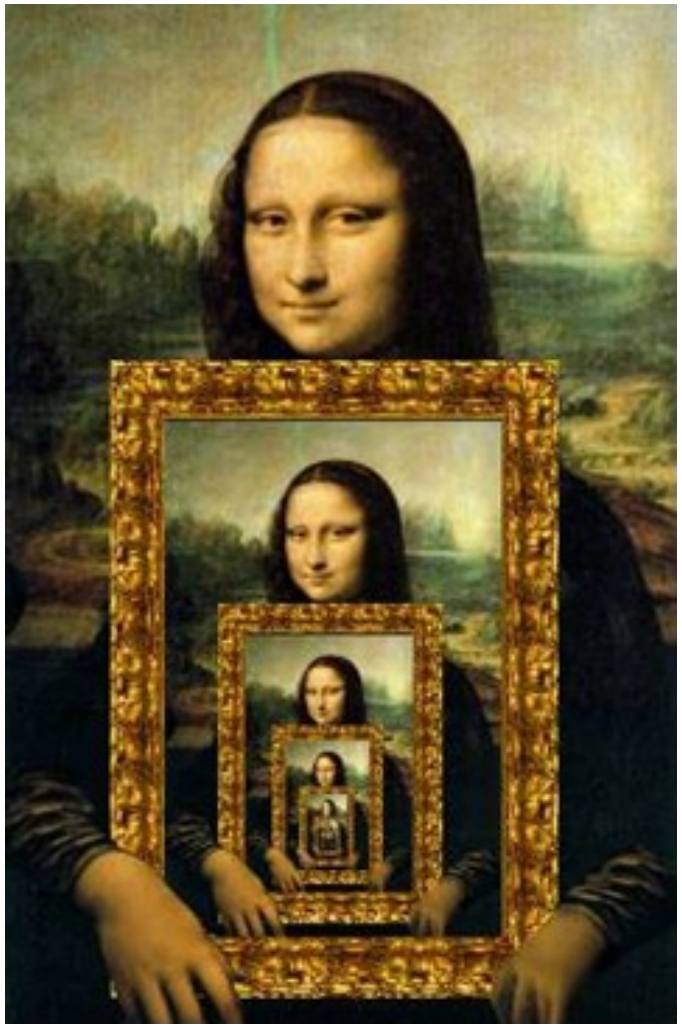
Lab6: Recursion

Yasin Zamani Dian-Lun Lin (Luan)
Department of Electrical and Computer Engineering
University of Utah, Salt Lake City, UT

Recursion



Problem

Sum the first **N** natural numbers

Input: 10

Output: 55 (1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10)

Solution

```cpp
/**
* Sum the first N natural numbers
*/

#include <iostream>

int sum_1_n(int n) {
  if (n == 0) return 0;

  return
    sum_1_n(n - 1) // sum of the first n-1 numbers
    + n; // add n
}

int main() {
  // define number
  int n;

  // read number
  std::cout << "Number: ";
  std::cin >> n;

  // print result
  std::cout
    << "Sum: "
    << sum_1_n(n) << '\n';
}
```

sum_1_n.cpp 11,48-50 All

```
> g++ sum_1_n.cpp
> ./a.out
Number: 10
Sum: 55
>
```

!/bin/bash [running] 1,1 Top

Problem

Sum of the **digits** of a natural number

Input: 1234

Output: 10 (1 + 2 + 3 + 4)

Solution

```cpp
/**
* Sum of the digits of a natural number
*/

#include <iostream>

int sum_digits(int n) {
  if (n == 0) return 0;

  return
    sum_digits(n / 10) // sum of the remaining digits
    + (n % 10); // add the last digit
}

int main() {
  // define number
  int n;

  // read number
  std::cout << "Number: ";
  std::cin >> n;

  // print result
  std::cout
    << "Sum of digits: "
    << sum_digits(n) << '\n';
}
```

sum_digits.cpp 2,30 All

```
> g++ sum_digits.cpp
> ./a.out
Number: 1234
Sum of digits: 10
>
```

!/bin/bash [running] 1,1 Top

Problem

Number of **3**s as the **last** digit,
in the first **N** natural numbers

Input: 33

Output: 4 (3, 13, 23, 33)

Solution

```cpp
/**
* Number of 3s as last digit in first N natural numbers
*/

#include <iostream>

int number_3_last(int n) {
  ?
}

int main() {
  // define number
  int n;

  // read number
  std::cout << "Number: ";
  std::cin >> n;

  // print result
  std::cout
    << "Number of 3s as last digit: "
    << number_3_last(n) << '\n';
}
```

```
> g++ number_3_last.cpp
> ./a.out
Number: 33
Number of 3s as last digit: 4
>
```