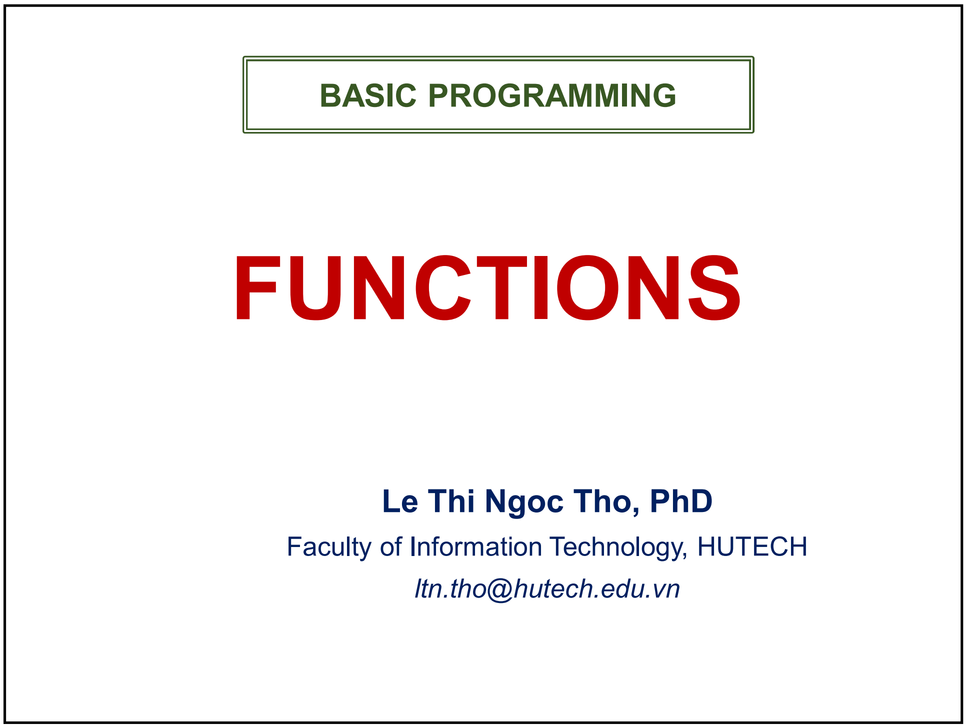

BASIC PROGRAMMING

FUNCTIONS

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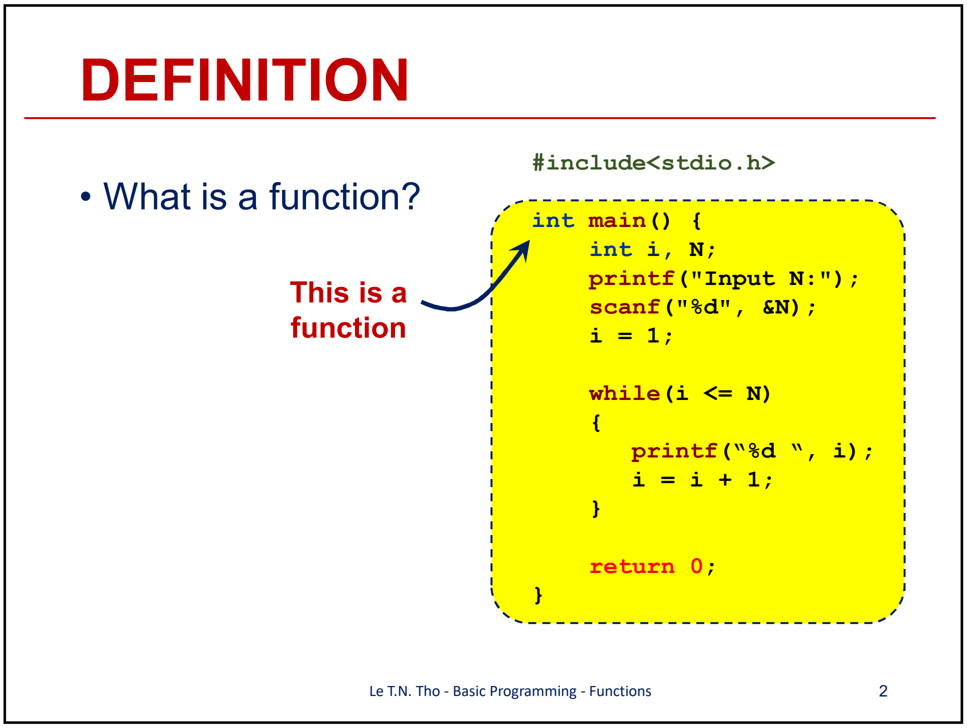


