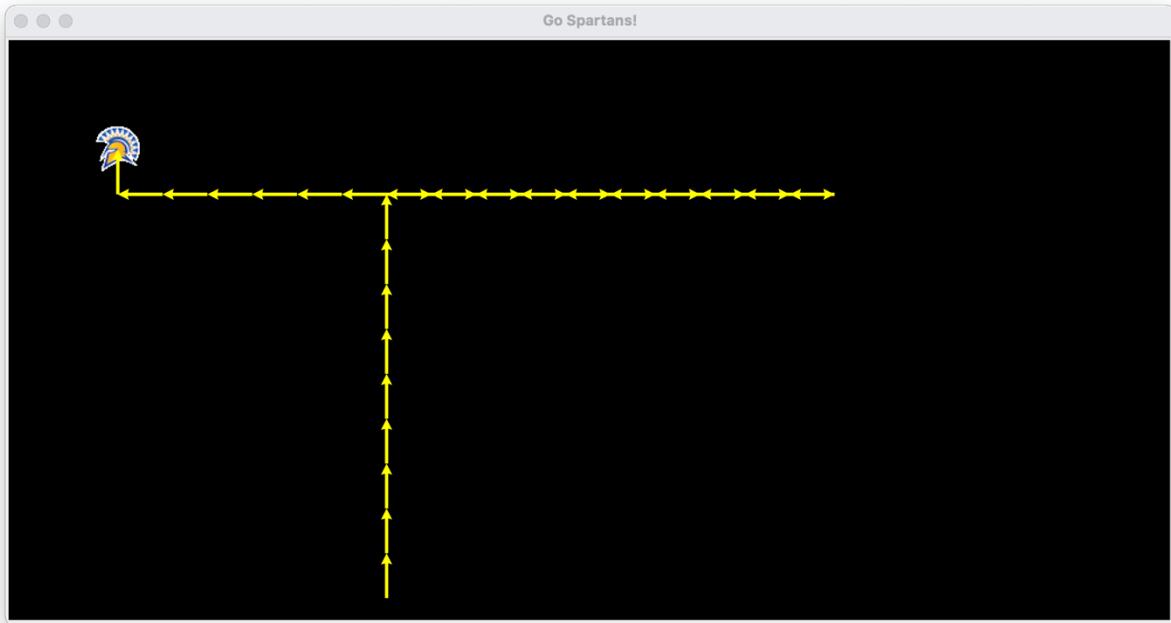
BFS:



DFS:



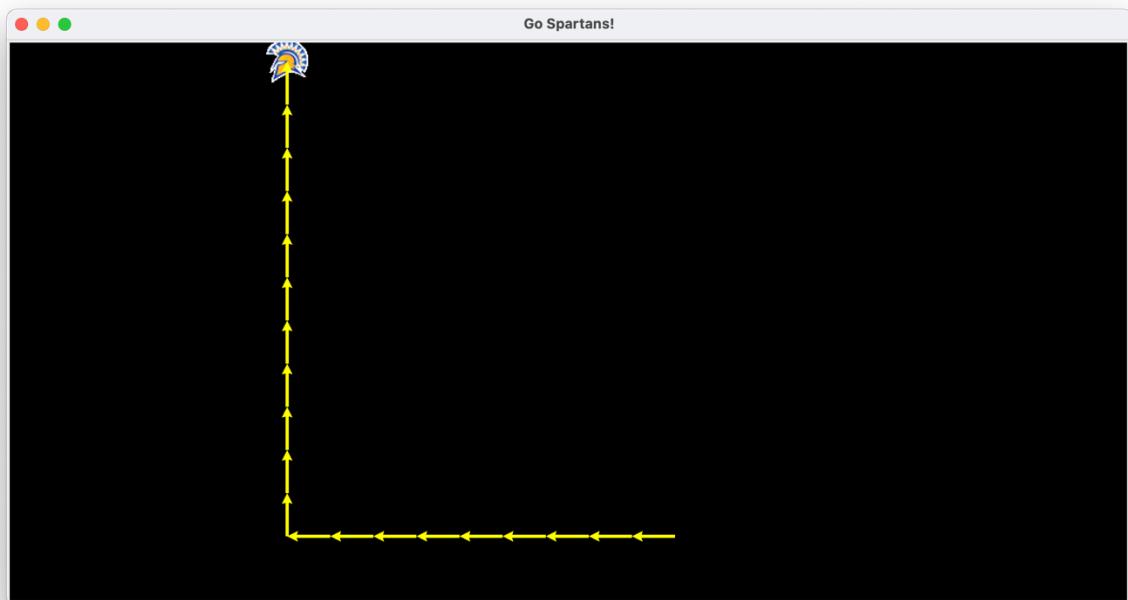
UCS:



