

C Programming

Functions

Part I Example

Problem to Solve

(from last week's optional)

“Write a program that will ask the user for a number then display a box of asterisks whose height and width is the number entered. Exit when the user enters 0.”

Solution using main() only

```
int main()
{
    int numberOfAsterisks = 1;
    int asterisksToDisplay = 0;
    int linesToDisplay = 0;
    int spacesToDisplay = 0;

    while( numberOfAsterisks != 0 )
    {
        // Ask the user for a number.
        printf("Enter number of asterisks: ");
        numberOfAsterisks = getNum();
    }
}
```

```
// Display top line.  
if( numberOfAsterisks > 0 )  
{  
    // While there are asterisks to display, do  
    asterisksToDisplay = 1;  
    while( asterisksToDisplay <= numberOfAsterisks )  
    {  
        printf("*");  
        ++ asterisksToDisplay ;  
    }  
    printf("\n");  
}
```

```
// Display middle lines.
linesToDisplay = 1;
while( linesToDisplay < numberOfAsterisks - 1 )
{
    // Display leftmost asterisk
    printf("*");
    // Display the right number of spaces.
    spacesToDisplay = 1;
    while( spacesToDisplay < numberOfAsterisks - 1 )
    {
        printf(" ");
        ++spacesToDisplay;
    }
    // display rightmost asterisk
    printf("*\n");
    ++linesToDisplay;
}
```

```
// Display bottom line.  
if( numberOfAsterisks > 2 )  
{  
    // While there are asterisks to display, do  
    asterisksToDisplay = 1;  
    while( asterisksToDisplay <= numberOfAsterisks )  
    {  
        printf("*");  
        ++ asterisksToDisplay ;  
    }  
    printf("\n");  
}
```

```
}
```

```
return 0;
```

```
}
```

Observations about the Solution

1. There's a lot of code for a bunch of PowerPoint slides.
2. There's a lot of repeated concepts.

Let's reorganize it
using functions!

Similarity #1

In three different places,
we draw a line of
a given number
of identical characters

In the top line, we draw a line of asterisks.

In the middle lines, we draw a line of spaces.

In the bottom line, we draw a line of asterisks.

So, why not
create a function!?!?

Common code (from top line):

```
asterisksToDisplay = 1;  
while( asterisksToDisplay <= numberOfAsterisks )  
{  
    printf("*");  
    ++ asterisksToDisplay ;  
}
```

Create a function called
`drawLineOfCharacters()`

```
void drawLineOfCharacters(void)
{
int charactersDisplayed = 1;
    while( charactersDisplayed <= numberOfCharacters )
    {
        printf("%c", characterToDisplay);
        ++ charactersDisplayed;
    }
}
```

We need information!

How many characters need to
be drawn?

What character needs to be
drawn?


```
void drawLineOfCharacters(char characterToDisplay,  
                           int numberOfCharacters)  
{  
    int charactersDisplayed = 1;  
    while( charactersDisplayed <= numberOfCharacters )  
    {  
        printf("%c", characterToDisplay);  
        ++ charactersDisplayed;  
    }  
}
```

Similarity #2

The drawing of the
top and bottom lines
is identical.

But wait!

We now have a function that
draws lines of characters!

Let's replace the
top and bottom
line drawing
with a call to that function

And we can also
replace the
drawing of the spaces
in the middle lines
with a similar call

End Result

```
// define drawLineOfCharacters() and getNum() here
int main()
{
    int numberOfAsterisks = 1;
    int linesToDisplay = 0;

    while( numberOfAsterisks != 0 )
    {
        // Ask the user for a number.
        printf("Enter number of asterisks: ");
        numberOfAsterisks = getNum();

        // Display a box of asterisks of the appropriate height and width.
        // Display top line.
```

```
if( numberOfAsterisks > 0 )  
{  
    drawLineOfCharacters('*', numberOfAsterisks);  
    printf("\n");  
}
```

```
// Display middle lines.  
linesToDisplay = 1;  
while( linesToDisplay < numberOfAsterisks - 1 )  
{  
    //Display hollow line of appropriate length.  
    printf("*");  
    drawLineOfCharacters(' ', numberOfAsterisks - 2);  
    printf("*\n");  
    ++linesToDisplay;  
}
```



```
// Display bottom line.  
if( numberOfAsterisks > 2 )  
{  
    drawLineOfCharacters('*', numberOfAsterisks);  
    printf("\n");  
}  
}  
  
return 0;  
}
```

And we only had to get
`drawLineOfCharacters()`
working once
and we could use it over
and over and over again

Instant Replay: Compare the drawing of the top line

```
asterisksToDisplay = 1;  
while( asterisksToDisplay <= numberOfAsterisks )  
{  
    printf("*");  
    ++ asterisksToDisplay ;  
}  
printf("\n");
```

```
drawLineOfCharacters('*', numberOfAsterisks);  
printf("\n");
```

So much better and clearer!

Aside: This is an example
of
refactoring

Functions

Part I Example Summary

Functions Example:

In Summary

You can simplify your code
by using functions.

This makes your life better!