Loops Control Structure

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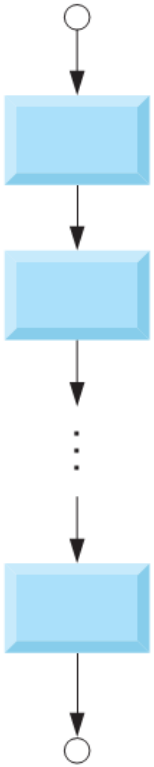
Loops

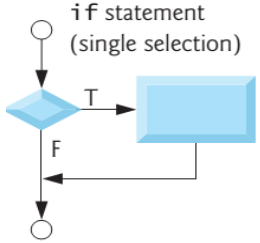
- The programs that we have developed so far used either a sequential or a decision control instruction.
  - In the first one, the calculations were carried out in a fixed order.
  - While in the second, an appropriate set of instructions were executed depending upon the outcome of the condition being tested (or a logical decision being taken).

Sequence

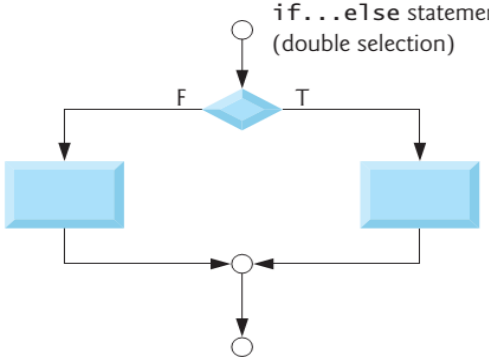


Selection

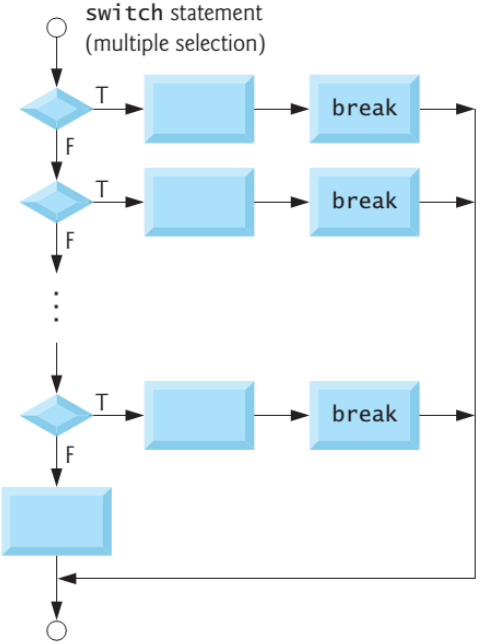
`if` statement
(single selection)



`if...else` statement
(double selection)



`switch` statement
(multiple selection)



Loops

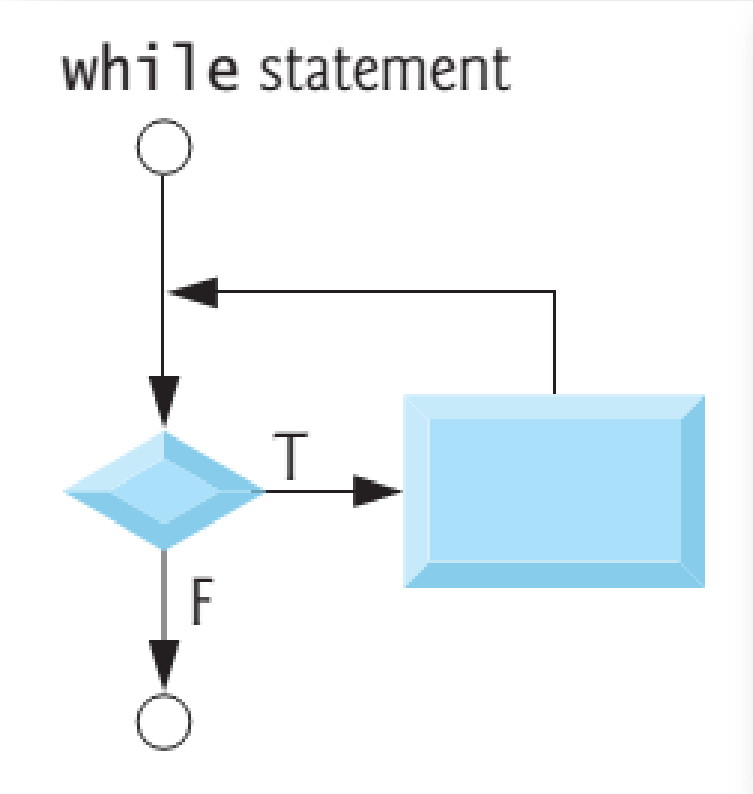
- The versatility of the computer lies in its ability to perform a set of instructions repeatedly.
  - This repetition operation is done through loop structure.
  - There are three structure through which we can repeat the part of a program.
    - While loop
    - For loop
    - Do while loop

