

RECURSION & REFERENCES

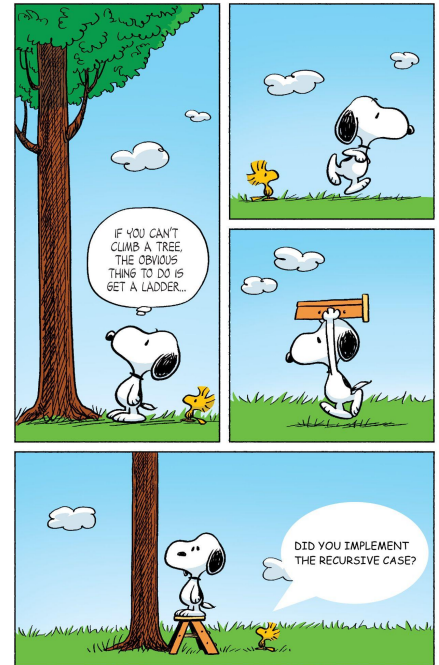
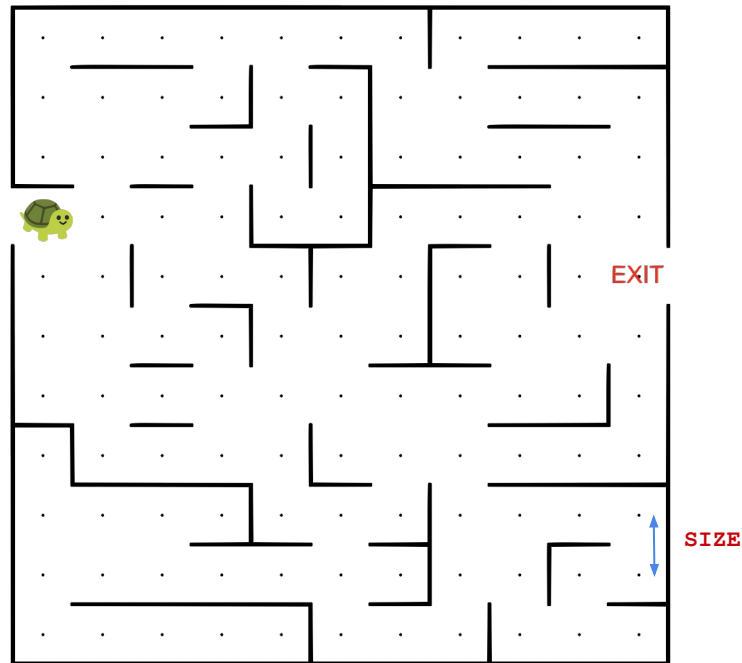
BeTheTurtle

(Full quiz credit for attempting each question)

Oh no! The **turtle** is stuck in a maze and only knows how to use recursion to get out. Use the **step** function to trace the path the **turtle** takes to exit the maze.

- **at_exit** returns **True** if the current position is the **EXIT**.
- **wall_at** returns **True** if there is a wall in the given direction relative to the current position.
- **visited** returns **True** if the neighboring cell in the given direction has already been visited (assume we are keeping track of this for each cell).

```
1 ANGLES = {'N':90, 'E':0, 'W': 180, 'S': 270}
2 def step():
3     if at_exit():
4         exit() # terminates the program
5     for d in ('N', 'E', 'W', 'S'):
6         if not wall_at(d) and not visited(d):
7             turtle.setheading(ANGLES[d])
8             turtle.forward(SIZE)
9             step()
10            turtle.setheading(ANGLES[d])
11            turtle.backward(SIZE)
```



BaseCase

If we replaced Line 4 with **return** (instead of **exit()**), the **turtle** would:

- ☐ Still stop at the maze exit.
- ☐ Visit every maze cell.
- ☐ Keep turning indefinitely.

See smaller maze on reverse to try this out.

WordSearch

recursion, base, mutable, reference, turtle, tree, level, memory, frame, docstring

```
F D O C S T R I N G
R I T C T U R T L E
A E R A G D Q R A M
M R E F E R E N C E
E H E Y U M K E P E
R R E C U R S I O N
M E M O R Y V Q J B
G F I T O O S O G A
E U R P L E V E L S
U O M U T A B L E E
```

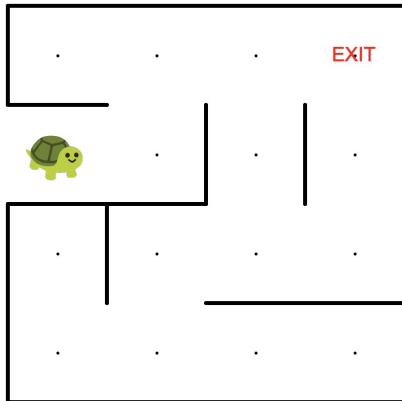
MutableJumble

```
1 a = ['k', 'm', 'p', 's', ['!', ' ', 'n'], 'd']
2 a.append(['t', 'e', 'q'])
3 b = a[:]
4 b[-1].sort()
5 a[4].append('r')
6 a[2] = 's'
7 (b[1], b[0]) = (b[0], b[1])
8 b.append('o')
```

A b[4][-2] a[5] w a[-1][0] b[4][-1] b[-2][0] b[-1] ff, li b[1] a[-1][0] a h b[-2][0] a[4][3] d of a[-1][-1] u b[4][3] b[-2][-1] l a[-1][0] a[2] b[4][0]

Evaluate the code on the left and then insert the characters labeled by the underlined list entries in the message below.

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Here is a smaller maze for the
BaseCase question.

TurtleChallenge (optional)

