CS1100 – Introduction to Programming

Trimester 3, April – June 2021

Instructor:

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Lecture 19

CS1100 – Introduction to Programming

- Programming : From Turtle to C.
- Data Types in C, Operators. Input and the Output.
- Modifying the control flow in Programs `if-else`, `switch`, loops : `while`, `do-while`, `for`.
- Implementing numerical methods using a C-program.
- `Arrays` and `Strings` in C.

} So Far

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- `functions` in C.
- Blocks and Scope

} Coming Up...

Character grids

- Given a character grid, and a string s, print the indices of the rows and columns of grid that contain s.

---

c	a	t	t	y
c	c	s	e	p
e	s	c	e	l
s	e	e	s	e
h	a	p	s	a

- Which rows and columns contain cse?

- Assume a code `find(x,y)` - that returns the index of `y` in `x`. write a code for `find` now.

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- Which rows and columns contain cse?

- Assume a code `find(x,y)` - that returns the index of `y` in `x`. write a code for `find` now.
- For each row R, find(R, s).
- For each column C, find(C, s).

Character grids

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Pseudo-code:

- For each row R of grid
  - If (find(R, s)) print(index of R).
- gridT = transpose(grid).
- For each row R of gridT
  - If (find(R, s)) print(index of R).

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functions : concept of writing the programs for `find`, transpose etc seperately and using them in the main program.

Can we define our own "commands"?

- We already know of commands like :
  - `sqrt(x)` evaluates to the square root of `x`.
  - `pow(x,k)` returns the value of `x` multiplied by itself value of `k` many times.
  - `forward(d)` moves the turtle forward `d` units.

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- Can we define new commands? e.g.
  - `gcd(m,n)` should evaluate to the GCD of `m,n`.
  - `dash(d)` should move the turtle forward, but draw dashes as it moves rather than a continuous line.

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  - `dash(d)` should move the turtle forward, but draw dashes as it moves rather than a continuous line.
- **functions** - official name for such commands, implemented seperately.

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- Giving a job to `functions` $\equiv$ outsourcing.

functions in C

```
#include <stdio.h>

int main()
{
    int var1 = 10;
    int var2 = 20;
    int var3,var4;
    var3 = FindSum(var1,var2);
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    printf("%d", var3);
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    return 0;
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- Before using the function - the compiler needs to be told about the function.
- How to tell them?

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```

What happens when you compile this program?

- Before using the function - the compiler needs to be told about the function.
- How to tell them? Declare functions.
- Only `name`, return `type`, number of arguments and their `type` need to be told initially. This is called the **prototype** of a function.

Completing the example

```
#include "stdio.h"
int FindSum(int, int);

int main()
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}

int FindSum(int a, int b)
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     int c=a+b;
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```

Prototype of a function:

- Name of the function
- Arguments and their types.
- Return type.

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- Name of the function
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Defintion of the function:

- Return type
- Function name
- Names of arguments and their types
- Body of the function
- Local variables
- Return statement

Prototype can be replaced by definition

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int FindSum(int a, int b)
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```

Prototype : Not provided.

Defintion of the function:

- Return type
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Extra Example: Anatomy of a function definition

Function `myMultipleFunction` returns the result of multiplication of integers.

