

Programming Languages Homework Assignment 3

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ML Tail Recursion

The function is not tail recursive, because the recursive function call is not the last operation the function makes before returning. Addition is the last operation that is executed.

Trace

- Begin sum ([10,20,30])
 - 10 + sum ([20,30])
 - Begin sum ([20,30])
 - 20 + sum ([30])
 - Begin sum ([30])
 - 30 + sum ([])
 - Begin sum([])
 - sum([])
 - Returns 0
 - End sum([])
 - Returns 30 + 0 = 30
 - End sum([30])
 - Returns 20 + 30 = 50
 - End sum([20,30])
 - Returns 10 + 50 = 60
- End sum ([10,20,30])

More Tail Recursion

The gcd function, in Python:

```
def gcd(x, y):  
    while y > 0:  
        tmp = y  
        y = x % y  
        x = tmp  
    return x
```

Memory Allocation

1. First Fit

Start: 50, 20, 100, 50, 30, 60.
Allocate 20: 30, 20, 100, 50, 30, 60.
Allocate 20: 10, 20, 100, 50, 30, 60.
Allocate 30: 10, 20, 70, 50, 30, 60.
Allocate 50: 10, 20, 20, 50, 30, 60.
Allocate 50: 10, 20, 20, 30, 60.
Allocate 45: 10, 20, 20, 30, 15.

2. Best Fit

Start: 50, 20, 100, 50, 30, 60.
Allocate 20: 50, 100, 50, 30, 60.
Allocate 20: 50, 100, 50, 10, 60.
Allocate 30: 20, 100, 50, 10, 60.
Allocate 50: 20, 100, 10, 60.
Allocate 50: 20, 100, 10, 10.
Allocate 45: 20, 55, 10, 10.

3. Worst Fit

Start: 50, 20, 100, 50, 30, 60.
Allocate 20: 50, 20, 80, 50, 30, 60.
Allocate 20: 50, 20, 60, 50, 30, 60.
Allocate 30: 50, 20, 30, 50, 30, 60.
Allocate 50: 50, 20, 30, 50, 30, 10.
Allocate 50: 20, 30, 50, 30, 10.
Allocate 45: 20, 30, 5, 30, 10.

4. Addition 30 bytes allocated

All of the allocation strategies result in enough space for an addition 30 bytes.