DEFINITION

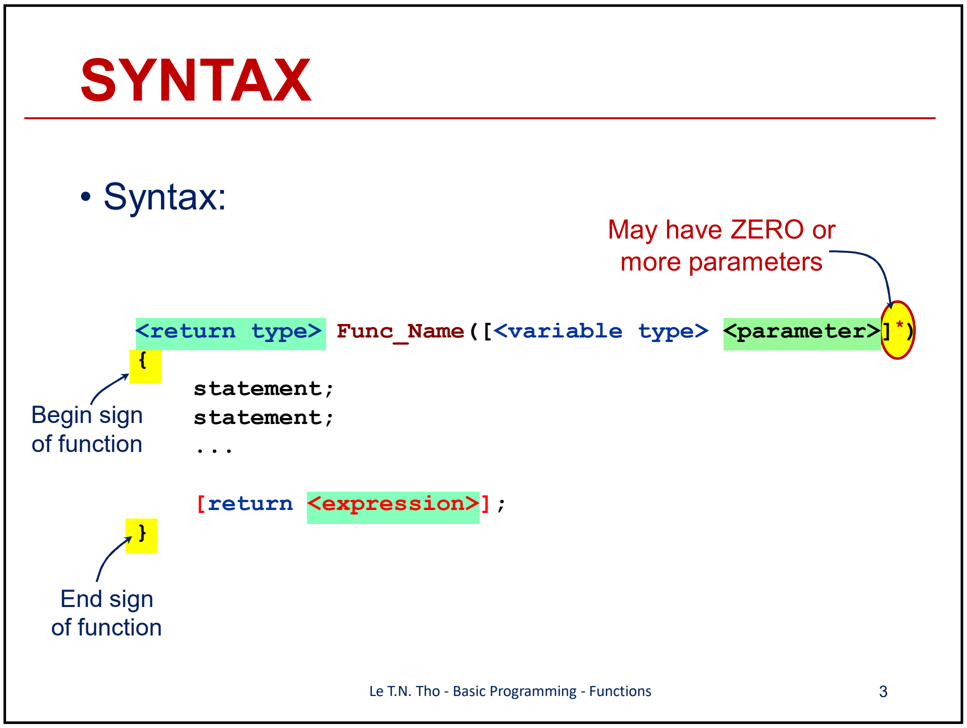
- What is a function?

This is a function

```
#include<stdio.h>
int main() {
    int i, N;
    printf("Input N:");
    scanf("%d", &N);
    i = 1;

    while(i <= N)
    {
       printf(“%d “, i);
       i = i + 1;
    }

    return 0;
}
```



SYNTAX

- Syntax:

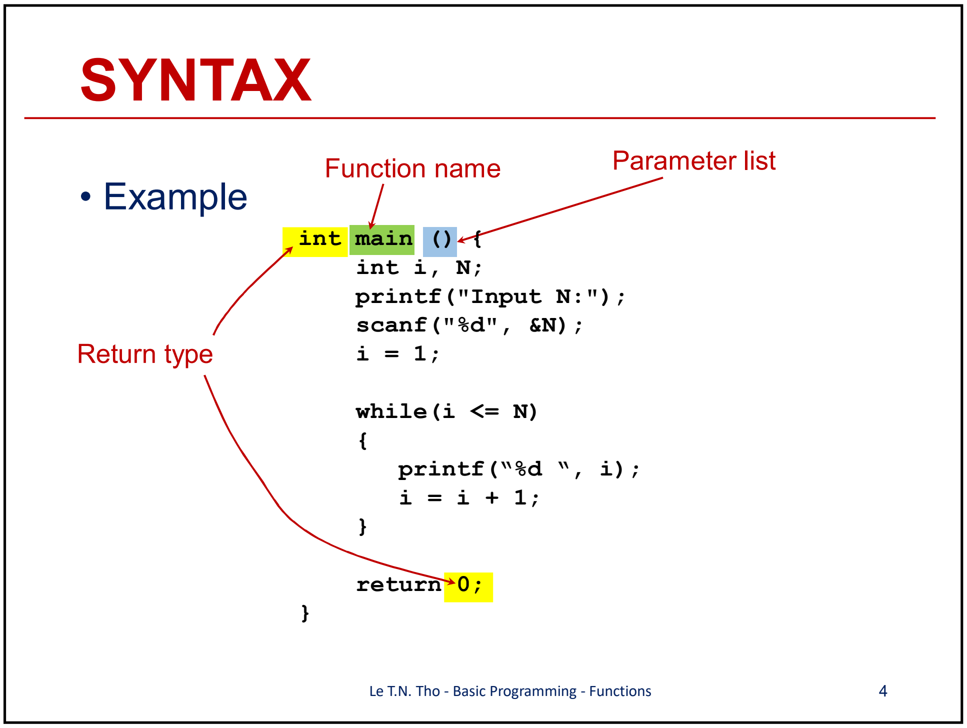
May have ZERO or more parameters

```
<return type> Func_Name([<variable type> <parameter>]*)
{
        statement;
        statement;
        ...

        [return <expression>];
}
```

Begin sign of function

End sign of function



SYNTAX

- Example

Function name

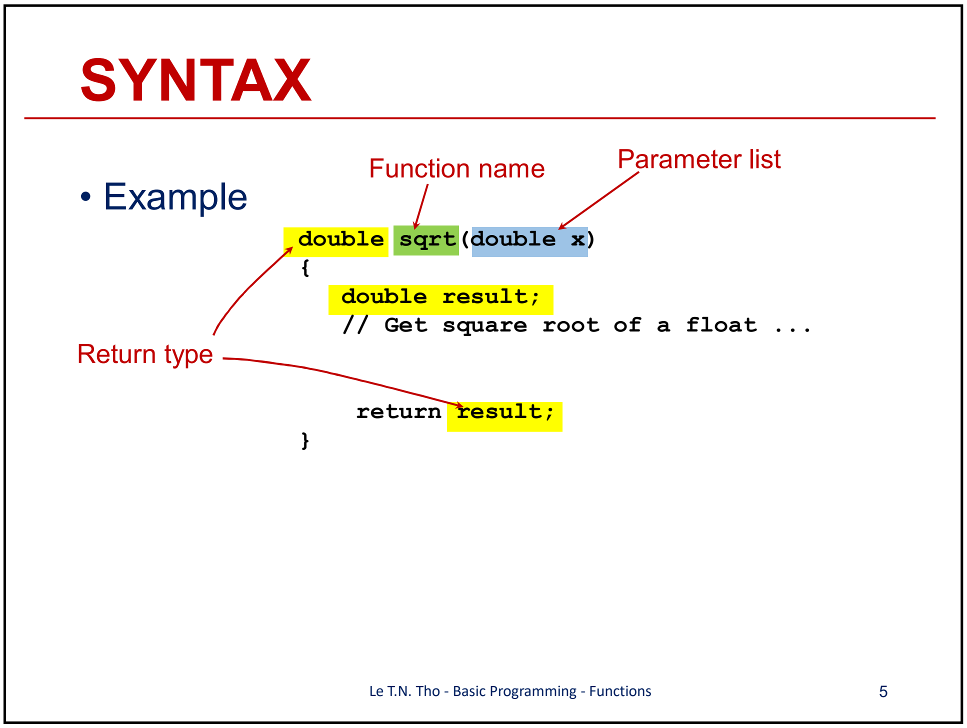
Parameter list

Return type

```
int main () {
    int i, N;
    printf("Input N:");
    scanf("%d", &N);
    i = 1;

    while(i <= N)
    {
       printf(“%d “, i);
       i = i + 1;
    }

    return 0;
}
```

