Functions: Part 2 of 3

CMSC 104, Spring 2014

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(thanks to John Park for slides)

Functions, Part 2 of 3

Topics

- Functions That Return a Value
- Parameter Passing
- Local Variables
- Header Files

Reading

- Sections 5.1 - 5.7

Functions Can Return Values

```
/*****************************************************************************
** averageTwo - calculates and returns the average of two numbers
** Inputs:  num1 - an integer value
**          num2 - an integer value
** Outputs:  the floating point average of num1 and num2
*****************************************************************************/
float AverageTwo (int num1, int num2)
{
    float average ;   /* average of the two numbers */

    average = (num1 + num2) / 2.0 ;
    return average ;
}
```

Using averageTwo

```
#include <stdio.h>

float AverageTwo (int num1, int num2) ;

int main ( )
{
      float ave ;
      int value1 = 5, value2 = 8 ;

      ave = AverageTwo (value1, value2) ;
      printf (“The average of %d and %d is %f\n”, value1, value2, ave) ;
      return 0 ;
}

float AverageTwo (int num1, int num2)
{
      float average ;

      average = (num1 + num2) / 2.0 ;
      return average ;
}
```

Parameter Passing

- **Actual parameters** are the parameters that appear in the function call.

  average = AverageTwo (**value1**, **value2**) ;

- **Formal parameters** are the parameters that appear in the function header.

  float AverageTwo (int **num1**, int **num2**)

- Actual and formal parameters are matched by position. Each formal parameter receives the value of its corresponding actual parameter.

Parameter Passing (con’t)

- Corresponding actual and formal parameters do not have to have the same name, but they may.
- Corresponding actual and formal parameters must be of the same data type, with some exceptions.

Local Variables

- Functions only “see” (have access to) their own **local variables**. This includes main( ) .
- Formal parameters are declarations of local variables. The values passed are assigned to those variables.
- Other local variables can be declared within the function body.

Parameter Passing and Local Variables

```
#include <stdio.h>
float AverageTwo (int num1, int num2);
int main ( )
{
      float ave;
      int value1 = 5, value2 = 8;

      ave = AverageTwo (value1,
                               value2);
      printf ("The average of ");
      printf ("%d and %d is %f\n",
               value1, value2, ave);
     return 0;
}
```

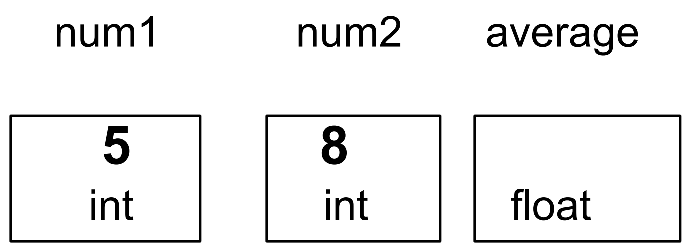
value1	value2	ave
5 int	**8** int	float

```
float AverageTwo (int num1, int num2)
{
     float average;

     average = (num1 + num2) / 2.0;
     return average;
}
```

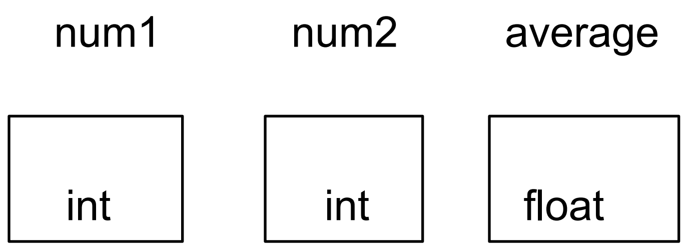
num1	num2	average
int	int	float

Same Name, Still Different Memory Locations

```
#include <stdio.h>
float AverageTwo (int num1, int num2) ;
int main ( )
{
     float average ;
     int num1 = 5, num2 = 8;

     average = AverageTwo (num1,
                                 num2);
     printf (“The average of “) ;
     printf (“%d and %d is %f\n”,
             num1, num2, average);
    return 0;
}
```

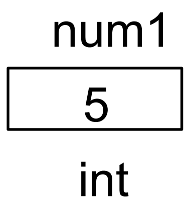


```
float AverageTwo (int num1, int num2)
{
     float average;

     average = (num1 + num2) / 2.0;
     return average;
}
```

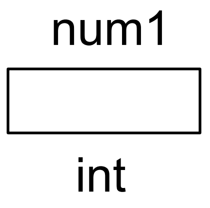


Changes to Local Variables Do NOT Change Other Variables with the Same Name

```
#include <stdio.h>
void AddOne (int number) ;
int main ( )
{
     int num1 = 5 ;
     AddOne (num1) ;
     printf (“In main: “) ;
     printf (“num1 = %d\n”, num1) ;
     return 0 ;
}
```



```
void AddOne (int num1) {
        num1++ ;
        printf (“In AddOne: “) ;
        printf (“num1 = %d\n”, num1) ;
}
```



OUTPUT

```
In AddOne: num1 = 6
In main: num1 = 5
```

Header Files

- Header files contain function prototypes for all of the functions found in the specified library.
- They also contain definitions of constants and data types used in that library.

Commonly Used Header Files

Header File	**Contains Function Prototypes for:**
<stdio.h>	standard input/output library functions and information used by them
<math.h>	math library functions
<stdlib.h>	conversion of numbers to text, text to numbers, memory allocation, random numbers, and other utility functions
<time.h>	manipulating the time and date
<ctype.h>	functions that test characters for certain properties and that can convert case
<string.h>	functions that manipulate character strings
others	see Chapter 5 of text

Using Header Files

```
#include <stdio.h>
#include <stdlib.h>
#include <math.h>
int main ( )
{
    float side1, side2, hypotenuse ;
    printf(“Enter the lengths of the right triangle sides:  “) ;
    scanf(“%f%f”, &side1, &side2) ;
    if ( (side1 <= 0) || (side2 <= 0) {
        exit (1) ;
    }
    hypotenuse = sqrt ( (side1 * side1) + (side2 * side2) ) ;
    printf(“The hypotenuse = %f\n”, hypotenuse) ;
    return 0 ;
}
```