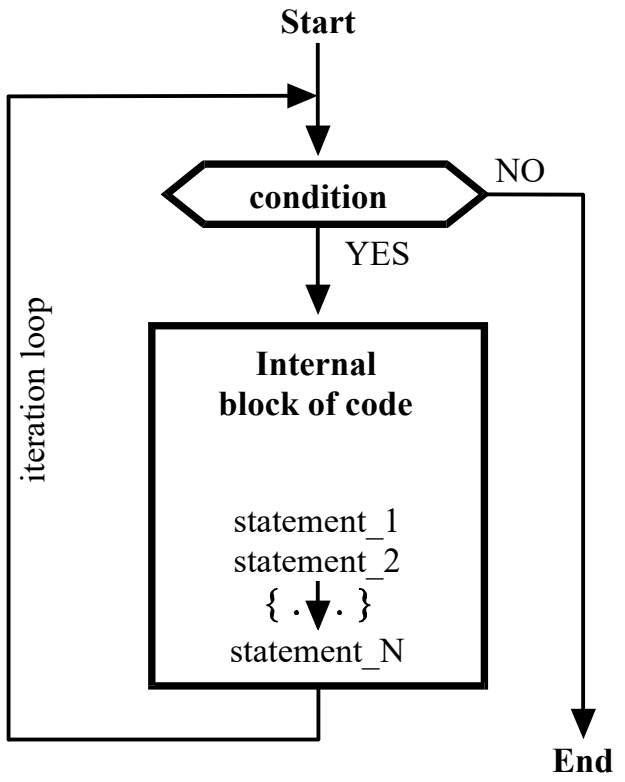
REPETITIVE STATEMENTS – LOOPS

- **while( )** loop




```
while ( condition )
    statement;
```

```
while ( condition )
 {
     statement_1;
     statement _2;
     . . .
     statement_N;
 }
```

The loop is executed as long as the value of the condition is **not zero**

Examples:

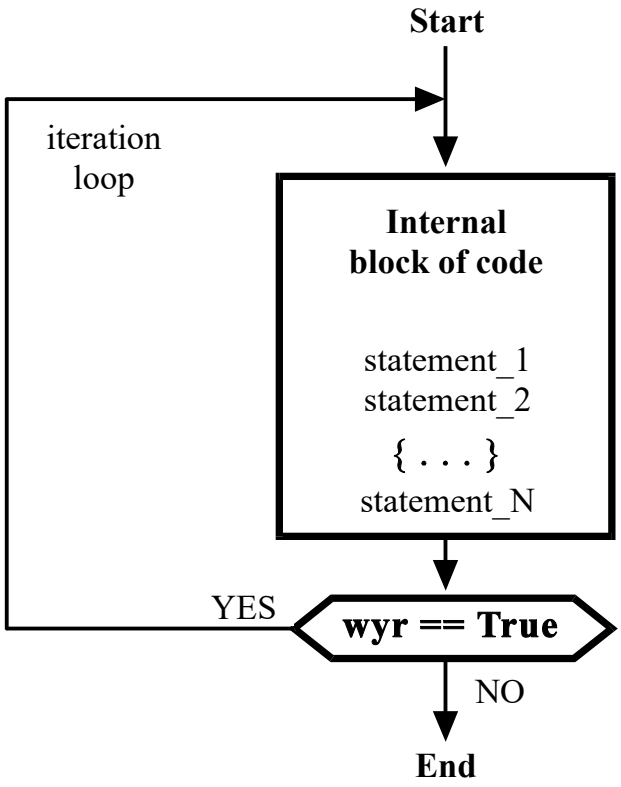
```
int i ;  // a loop displaying numbers 1,2,3 ...
i = 1;
while( i <=10 )
  {
    printf ( "%2d\n" , i );
    i = i + 1;
  }
```

```
int i = 1;  // 1, 2, 3, . . . in another notation
while( i<11 )
   printf ( "%2d\n" , i++ );
```

```
int i ;  // a loop displaying numbers 10,9,8
i = 10;
while( i != 0 )
  {
    printf ( "%2d\n" , i );
    i = i – 1;
  }
```

```
int i = 10;  //10, 9, 8, . . . in another notation
while( i )
   printf ( "%2d\n" , i –– );
```