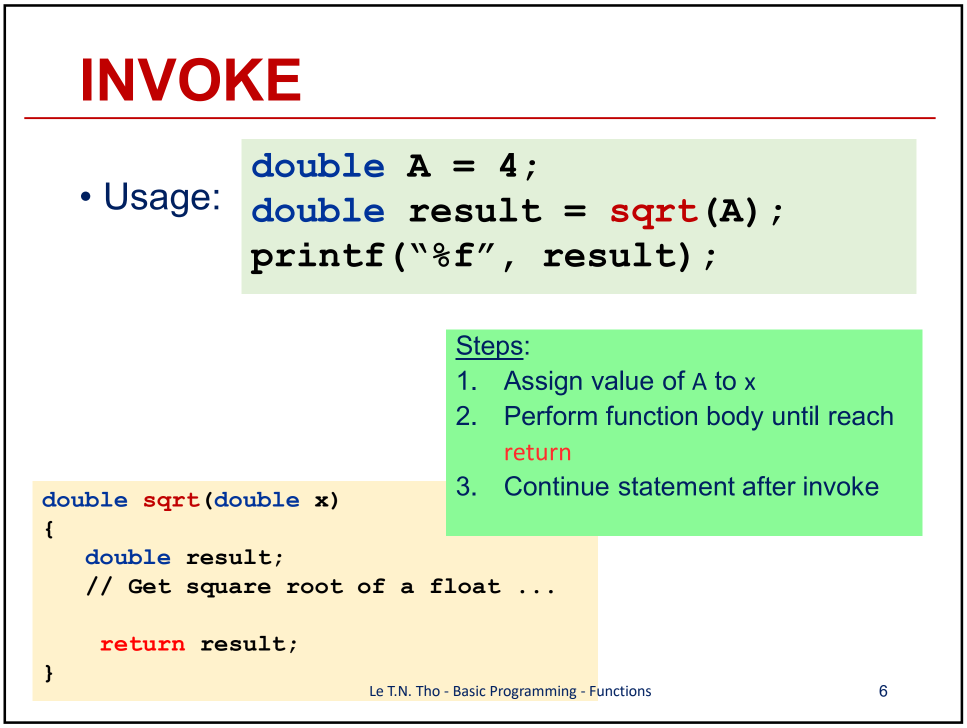


SYNTAX

- Example

```
double sqrt(double x)
{
   double result;
   // Get square root of a float ...

    return result;
}
```



INVOKE

- Usage:

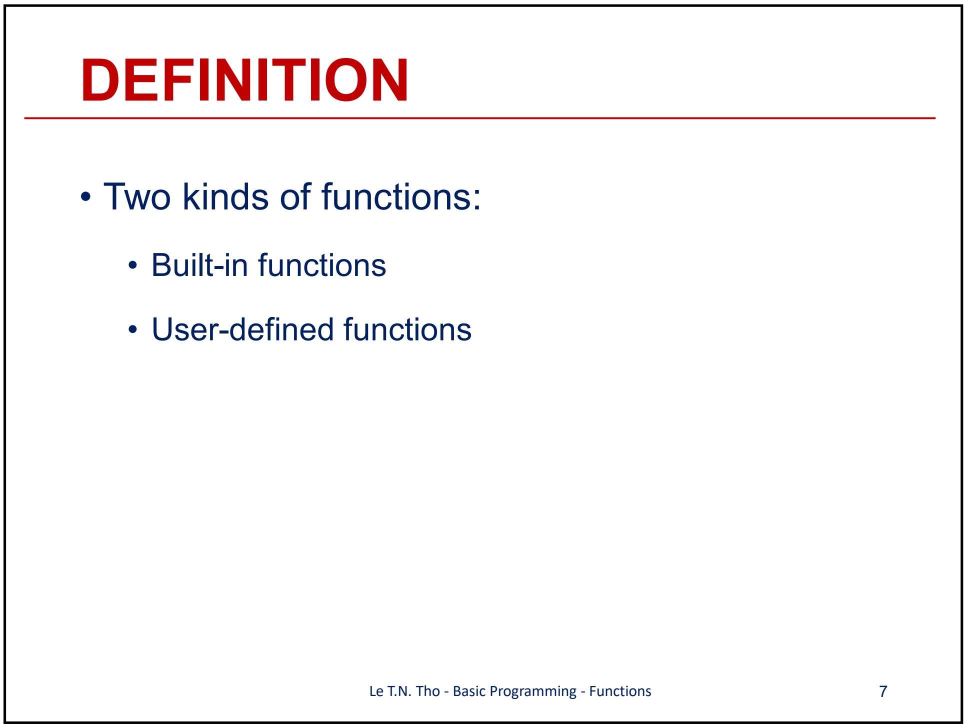
```
double A = 4;
double result = sqrt(A);
printf(“%f”, result);
```

Steps:

1. Assign value of A to x
2. Perform function body until reach return
3. Continue statement after invoke

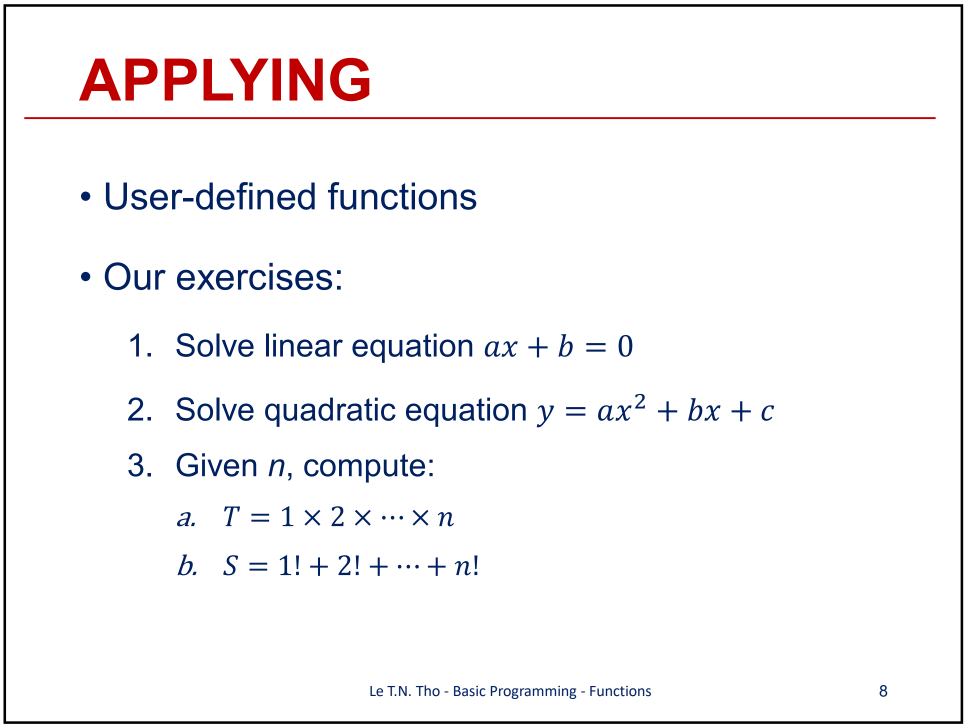
```
double sqrt(double x)
{
   double result;
   // Get square root of a float ...

    return result;
}
```



