Functions: Part 3 of 3 (Lab5)

CMSC 104, Fall 2012
John Y. Park

Functions, Part 1 of 3

Topics

- In-Class Coding Practice
  - Project 1: The Box
  - Project 2: Drawing a Rectangle
  - Project 3: Multiplication Table

Reading

- none

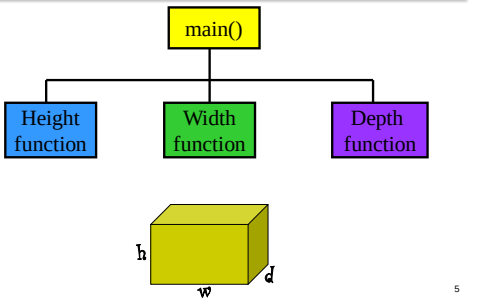
Coding Practice

- Starting with some simple problems, we will:
  1. Design appropriate algorithms
  2. Modularize them
  3. Create pseudocode
  4. Write actual C code

The Box

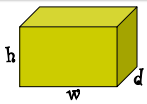
Problem: Write an interactive program to compute and display the volume and surface area of a box. The program must also display the box dimensions. Error checking should be done to be sure that all box dimensions are greater than zero.

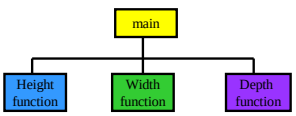
Hierarchy Chart



The Box – Pseudocode for height function

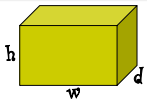
```
Display "Enter the height: "
Read <height>
While (<height>  <=  0 )
    Display "The height must be > 0"
    Display "Enter the height: "
    Read <height>
End_while
Return height
```

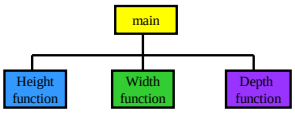




The Box - Pseudocode for width function

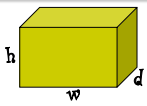
```
Display "Enter the width: "
Read <width>
While (<width> <= 0 )
    Display "The width must be > 0"
    Display "Enter the width: "
    Read <width>
End_while
Return width
```

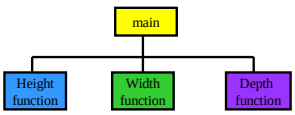




The Box – Pseudocode for depth function

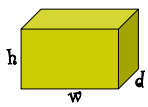
```
Display "Enter the depth: "
Read <depth>
While (<depth> <= 0 )
    Display "The depth must be > 0"
    Display "Enter the depth: "
    Read <depth>
End_while
Return depth
```

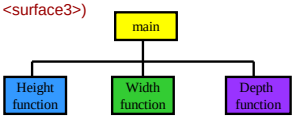




The Box - Pseudocode (cont.)

```
Call height_function saving answer in <height>
Call width_function saving answer in <width>
Call depth_function saving answer in <depth>

<volume> = <height> X <width> X <depth>

<surface1> = <height> X <width>
<surface2> = <width> X <depth>
<surface3> = <height> X <depth>
<surface area> = 2 X (<surface1> + <surface2>
                      + <surface3>)
```





The Box - Pseudocode (cont.)

Display “Height = “, <height>

Display “Width = “, <width>

Display “Depth = “, <depth>

Display “Volume = “, <volume>

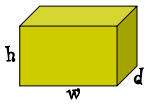
Display “Surface Area = “, <surface area>

Code the Design

```
#include <stdio.h>
   int height_function( void );
   int width_function( void );
   int depth_function( void );
```

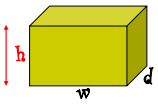


```
int main( void )
{
    int height, width, depth, volume;
    int surface1, surface2, surface3, surface_area;

    height = height_function( );
    width =  width_function( );
    depth = depth_function( );

    volume = height * width * depth;

    surface1 = height * width;
    surface2 = width * depth;
    surface3 = height * depth;
    surface_area = 2 * (surface1 + surface2 + surface3);

    printf( "Height = %d\n", height );
    printf( "Width = %d\n", width );
    printf( "Depth = %d\n", depth );
    printf( "Volume = %d\n", volume );
    printf( "Surface Area = %d\n", surface_area );

    return 0;
}
```



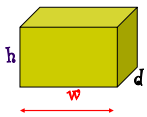
height_function( )

```
int height_function( void )
{
    int height;

    printf( "Enter the height:  " );
    scanf( "%d", &height);

    while( height <= 0 )
    {
        printf( "The height must be > 0\n" );
        printf( "Enter the height:  " );
        scanf( "%d", &height);
    }
    return height;
}
```