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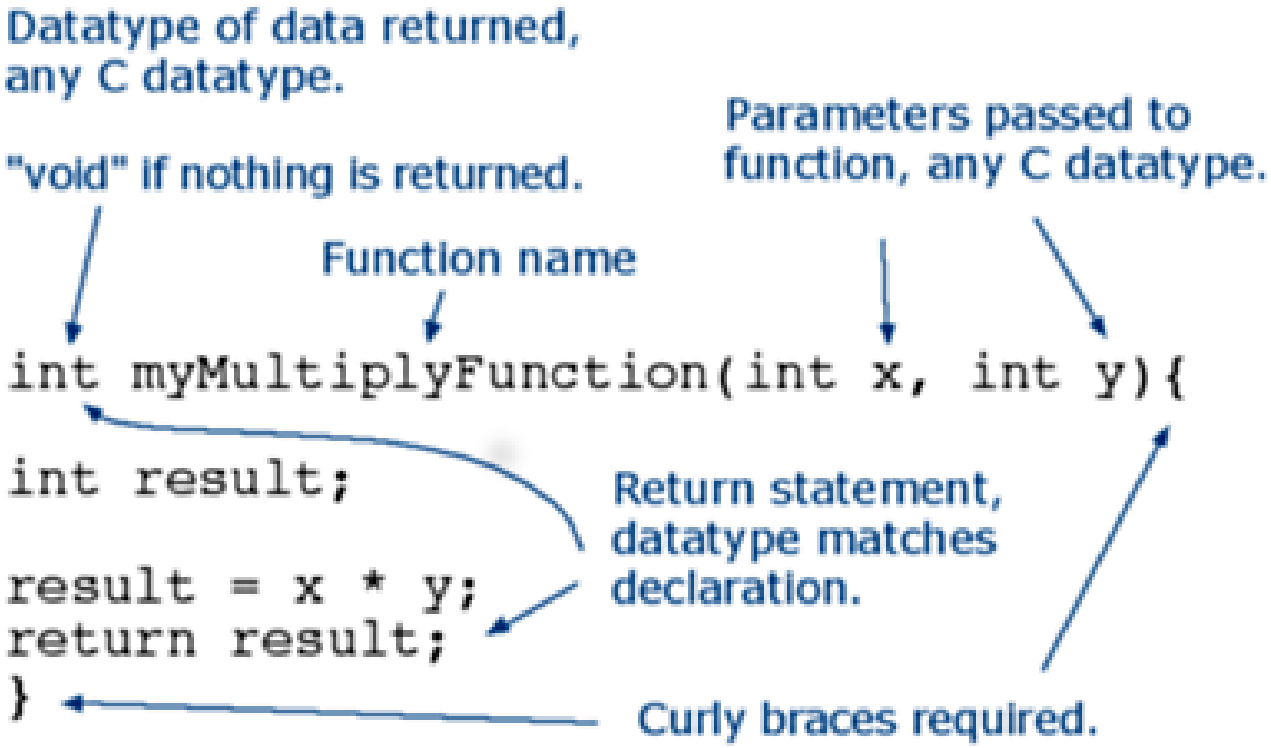

Extra Example : Anatomy of a function definition

Function `getAreaOfSquare` returns the area of a square in cm^2 whose side is of length `side` in cm.