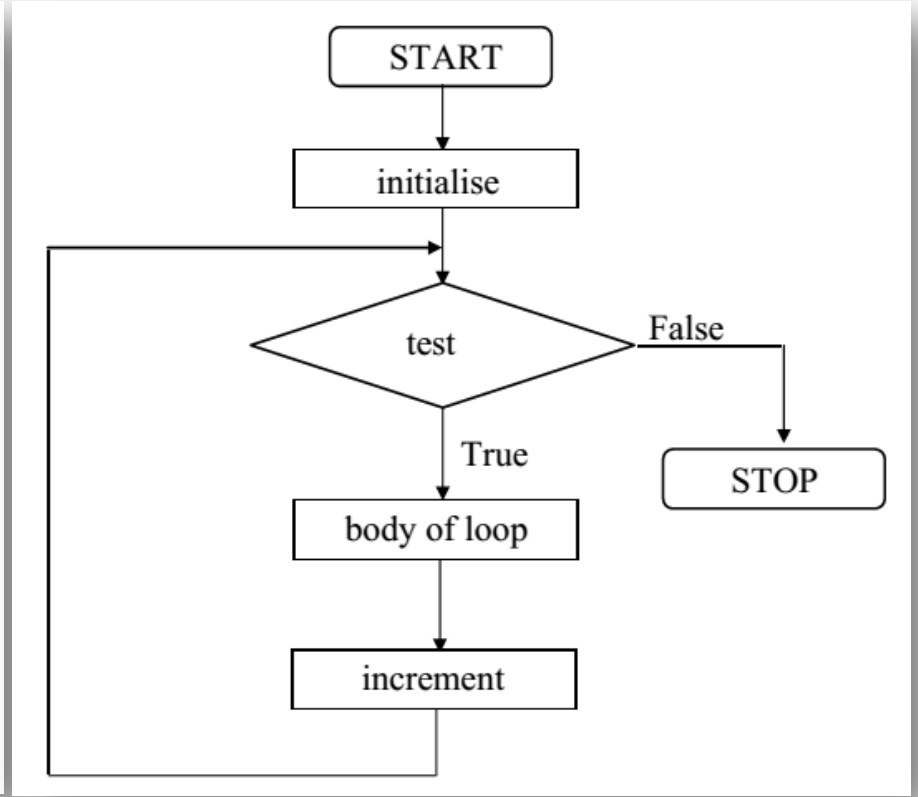
The while loop

- The while loop continues to loop while some condition is true.
  - When the condition becomes false, the looping is discontinued.
  - The general from of while loop is,

```
initialize loop counter ;
while(test loop counter using a condition)
{
do this;
 and this;
increment loop counter ;
}
```

Flow chart of while loop





Important points

- In place of the condition there can be any other valid expression.
  - So long as the expression evaluates to a non-zero value the statements within the loop would get executed.
  - The condition being tested may use relational or logical operators as shown in the following examples:

```
while ( i <= 10 )
while ( i >= 10 && j <= 15 )
while ( j > 10 && ( b < 15 || c < 20 ) )
```

The while loop

- The statements with in the loop may be one or multiple. Braces are optional, for example,

```
while ( i <= 10 )
    i = i + 1 ;

is same as

while ( i <= 10 )
{
    i = i + 1 ;
}
```

The while loop

- As a rule the while must test a condition that will eventually become false, otherwise the loop would be executed forever, indefinitely.

```
main( )
{
    int   i = 1 ;
    while ( i <= 10 )
          printf ( "%d\n", i ) ;
}
```

  - This is an indefinite loop since i=1 remains forever.

The while loop

- The correct form would be as under,

```
#include<stdio.h>
#include<conio.h>
main()
{
int i=0;
    while (i<10)
    {
    printf("%d\n", i);
    i++;
    }
getche();
}
```

The while loop

- Instead of incrementing, we can decrement the counter as well, for example,

```
#include<stdio.h>
#include<conio.h>
main( )
{
int i = 5 ;
   while (i>=1)
   {
    printf ("%d\n", i);
    i = i - 1 ;
   }
getche();
}
```

The while loop

- It is not necessary that a loop counter must only be an int. it can be even float.

```
#include<stdio.h>
#include<conio.h>
main( )
{
float a = 10.0 ;
   while(a<=10.5)
   {
      printf ("\n %f Hmmmm rain !!!", a);
      printf (" Enjoy the awsome weather ....");
      a = a + 0.1 ;  //increament counter
   }
getche();
}
```

More operators

(a)
```
main( )
{
    int  i = 1 ;
    while ( i <= 10 )
    {
        printf ( "%d\n", i ) ;
        i = i + 1 ;
    }
}
```

(b)
```
main( )
{
    int  i = 1 ;
    while ( i <= 10 )
    {
        printf ( "%d\n", i ) ;
        i++ ;
    }
}
```

(c)
```
main( )
{
    int  i = 1 ;
    while ( i <= 10 )
    {
        printf ( "%d\n", i ) ;
        i += 1 ;
    }
}
```

(e)
```
main( )
{
    int  i = 0 ;
    while ( ++i <= 10 )
        printf ( "%d\n", i ) ;
}
```

Problem statement 1

- A class of ten students took a quiz. The grades (integers in the range 0 to 100) for this quiz are available to you. Determine the class average on the quiz.