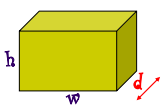
width_function( )

```
int width_function( void )
{
    int width;

    printf( "Enter the width:  " );
    scanf( "%d", &width );

    while( width <= 0 )
    {
        printf( "The width must be > 0" );
        printf( "Enter the width:  " );
        scanf( "%d", &width );
    }

    return width;
}
```



depth_function( )

```
int depth_function( void )
{
    int depth;

    printf( "Enter the depth:  " );
    scanf( "%d", &depth );

    while( depth <= 0 )
    {
        printf( "The depth must be > 0" );
        printf( "Enter the depth:  " );
        scanf( "%d", &depth );

    }

    return depth;
}
```

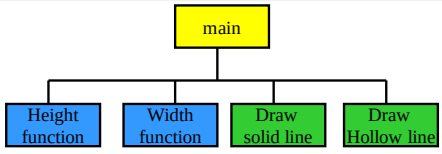


Drawing a Rectangle

Problem: Write an interactive program that will draw a solid rectangle of asterisks (*). The program must also display the dimensions of the rectangle. Error checking must be done to be sure that the dimensions are greater than zero.

```
**********
*        *
*        *
**********
```


Hierarchy Chart




```
**********
*        *
*        *
**********
```


The Rectangle – Pseudocode for Height_function

```
Display "Enter the height: "
Read <height>
While (<height>  <=  0 )
    Display "The height must be > 0"
    Display "Enter the height: "
    Read <height>
End_while
Return <height>
```

```
**********
*        *
*        *
**********
```

The Rectangle - Pseudocode for Width_function

```
Display “Enter the width:  “
Read <width>
While (<width>  <=  0 )
    Display “The width must be > 0”
    Display “Enter the width:  “
    Read <width>
End_while
return <width>
```


The Rectangle – Pseudocode function Draw_solid_line

```
Receive width_size
Set I to 0
While ( I < width_size )
      Display “*”
      add 1 to I
Display “\n”
```


The Rectangle – Pseudocode function Draw_hollow_line

```
Receive <width_size>
Display “*”
Set I to 0
While ( I < <width_size> - 2 )
      Display “ ”
      add 1 to I
Display “*\n”
```

The Rectangle - Pseudocode main function

Call **Height_function** saving answer in <height>
Call **Width_function** saving answer in <width>
Skip a line

The Rectangle - Pseudocode (cont.)

Call **Draw_solid_line** sending <width>
Set height_counter to 1
While (<height counter> <= <height - 2>)
  call **Draw_hollow_line** sending width
  <height counter> = <height counter> + 1
End_while
Call **Draw_solid_line** sending width

The Rectangle Code

```
#include <stdio.h>
int height_function( void );
int width_function( void );
void draw_solid_line( int width_size );
void draw_hollow_line( int width_size );
```

```
int main( void )
{
    int height;
    int     width;
    int height_counter;

    height = height_function(  );
    width = width_function(  );
    printf( "\n" );

    draw_solid_line( width );
    height_counter = 1;

    while ( height_counter < ( height - 2 ) )
    {
        draw_hollow_line( width );
        height_counter++;
    }

    draw_solid_line( width );

    return 0;
}
```


height_function( ) – software reuse

```
int height_function( void )
{
    int height;

    printf( "Enter the height:  " );
    scanf( "%d", &height);

    while( height <= 0 )
    {
        printf( "The height must be > 0\n" );
        printf( "Enter the height:  " );
        scanf( "%d", &height);
    }
    return height;
}
```


width_function( ) – software reuse

```
int width_function( void )
{
    int width;

    printf( "Enter the width:  " );
    scanf( "%d", &width );

    while( width <= 0 )
    {
        printf( "The width must be > 0" );
        printf( "Enter the width:  " );
        scanf( "%d", &width );
    }

    return width;
}
```

draw_solid_line( )

```
void draw_solid_line( int width_size )
{
    int i;

    i = 0;

    while ( i < width_size )
    {
        printf( "*" );
        i++;
    }
    printf( "\n" );

}
```


draw_hollow_line( )

```
void draw_hollow_line( int width_size )
{
    int i;

    printf( "*" );
    i = 0;

    while( i < ( width_size - 2 ) )
    {
        printf( " " );
        i++;
    }
    printf( "*\n" );

}
```