

Intro. Computing with the C Programming Language

# Function

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# Function

- In mathematics, a function maps input values to output values
  - e.g.,  $\sin(x)$ ,  $\cos(x)$ , and  $\log(x)$
- In C, a function defines a sequence of statements that receives input values, performs computation and actions, and then returns a value
  - unlike in math, a C function may induce side-effects
- In C, a function may use standard library functions, external library functions, and user-defined functions
  - a function calls another function to get certain service

# Function Call

- The declaration of a function (the outfit of a function) defines:
  - function name
  - type of the return value
  - a list of parameter types and names
- A function call statement executes a target function by providing values, and receives the return value
  - a value given to a function call is called an argument
- Example

```
int rectangle_area (int length, int width) ;
```

```
a = rectangle_area(10, 5) ; // a is assigned as 50
```

# Composition

- C functions can be composed by calling a function to define an argument of another function call
- An argument is first evaluated, and subsequently the called function is executed
- Examples

```
double x = cos (angle + PI/2) ;
```

```
double x = exp(log (10.0)) ;
```

# Adding New Functions

- We can add a new function by defining a function body as a sequence of statements (i.e., code block)
- A function parameter is a special-purpose variable of a function, that receives a value from a function call statement
- Example

```
int rectangle_area (int length, int width) {  
    return length * width ;  
}
```

# Local Variables

- A parameter and variables defined in a function exist only when the function is executed, and removed once the function is returned
  - these are called local variables
- Whenever a function is called, a new instance of the function is created
  - each instance contains the parameter and the local variables

# Questions

- Where is the definition of library functions?
- Can a function return more than one values?
- May a function not return any value?
- Is it possible for a function to call itself?
- How does `printf` receive different numbers of arguments depending on situations?