Solution

```c
/* Fig. 3.6: fig03_06.c
   Class average program with counter-controlled repetition */
#include <stdio.h>

/* function main begins program execution */
int main( void )
{
   int counter; /* number of grade to be entered next */
   int grade; /* grade value */
   int total; /* sum of grades input by user */
   int average; /* average of grades */

   /* initialization phase */
   total = 0; /* initialize total */
   counter = 1; /* initialize loop counter */

   /* processing phase */
   while ( counter <= 10 ) { /* loop 10 times */
      printf( "Enter grade: " ); /* prompt for input */
      scanf( "%d", &grade ); /* read grade from user */
      total = total + grade; /* add grade to total */
      counter = counter + 1; /* increment counter */
   } /* end while */

   /* termination phase */
   average = total / 10; /* integer division */

   printf( "Class average is %d\n", average ); /* display result */
   return 0; /* indicate program ended successfully */
} /* end function main */
```

```
Enter grade: 98
Enter grade: 76
Enter grade: 71
Enter grade: 87
Enter grade: 83
Enter grade: 90
Enter grade: 57
Enter grade: 79
Enter grade: 82
Enter grade: 94
Class average is 81
```

Problem statement 2

- Find out the factorial of a given number using while loop???

Solution

```
//Factorial of a number
#include<stdio.h>
#include<conio.h>
main()
{
int number,factorial;
clrscr();
printf("\nEnter a number.  ");
scanf("%d",&number);
factorial=1;
while (number>0) //while loop continues util test condition number>0 is true
{
factorial=factorial*number;
--number;
}
printf("Factorial= %d",factorial);
getche();
}
```

Output !!!

Enter a number. 5
Factorial= 120

Problem statement 3

- Find the sum of all the digits from 1 to given number???

Solution

```
//sum of all the digits (from 1 to given number)
#include<stdio.h>
#include<conio.h>
main()
{
int number,sum;
clrscr();
printf("\nEnter a number.  ");
scanf("%d",&number);
sum=0;
while (number>0) //while loop continues util test condition number>0 is true
{
sum=sum+number;
number = number - 1;
}
printf("Sum = %d", sum);
getche();
}
```

Output !!!

Enter a number. 5
Sum = 15

Problem statement 4

- Write a program that find the even upto a given number and add all the those even numbers?

Solution

```
//Find the even upto a given number and add all the even upto given number)
#include<stdio.h>
#include<conio.h>
main()
{
int n=0, number;
int total=0;
clrscr();
printf("\nEnter a number.  ");
scanf("%d",&number);
   while (n<=number)
   {
      if(n%2==0)
      {
      printf("%d\n", n);
      total=total + n;
      }   //End of if
   n++;
   }   // End of while loop
printf("\nSum of all the even from 1 to %d is %d", number, total);
getche();
}
```

Output !!!

Enter a number. 10
0
2
4
6
8
10

Sum of all the even from 1 to 10 is 30

Problem statement 5

- Generate the following output using while loop? (table of 2)


```
Output !!!

Enter a number.  16
1 x 2 = 2
2 x 2 = 4
3 x 2 = 6
4 x 2 = 8
5 x 2 = 10
6 x 2 = 12
7 x 2 = 14
8 x 2 = 16
9 x 2 = 18
10 x 2 = 20
11 x 2 = 22
12 x 2 = 24
13 x 2 = 26
14 x 2 = 28
15 x 2 = 30
16 x 2 = 32
```

Solution

```
//Table of 2 using while loop
#include<stdio.h>
#include<conio.h>
main()
{
int n=1, number;
clrscr();
printf("\nEnter a number.  ");
scanf("%d",&number);
    while (n<=number)
    {
    printf("%d x 2 = %d\n", n, n*2);
    n++ ;
    }
getche();
}
```

Problem statement 6

- Write a program that print ASCII 8 table against the (letters, number, symbols etc) using while loop???

Solution

```
//ASCII 8 Table using while loop
#include<stdio.h>
#include<conio.h>
main( )
{
 int x = 0 ;
 printf(" \n---- ASCII 8 Table ----\n");
 while ( x <=255 )
{
  printf ( "%c --- > %d\n", x, x) ;
  x++;
}
getche();
}
```

Analyze the output???


THANKS