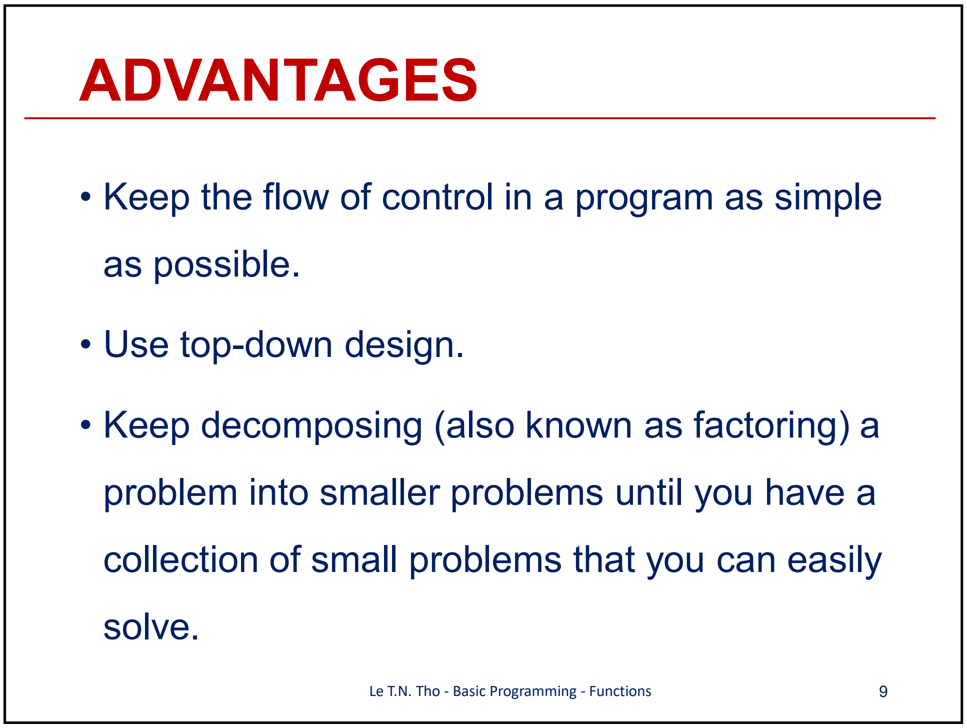
DEFINITION

- Two kinds of functions:
  - Built-in functions
  - User-defined functions



APPLYING

- User-defined functions
- Our exercises:
  1. Solve linear equation $ax + b = 0$
  2. Solve quadratic equation $y = ax^2 + bx + c$
  3. Given n, compute:
     a. $T = 1 \times 2 \times \cdots \times n$
     b. $S = 1! + 2! + \cdots + n!$



ADVANTAGES

- Keep the flow of control in a program as simple as possible.
- Use top-down design.
- Keep decomposing (also known as factoring) a problem into smaller problems until you have a collection of small problems that you can easily solve.

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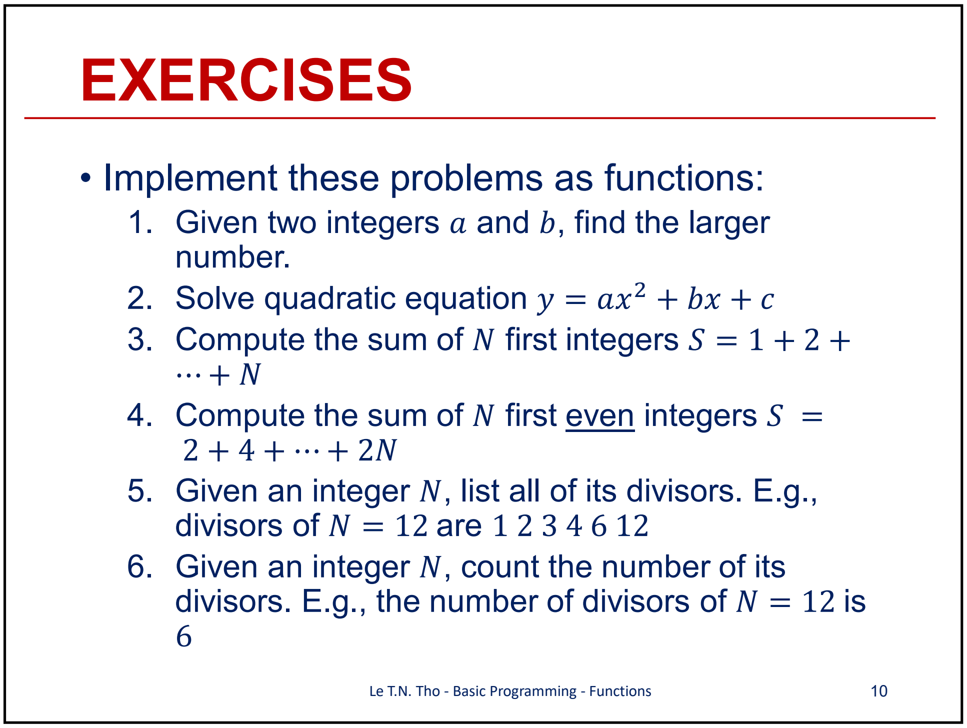