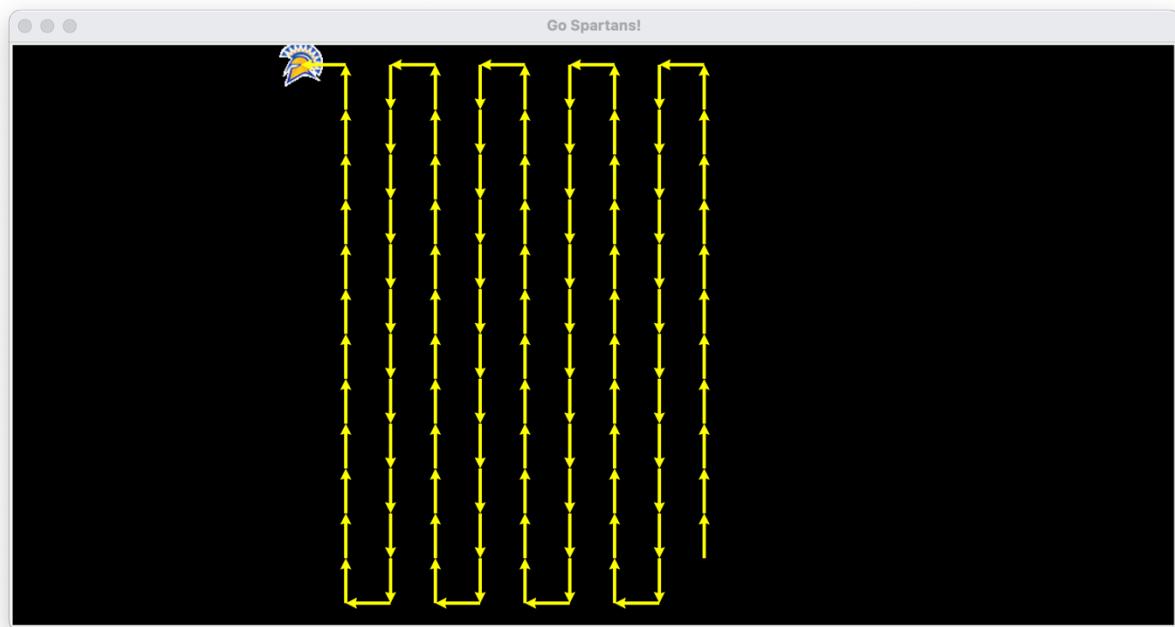
NOWAY:

```
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py noway.txt dfs
Path length: 116
Carrots consumed: 931
Number of nodes expanded: 116
Processing time: 0.0018 (sec)
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py noway.txt bfs
Path length: 20
Carrots consumed: 163
Number of nodes expanded: 315
Processing time: 0.0034 (sec)
(base) TGS-MacBook-Pro:HW3 GiangDuong$ python spartanquest.py noway.txt ucs
Path length: 20
Carrots consumed: 163
Number of nodes expanded: 275
Processing time: 0.0034 (sec)
```

BFS:



DFS:



UCS:

