2024-09-19

# do while

## Comparing while and if statements

* while and if are very similar: Both test a condition, execute a block of code if the condition is true, and skip the block of code if the condition is false
* There is only a difference if the condition is true: if statements only execute the block of code once if the condition is true, but while statements may execute the block of code multiple times if the condition is true
* Compare these snippets of code:

if(number < 3)  
{  
 Console.WriteLine("Hello!");  
 Console.WriteLine(number);  
 number++;  
}  
Console.WriteLine("Done");

and

while(number < 3)  
{  
 Console.WriteLine("Hello!");  
 Console.WriteLine(number);  
 number++;  
}  
Console.WriteLine("Done");

* If number is 4, then both will do the same thing: skip the block of code and display “Done”.
* If number is 2, both will also do the same thing: Display “Hello!” and “2”, then increment number to 3 and print “Done”.
* If number is 1, there is a difference: The if statement will only display “Hello!” once, but the while statement will display “Hello! 2” and “Hello! 3” before displaying “Done”

## Code duplication in while loops

* Since the while loop evaluates the condition before executing the code in the body (like an if statement), you sometimes end up duplicating code
* For example, consider an input-validation loop like the one we wrote for Item prices:

Console.WriteLine("Enter the item's price.");  
decimal price = decimal.Parse(Console.ReadLine());  
while(price < 0)  
{  
 Console.WriteLine("Invalid price. Please enter a non-negative price.");  
 price = decimal.Parse(Console.ReadLine());  
}  
Item myItem = new Item(desc, price);

* Before the while loop, we wrote two lines of code to prompt the user for input, read the user’s input, convert it to decimal, and store it in price
* In the body of the while loop, we also wrote two lines of code to prompt the user for input, read the user’s input, convert it to decimal, and store it in price
* The code before the while loop is necessary to give price an initial value, so that we can check it for validity in the while statement
* It would be nice if we could tell the while loop to execute the body first, and then check the condition

## Introduction to do-while

* The do-while loop executes the loop body **before** evaluating the condition
* Otherwise works the same as a while loop: If the condition is true, execute the loop body again; if the condition is false, stop the loop
* This can reduce repeated code, since the loop body is executed *at least once*
* Example:

decimal price;  
do  
{  
 Console.WriteLine("Please enter a non-negative price.");  
 price = decimal.Parse(Console.ReadLine());  
} while(price < 0);  
Item myItem = new Item(desc, price);

* The keyword do starts the code block for the loop body, but it does not have a condition, so the computer simply starts executing the body
* In the loop body, we prompt the user for input, read and parse the input, and store it in price
* The condition price < 0 is evaluated at the end of the loop body, so price has its initial value by the time the condition is evaluated
* If the user entered a valid price, and the condition is false, execution simply proceeds to the next line
* If the user entered a negative price (the condition is true), the computer returns to the beginning of the code block and executes the loop body again
* This has the same effect as the while loop: the user is prompted repeatedly until he/she enters a valid price, and the program can only reach the line Item myItem = new Item(desc, price) when price < 0 is false
* Note that the variable price must be declared before the do-while loop so that it is in scope after the loop. It would not be valid to declare price inside the body of the loop (e.g. on the line with decimal.Parse) because then its scope would be limited to inside that code block.

## Formal syntax and details of do-while

* A do-while loop is written like this:

do  
{  
 <statements>  
} while(<condition>);

* The do keyword does nothing, but it is required to indicate the start of the loop. You cannot just write a { by itself.
  + Unlike a while loop, a semicolon is required after while(<condition>)
  + It’s a convention to write the while keyword on the same line as the closing }, rather than on its own line as in a while loop
  + When the computer encounters a do-while loop, it first executes the body (code block), then evaluates the condition
  + If the condition is true, the computer jumps back to the do keyword and executes the loop body again
  + If the condition is false, execution continues to the next line after teh while keyword
  + If the loop body is only a single statement, you can omit the curly braces, but not the semicolon:
* do  
  <statement>  
  while(<condition>);

## do-while loops with multiple conditions

* We can combine both types of user-input validation in one loop: Ensuring the user entered a number (not some other string), and ensuring the number is valid. This is easier to do with a do-while loop:

decimal price;  
bool parseSuccess;  
do  
{  
 Console.WriteLine("Please enter a price (must be non-negative).");  
 parseSuccess = decimal.TryParse(Console.ReadLine(), out price);  
} while(!parseSuccess || price < 0);  
Item myItem = new Item(desc, price);

* There are two parts to the loop condition: (1) it should be true if the user did not enter a number, and (2) it should be true if the user entered a negative number.
* We combine these two conditions with || because either one, by itself, represents invalid input. Even if the user entered a valid number (which means !parseSuccess is false), the loop should not stop unless price < 0 is also false.
* Note that both variables must be declared before the loop begins, so that they are in scope both inside and outside the loop body