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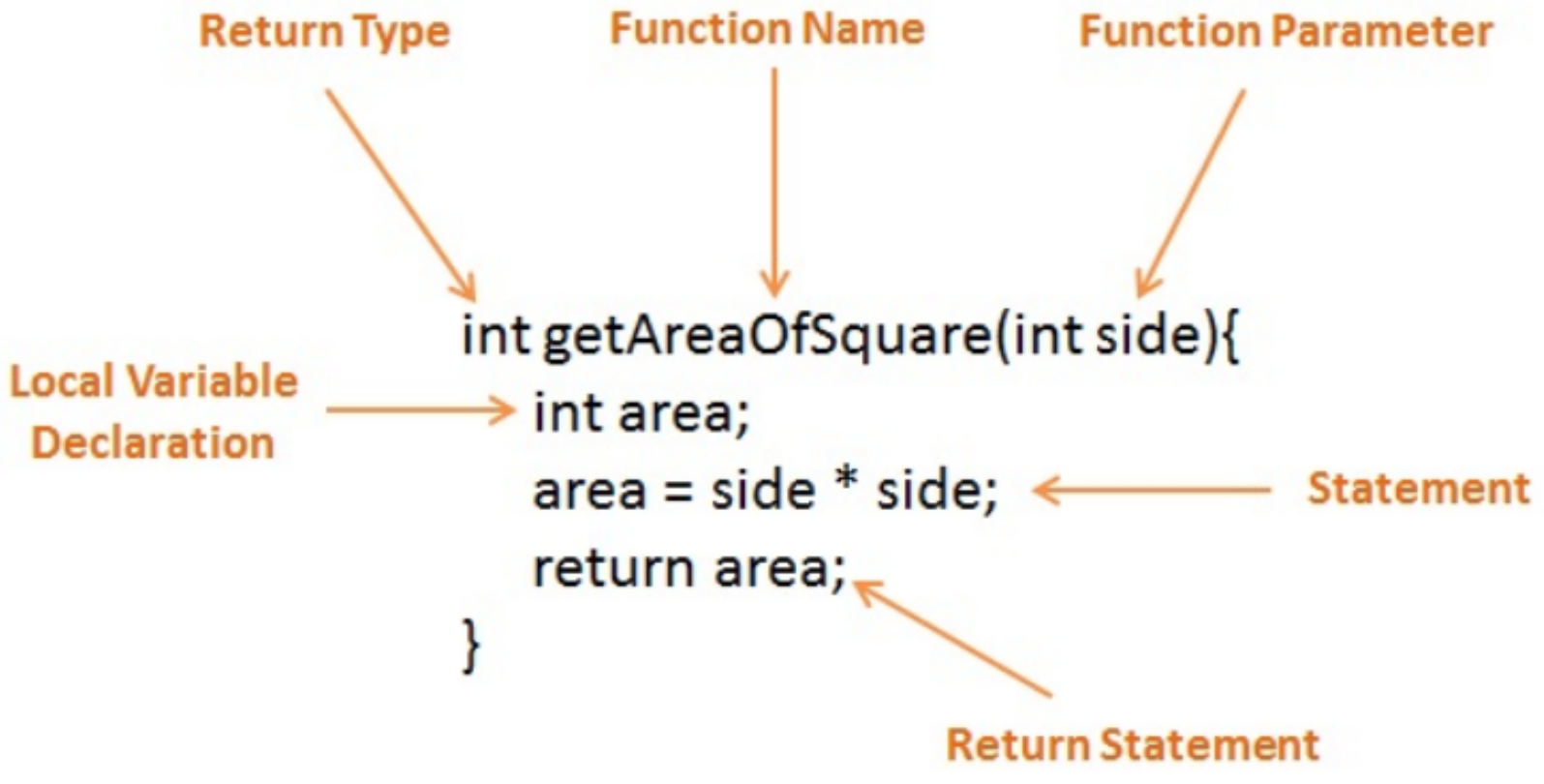

Back to Example 1 : Invocation of the Function

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Invocation (function call):

- arguments passed to the function.

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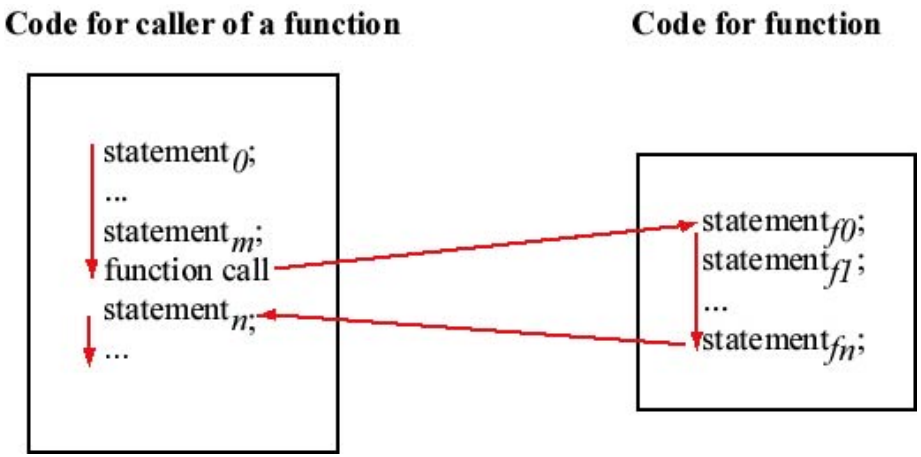
Invocation (function call):

- arguments passed to the function.
- receiving the return value from the function.
- a function can be called multiple times, with different arguments.



Another Example : implementing `fact`

```
#include<stdio.h>
int fact(int);

int main() {
    int x, y;
    printf("Enter a number:");
    scanf("%d", &x);
    y = fact(x);
    printf("%d\n",y);
}

int fact(int n) {
    int i = 1;
    while(n>0) {
        i = i * n;
        n--;
    }
    return i;
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Take Aways:

- We can write more complicated code within the body of functions.

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- In fact, `math.h` has such definitions to compute `sqrt` and `pow` etc.

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- We can define our own math functions.
- In fact, `math.h` has such definitions to compute `sqrt` and `pow` etc.
- More interestingly, `printf` and `scanf` are also functions defined inside `stdio.h`.

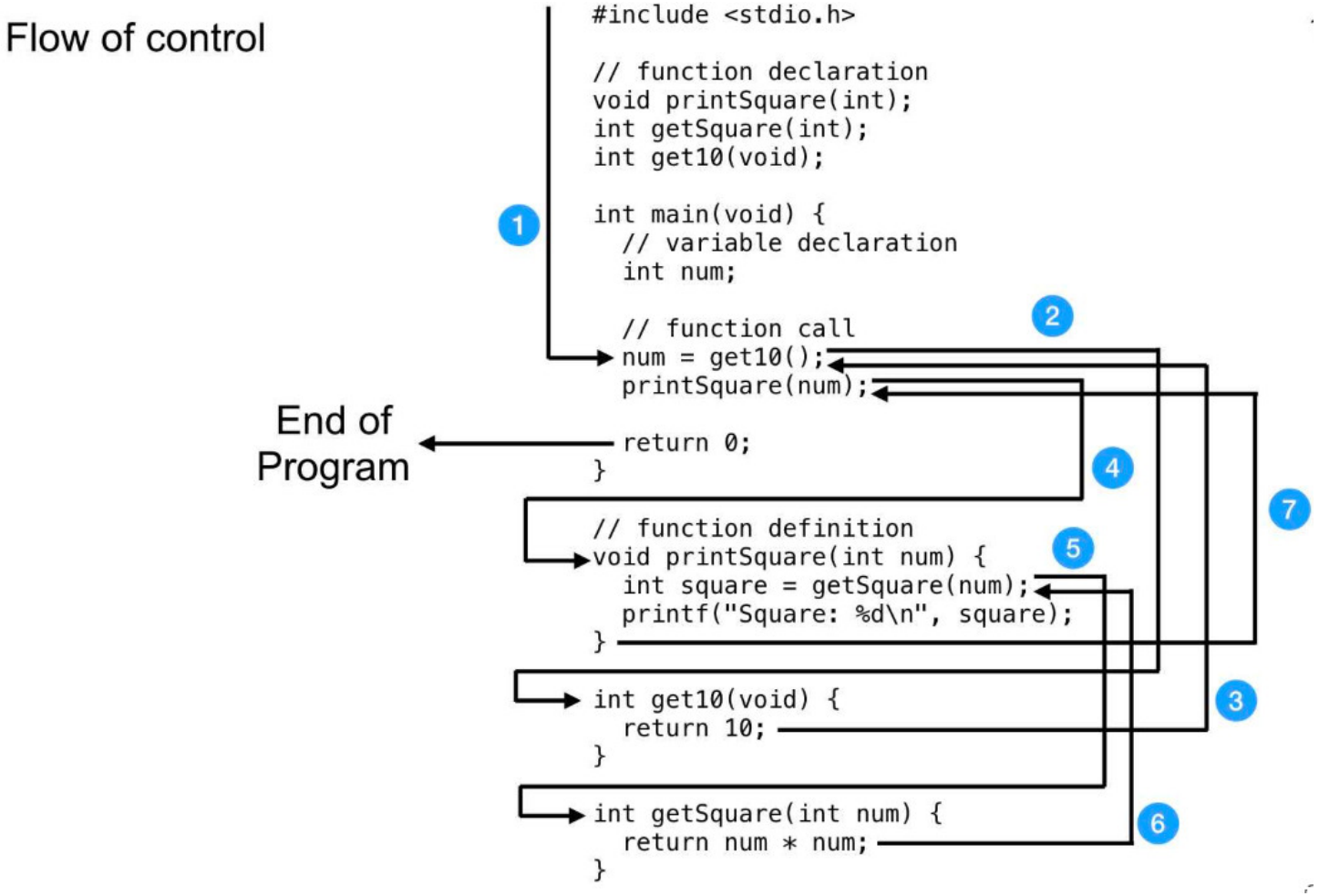
Functions with arguments & no return value