EXERCISES

- Implement these problems as functions:
  1. Given two integers a and b, find the larger number.
  2. Solve quadratic equation $y = ax^2 + bx + c$
  3. Compute the sum of N first integers $S = 1 + 2 + \cdots + N$
  4. Compute the sum of N first <u>even</u> integers $S = 2 + 4 + \cdots + 2N$
  5. Given an integer N, list all of its divisors. E.g., divisors of $N = 12$ are $1\ 2\ 3\ 4\ 6\ 12$
  6. Given an integer N, count the number of its divisors. E.g., the number of divisors of $N = 12$ is 6

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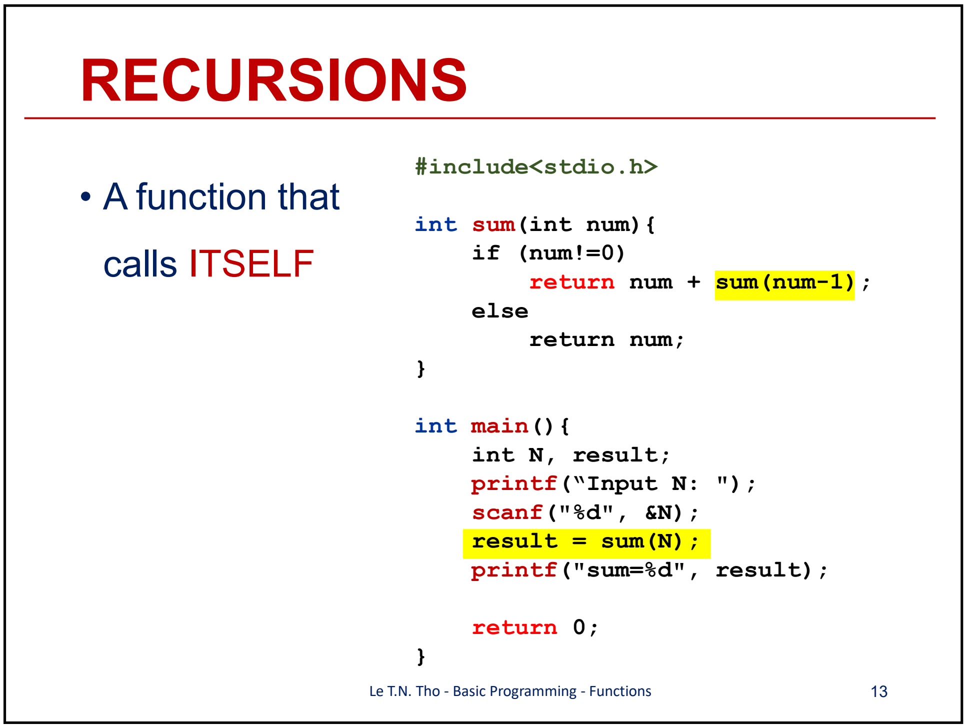
EXERCISES

