Lab 4: Functions

Goals

Understand how to build simple C language functions

Background

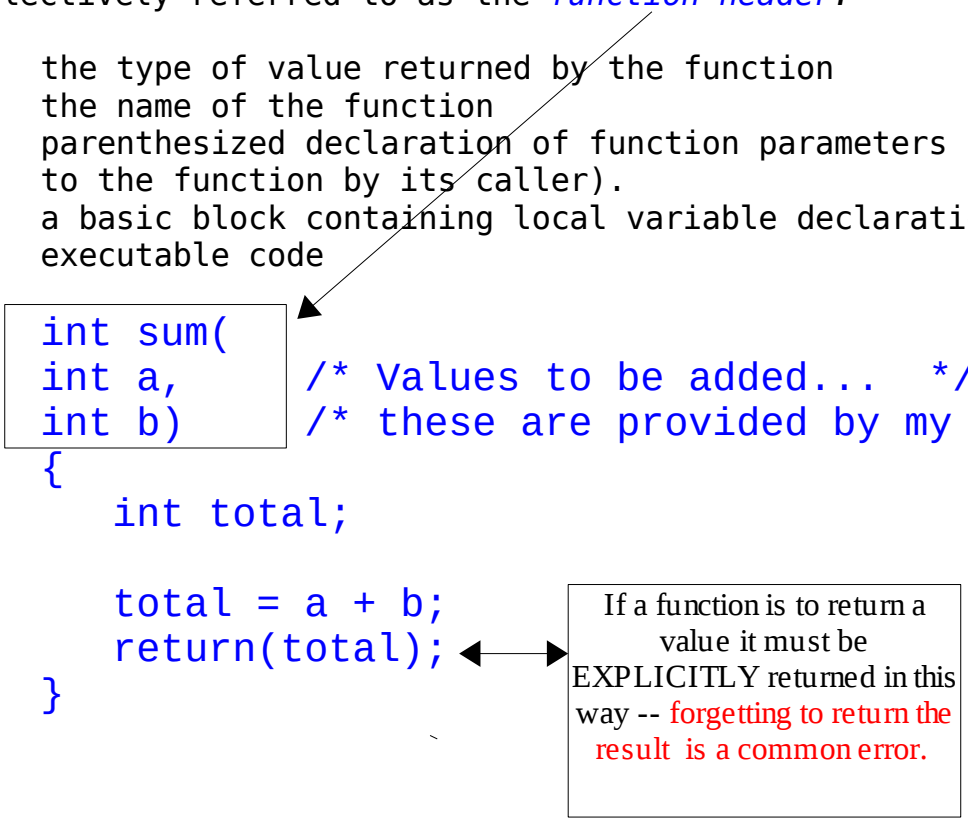
Functions

- Functions provide a mechanism for partitioning a large, complex program into a collection of small, easily understood components.
- Each function should be designed to solve ONE aspect of the problem at hand.

Function definitions

A C function is comprised of 4 components. The first three are collectively referred to as the *function header*.

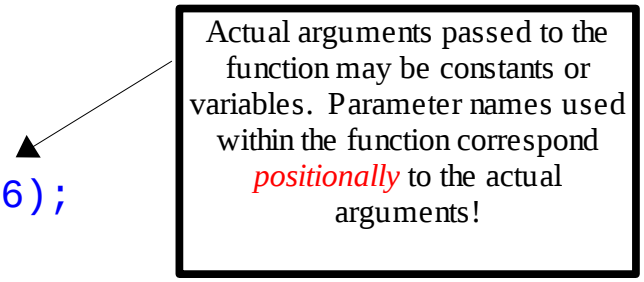
- the type of value returned by the function
- the name of the function
- parenthesized declaration of function parameters (values passed to the function by its caller).
- a basic block containing local variable declarations and executable code



A C function is called or invoked by just using its name anywhere a variable or constant might be used in an expression:

```
int main()
{
   int num = 0;

   num = sum(4, 5);
   num = num + sum(num, 6);
}
```



When an expression is evaluated, the value returned by the function replaces its invocation in the expression. So here, the first call to *sum()* will return a 9 and 9 will be assigned to *num.* Then the second call will return a 15 and so the final value of *num will be 15.*

NOTES:

- Local variable name spaces of different functions are completely disjoint. I can declare a local variable called *total* in *main()* and it will be *completely independent of the total in sum.*

- The correspondence between the formal parameters (a, and b) in *sum()* with the actual arguments (4, and 5) in main() is positional. When this program runs, if we were to include
  fprintf(stdout, "%d %d\n", a,b);
  in *sum()*, we would see *a* holds the value 4 and *b* holds 5 during the first call and *a* holds the value 9 and *b* holds the value 6 during the second call.

- Therefore, the number and types of the actual arguments used when invoking a function should *exactly match* the formal parameters of the function definition.

Function prototypes:

A function prototype is the first element of the function definition followed by a semi-colon.

```
int sum(int a, int b);
```

If the actual function definition comes after the function from which it is called or appears in a difference .c source file, then a prototype is required to ensure that the actual arguments passed to the function match the formal parameters in the function header/prototype. If the function definition precedes its invocation, then the proper information can be picked up from the function itself. Nevertheless, including a prototype is never an error.

Assignment:

Codelab:

In section Original->Functions->Invocation->Scalar_Variables, do exercises 10142 *through* 10145 and in section Original->Functions->Definition->Scalar_Parameters, do exercises 10155 *through* 10160.

Non Codelab:

The *www.cs.clemson.edu/~westall/101/labs* contains a program called *lab4.c*. Complete the bodies of the three missing functions. You may assume that the input character will always be a legitimate lower case or upper case alphabetic character. You may avoid having to do bit operations by adding or subtracting the expression ('a' - 'A') as required.

Turn In Work

Show your TA that you completed the assignment. Then turn in your lab4.c program using the command:

sendlab.101.*section_number* 4 lab4.c