

Problem Set 3, Problems 1 and 3

Problem 1: Tracing function calls

global variables

a	b	c	d
3	5	2	4
3	5	2	7

hello's local variables

a	b	c	d
3	5	2	4
3	5	7	4
3	5	7	6

goodbye's local variables

a	c	b
5	4	
5	4	7

adios's local variables

a	b	c	d
5	5	4	4
3	4	5	5

output (the lines printed by the program)

```
3 5 2 4
5 5 4 4
3 4 5 5
hello 3 5 7 6
3 5 2 7
```

Problem 3: Thinking recursively

3-1)

mystery(0, 9)

```
a = 0
b = 9
myst_rest = mystery(1, 7) = 15
return 24
```

mystery(1, 7)

```
a = 1
b = 7
myst_rest = mystery(2, 5) = 8
return 15
```

mystery(2, 5)

```
a = 2
b = 5
myst_rest = mystery(3, 3) = 3
return 8
```

mystery(3, 3)

```
a = 3
b = 3
return 3
```

3-2)

The value returned by mystery(0, 9) is:

24

3-3)

There is a total of 4 stack frames made when the base case is reached.

3-4)

To produce an infinite recursion with the function given for Problem Set 3, Problem 3, specific values such as $a = 0$ and $b = 10$ can be used. This produces an infinite loop. Why? That's because the program calls for 'a' to be added by 1 and 'b' to be subtracted by 2. As a result of this formula, the function will only yield an integer if and only if the difference between 'a' and 'b' is a multiple of three. That is why $a = 3$ and $b = 6$ works. $6 - 3 = 3$; $9 - 0 = 9$; etc. These are multiples of three, and will thus result in a finite recursion. However, if $a = 3$ and $b = 7$, the function will result in an infinite recursion loop because $7 - 3 = 4$, and 4 is not a multiple of 3.