- Implement these problems as functions:
  7. Given an integer N, sum up all its divisors. E.g., sum of all divisors of $N = 12$ is 28
  8. Given an integer N, e.g., $N = 128$
     a) How many digits in N? E.g., 3
     b) What is its last digit? E.g., 8
     c) What is its first digit? E.g., 1
     d) Compute the sum of all digits in N. E.g., $\text{sum} = 11$
     e) Find the integer which is the reverse of N. E.g., 821

EXERCISES

- Implement these problems as functions:
  9. Check if a given integer N is a prime number.
  10. Given integer n, compute:
      a. $S = 1^2 + 2^2 + \cdots + n^2$
      b. $S = 1 + \frac{1}{2} + \cdots + \frac{1}{n}$
      c. $S = \frac{1}{2} + \frac{2}{3} + \cdots + \frac{n}{n+1}$
      d. $T = 1 \times 2 \times \cdots \times n$
      e. $S = 1! + 2! + \cdots + n!$



RECURSIONS

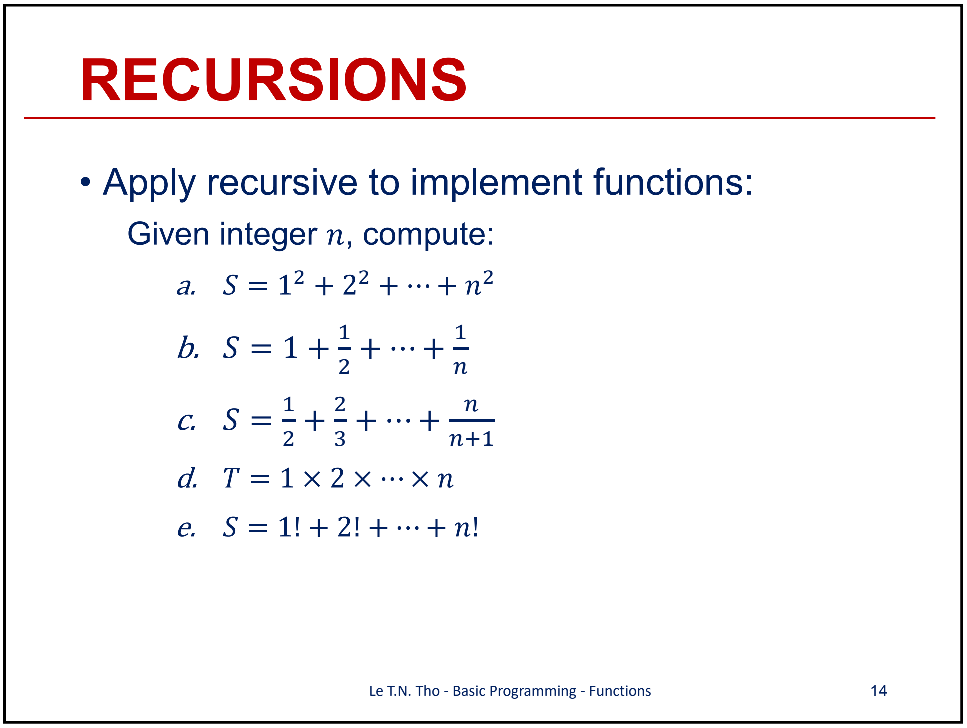
- A function that calls ITSELF

```
#include<stdio.h>

int sum(int num){
    if (num!=0)
        return num + sum(num-1);
    else
        return num;
}

int main(){
    int N, result;
    printf(“Input N: ");
    scanf("%d", &N);
    result = sum(N);
    printf("sum=%d", result);

    return 0;
}
```



RECURSIONS

- Apply recursive to implement functions:

  Given integer n, compute:

  a. $S = 1^2 + 2^2 + \cdots + n^2$

  b. $S = 1 + \frac{1}{2} + \cdots + \frac{1}{n}$

  c. $S = \frac{1}{2} + \frac{2}{3} + \cdots + \frac{n}{n+1}$

  d. $T = 1 \times 2 \times \cdots \times n$

  e. $S = 1! + 2! + \cdots + n!$

Any Questions?

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