

EXAMPLE 4 – A simple “While” loop

Problem: We will write a program to add up a column of positive integers, where we do not know in advance how many numbers there are, and the user is unable to provide this information. (The restriction to positive numbers is totally artificial, as we shall see.)

Analysis:

The inputs are a sequence of positive integers. There may be none at all, or there may be very many. So we have to have some scheme for finding out when the user is done entering data. We will instruct the user to enter zero after the last positive integer has been entered. (This gimmick is called a “sentinel”. Ideally, we would instruct the user to enter something that is not a number at all, such as “Done” or “X”, but at this point in this course, we do not have a tool to determine whether an input is or is not a number.)

We will set up a variable which we will call Sum to accumulate the sum (yes, this is really called an *accumulator*). We will start it out at zero, then add to it each number that the user enters.

Variables table:

| Name | Data Type | Usage |
|---------------|-----------|--|
| NumberEntered | Integer | Any of the numbers entered by the user |
| Sum | Integer | Accumulates the sum |

Test Cases:

| Numbers entered | Sum |
|-----------------|-----|
| 0 | 0 |
| 7, 0 | 7 |
| 3, 5, 8, 0 | 16 |

Pseudocode

```
Begin program
Declare Integer NumberEntered, Sum
Set Sum = 0
// Setup
Print “Start entering numbers, then enter zero when you are done\n”
Input NumberEntered
// Start collecting data and accumulate the sum
While (NumberEntered > 0)
    Sum = Sum + NumberEntered
    Input NumberEntered    // Now we get the next number!
End While
Print “The sum is “ + Sum
End Program
```

Notes

Notice that we requested an initial input from the user *before* we start the loop. If the user immediately enters zero, then there are no positive numbers to add to the Sum, so the body of the While loop is never executed and the Sum remains zero.

Inside the body of the loop, we have an Input statement, which will probably result in a change in the value of the NumberEntered variable. In general, in a While loop, *something must happen inside the loop that can change the value of the continuation condition*. If there is no such thing in the loop, the loop will execute forever and the program will never end!

Here is a flowchart for this example. I have abbreviated the prompt text and variable names for clarity.