```
#include<stdio.h>

void area(float rad);  // Prototype Declaration

int main()
{
   float rad;
   printf("Enter the radius : ");
   scanf("%f",&rad);
   area(rad);
}

void area(float rad)
{
   float ar;
   ar = 3.14 * rad * rad ;
   printf("Area of Circle = %f",ar);
}
```

Functions with no arguments & no return value

```
#include<stdio.h>
void area();  // Prototype Declaration

void main()
{
  area();
}

void area()
{
    float area_circle;
    float rad;
    printf("Enter the radius : ");
    scanf("%f",&rad);

    area_circle = 3.14 * rad * rad ;

    printf("Area of Circle = %f",area_circle);
}
```

Control Flow : More complicated example



Now this slide may make more sense

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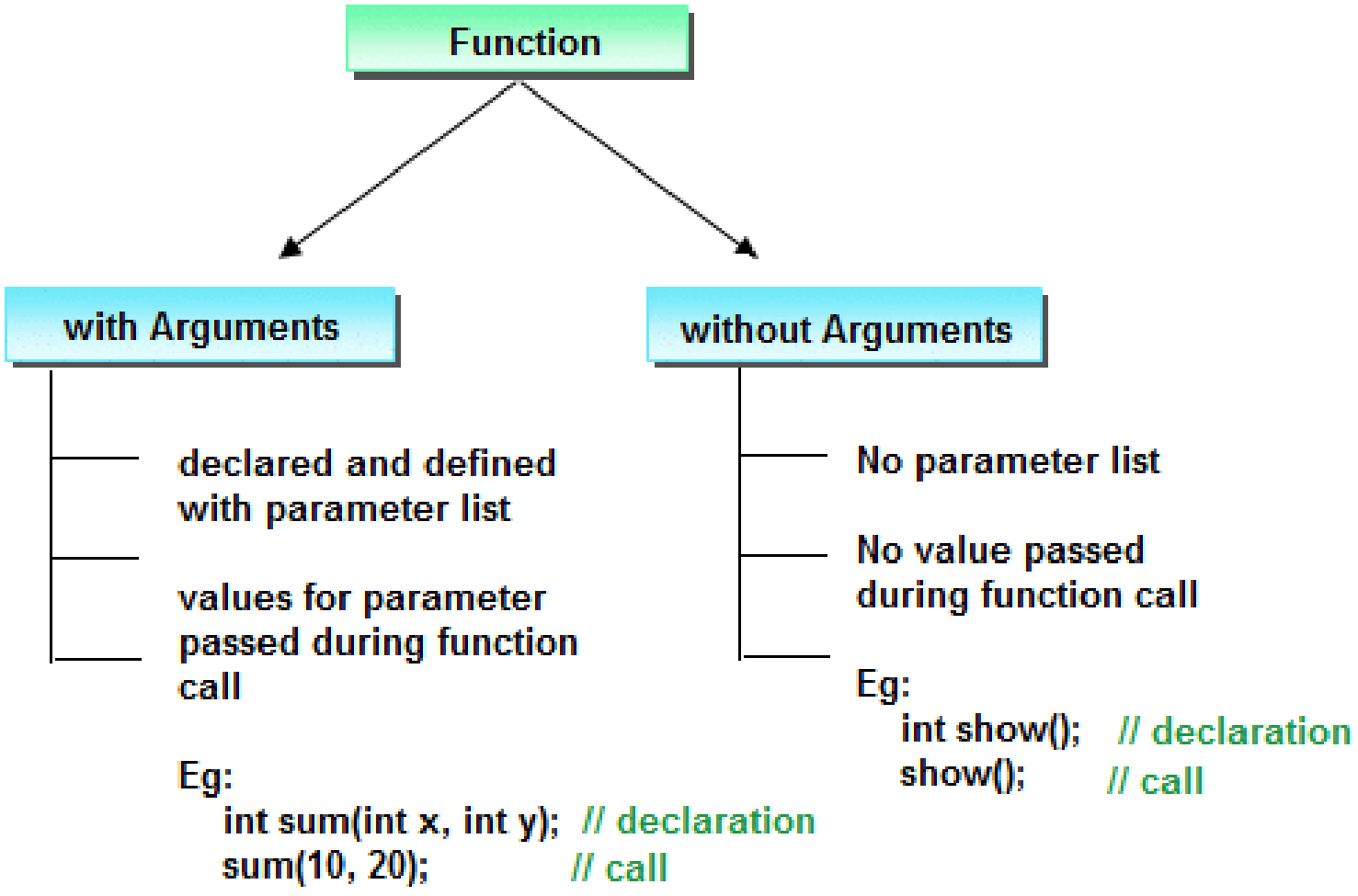
Classifying functions in C



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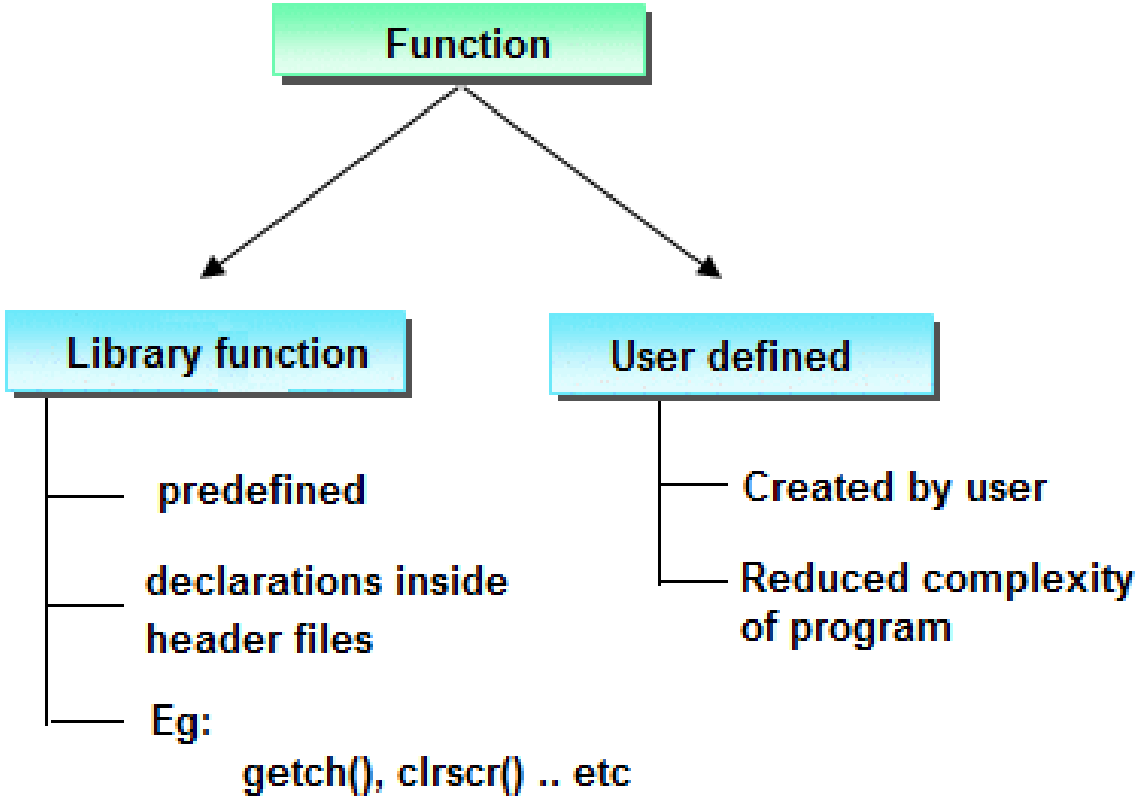

New Concept : Blocks and Scope

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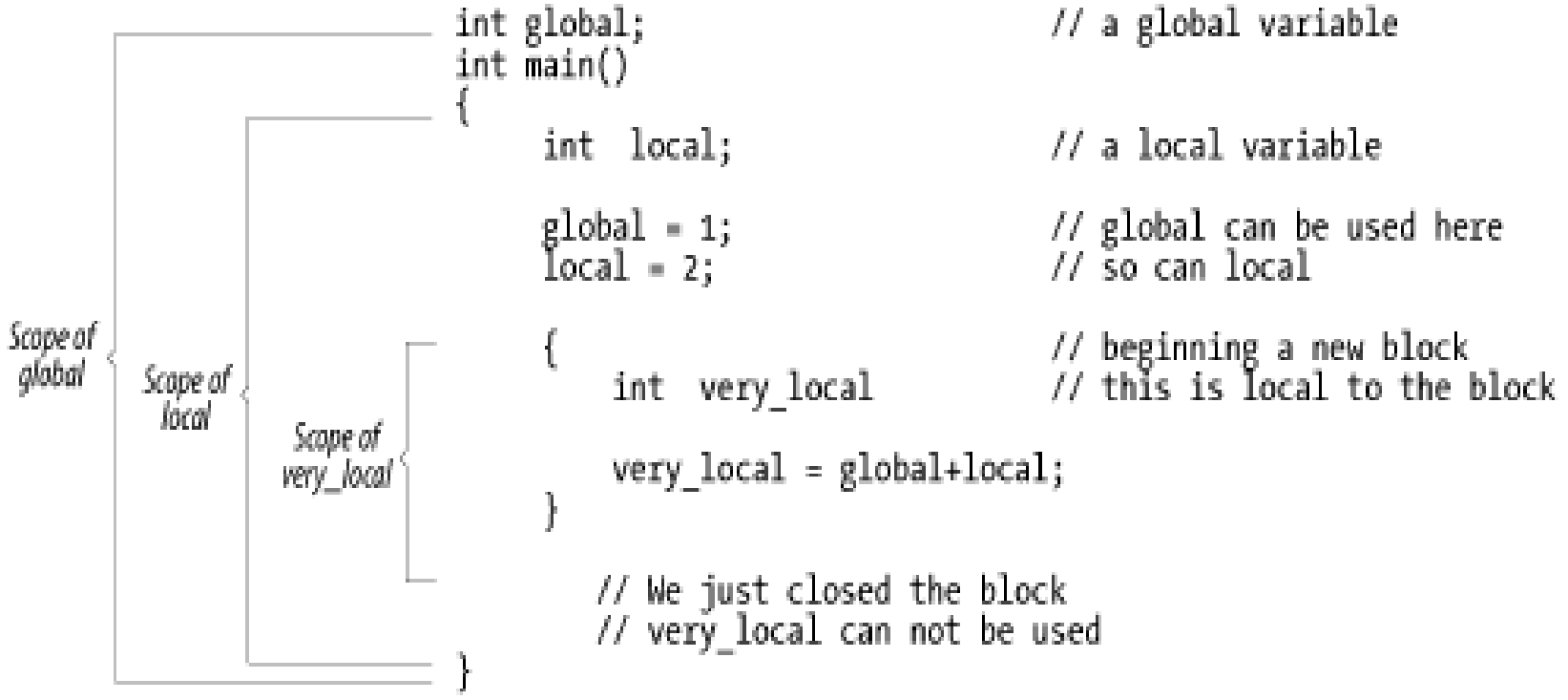

Practicing the Concept : Blocks and Scope

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int var1 = 10;

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    {
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      printf("%d\n", var3);
    }
    float var3=100;
    printf("%f\n", var3);
    return 0;
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int FindSum(int a, int b)
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     int c=a+b;
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Local vs **Global** variables : `var1` is global but `var2` is local for `main` function.

Take Aways

- Functions : Modular Programming. Build programs brick by brick. Reusing built and tested part.
- Declaration, Definition and Invocation of functions.
- Block and Scope. Local and Global Variables.

Coming up :

- We will do hands-on examples of using functions.
- Is `main` program a function?
  Why are we ending with `"return 0;"` Who is it returning to?

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- Can a function invoke itself? Yes ! Recurison !.