Chapter 5 Looping (while)

Motivation:
How to tell the computer to print the following pattern?

*	**	***	****	*****

We can simply use **printf**("*"); **printf**("**"); etc… to print.
If I want to print out 32767 starts, it is nearly impossible to type the "*" 32767 times.
In fact, if we do so, we usually count the number of stars wrongly.

Furthermore, if I give an integer N, and want the computer to display N lines, each consisting N stars, without using the **if-else** statement, how can we do this?

while:

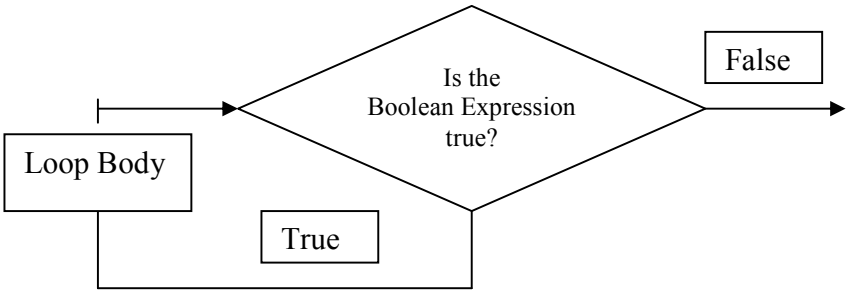
while (*Boolean expression) statement;*

while (*Boolean expression)* {
statement1;
statement2;
…
statementN;
} // No semi-colon here

Very similar to **if** statement, we use the **while** statement to tell the computer to repeat some tasks whenever the given condition is **true**.

*This kind of statements is called **loop**.*

Flow chart of while loop:



Nested-loop:

Like the **nested-if** statements, we can have a looping in another looping.

Example:

```
#include <stdio.h>
int main(){
        int i,j;
        i=1;
        while (i<=5){
                j=1;
                while (j<=5){
                        printf("*");
                        j=j+1;
                }
                printf("\n");
                i=i+1;
        }
        int pause;
        scanf("%d", &pause);
        return 0;
}
```

Practice Examples: (Level 1)

	Description	**Output**
1)	Output 1 to 5 in ascending order in one line	1 2 3 4 5
2)	Output 1 to 5 in descending order in one line	5 4 3 2 1
3)	Given a number n, find the sum of 1+2+3+ … + n	*100* 5050
4)	Given a number n, check whether it is a prime.	*101* Prime!
5)	Find the HCF of two integers.	*10 20* 10
6)	Find the LCM of two integers.	*10 20* 20
7)	Calculate a^n	*2 8* 64
8)	Output n odd numbers.	*5* 1 3 5 7 9
9)	Reverse a given integer.	*12345* 54321
10)	HKOI2003FSE Question 0 Enumeration	
a)	How to check if a number n is perfect square?	sqrt(n)==floor(sqrt(n))
b)	When is a newline printed?	Perfect square number
c)	How many numbers to be printed?	n^2
	Use the above 3 part to help you for this question	

Practice Examples: (Level 2)

	Description
1)	Find out all primes ≤ 100
2)	Find out the sum of n inputted numbers
3)	Find out the average of n inputted numbers.
4)	Find out the n-th Fibonacci number.
5)	Display 10 distinct random integers between 1 and 100 in ascending order.
6)	HKOI2003FJE Question 0 Enumeration
7)	HKOI2004FJE Question 0 Enumeration
8)	HKOI2003FJE Question 3 Goldbach's Conjecture
	Hints: Break into the odd numbers and even numbers
9)	HKOI2003FJE Question 4 Bridge
	Hints: Just a straight vertical or horizontal line may be the shortest.
10)	Find the least positive integer k such that the product of 1998 and k has the same digits. (Like 11111, 22222, 33333 etc...)

Practice Examples: (Pattern)

1.
```
*****
*****
*****
*****
*****
```

2.
```
*****
****
*****
****
*****
```

3.
```
* * *
 * *
* * *
 * *
* * *
```

4.
```
*
**
***
****
*****
```

5.
```
*****
****
***
**
*
```

6.
```
*****
*   *
*   *
*   *
*****
```

7.
```
    *
   ***
  *****
 *******
*********
```

Problems: (Challenge)

1.
```
11111
12221
12321
12221
11111
```

2.
```
32123
22122
11111
22122
32123
```

3.
```
__x__
_x_x_
x___x
_x_x_
__x__
```

Answer can be found in the folder "/Examples/while/"

End of Chapter

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