

2. Write a **recursive function** that reverses a string (e.g. “Racecar” yields “racecaR”).

3. Perform a substitution trace on `reverse('Doge')`.

4. What does the following evaluate to?

```
1 def writeThatDown( n ):
2     if n < 5:
3         return n
4     return (2 * n)
5
6 def he( n ):
7     temp = n + 180
8     if temp > 185:
9         return temp
10    return n
11
12 def putstheFernback( n ):
13    return -n
14
15 n = 20
16 n = he(putstheFernback(writeThatDown( n ) ) )
17 print( n )
```

5. Define a function that takes an input string and rotates the sequence of letters in the string by n . For example: `shift_left("DEADBEEF", 3)` will produce the output string "DBEEFDEA".
`shift_left("Giant Robot", 4)` will produce "t RobotGian"
`shift_left("X", 5)` will produce "X"

You should be able to shift a string by a value greater than the length of the string¹.

Assume a function `len(str)` which returns the length of a string is provided.

- (a) Design: Give brief description on how your function should accomplish this.
- (b) Testing: Provide at least 3 test cases, using specific values for the input string and amount of shifting and what the expected output should be for each.
- (c) Implement the function in Python.
- (d) Implement the function `shift_right()`, which rotates letters in the opposite direction. Use `shift_left()` in your implementation².

¹The modulus (%) operator, which finds the remainder of a division operation, will be useful here.

²The behavior of % with negative numbers varies by language. In Python, it works like this: `7%2=1` and `-7%2=1`.

6. Write a function that takes in a file name, and returns the average size of a word in that file. Assume the files will only have 1 word per line, for example:

No
soup
for
you!

which has an average length of: 3.25

Assume a function `len(str)` which returns the length of a string is provided.

7. Write a function that takes in a string representation of a number and returns the sum of all of digits in the string. For example, `sum('11235')` returns 12.

Assume a function `len(str)` that returns the length of a string is provided.

Further, assume there is a function `int(str)` which, given a string representation of an integer, returns its integer value.

(a) Recursively.

(b) Iteratively

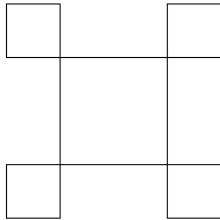
(c) How would you test this function?

8. Assuming the turtle is facing East, write the Python code to draw the following picture given the proper depth as input:

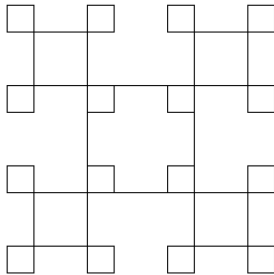
- depth = 0
No output
- depth = 1



- depth = 2



- depth = 3



9. Connor is a big dweeb and loves keeping a count of things. You will be writing a tail-recursive function to satisfy his desires.

Assume you are given the functions `strHead()` and `strTail()`, which run in constant time.

`strHead()` returns the first character in the string and `strTail()` returns the rest of the string.

- (a) Write a tail recursive function `coRec`, which takes a string and a character and returns the number of times the character appears in the string.

For example, `coRec("Eric is enjoying the weather.", "i")` should return 3.

Do not use the `len()` function.

- (b) What is the complexity of the functions you wrote for 9a?

10. Write a function which performs basic string compression, using the counts of repeated characters. For example, the string `abbccc4aaa` would be compressed to: `a1b3c4a3`.

Assume the function `len(str)`, which returns the length of a string, is provided.

Further, assume you may use `int(str)` and `str(int)`, which converts a string to its integer representation, and converts an integer to its string representation, respectively.

11. Although most in the industry will be reasonably forgiving when it comes to coding by hand, you should still be comfortable with the syntax of your language of choice.

(a) Identify and fix the line(s) that have invalid syntax in the following code:

If you are unsure about a specific line, just write a brief explanation of the error. Assume that incorrect lines do not affect the validity of other lines which may depend on them.

```
1 include math
2
3 int a = 0
4 b = 0
5
6 def function(arg):
7     return (arg + 2)
8
9 c = "hello"
10 sum = b + math.sqrt(c)
11 total = a + (b ** 0.5)
```

(b) Which of the following *are* keywords or standard functions in Python?

import	in	from	class	define	int	str	String
True	false	where	while	or	not	isinstance	new
print	range	float	char	bool	xor	sum	

12. Write a function that takes a filename as its parameter and prints all the last names from the given file. Each line of the file follows the format of a first name, a space, a last name, a space, and miscellaneous extra data.