- **do while( )** loop




```
do
    statement;
while ( condition );
```

```
do
   {
       statement_1;
       statement_2;
   . . .
       statement_N;
   }
while ( condition );
```

The loop is executed as long as the value of the condition is **not zero**

Examples:

```
int i ;  // a loop displaying numbers 1,2,3 ...
i = 1;
do
  {
    printf ( "%2d\n" , i );
    i = i + 1;
  }
while( i<=10);
```

```
int i = 1;  // 1, 2, 3, . . .  in another notation
do
   printf ( "%2d\n" , i );
while( ++i <11 );
```

```
int i ;  // a loop displaying numbers 10,9,8
i = 10;
do
  {
    printf ( "%2d\n" , i );
    i = i – 1;
  }
 while( i != 0 );
```

```
int i = 10;  // 10, 9, 8, . . . in another notation
do
   printf ( "%2d\n" , i );
while( – –i );
```

example 1: *Reading the keyboard keys until you press 'k' – with a **„while"** loop*

```
#include <stdio.h>                                   // implementation in C
#include <conio.h>
// library <conio.h> containing function getch()

int main( void )
{
   char key = 'a';
   while( key != 'k' ) {
      printf( "\n press any key: " );
      key = getch( );
   }
}
```

example 2: *Reading the keyboard keys until you press ESC button – with a **„do while"** loop*

```
#include <stdio.h>                                   // implementation in C
#include <conio.h>

int main( void )
{
   char key;
   do {
      printf( " \n press any key: " );
      key = getche( );                          // the "e" echo variant of getch()
   } while(key != 27 );                         // 27 = the code of ESCape key
}
```

example 3: *Display a line constructed from 10 characters „minus"*

```
#include <stdio.h>                                   // implementation in C

int main( )
{
   int counter=0;  while( counter<10 ) {  printf( "-" );  counter++;  }
}
```

example 4: *Simulation of a dice: drawing numbers from range 1÷6, until hitting „six"*

```
#include <stdio.h>                                   // implementation in C
#include <stdlib.h>          // library containing functions „rand" i „srand"
#include <time.h>            // library containing function „time"

int main( )
{
   int  random_number;
   srand( time(0) );
   do {
        random_number = rand()%6 + 1;                    // simulate a dice roll
        printf("\n Selected random number: %d ", random_number );

   } while(random_number != 6 );
   printf( "\n\n Done! Press ENTER to finish the program" );  getchar();
}
```

- Loop **for(; ;)**

for(*initialization* **;** *condition* **;** *modification* **)**
    internal_statement ;

is equivalent of construction:

```
initialization ;
while( condition )
  {
    internal_statement ;
    modification ;
  }
```

```
int i ;
i = 10;
while( i != 0 )
  {
    printf ( "%2d\n" , i );
    i = i – 1;
  }
```

```
int i ;
for( i = 10; i != 0 ; i = i – 1 )
  printf( "%2d\n" , i );
```

or another notation:

```
for(int i = 10; i ;––i ) printf("%2d\n" , i );
```

example 5: *Display a bar from 80 characters '#'*

```
#include <stdio.h>
int main( )
{
  for( int i=0 ; i<80 ; ++i )  printf( "# " );
}
```

example 6: *Program printing the table of selected ASCII codes*

```
#include <stdio.h>
int main( )
{
  for( int code=32; code <256; ++code )
    printf( "%4d = %c" , code , code );
}
```

example 7: *Primitive calculator for adding a numbers typed on the keyboard*

```
#include <stdio.h>
int main( )
{
  double sum=0, number;
  while( scanf( "%lf" , & number ) )
    printf( "\t%.2f\n" , sum+= number );
}
```

example 8: *Calculate the sum of **N** numbers, loaded from the console*

```
#include <stdio.h>                                          // implementation in C
int main( )
{
   int i, N;
   float number, sum;
   printf( "How many numbers would you like to sum N = " );
   scanf( "%d" , &N );
   sum=0;
   for( i=1; i<=N; ++i )
      {
         printf(  "Enter %d number:  " , i ) ;
         scanf( "%f",  &number );
         sum = sum+number;
      }
   printf( "The sum of %d entered numbers is: %.3f " , N , sum );
   return 0;
}
```

example 9: *Drawing on the screen, rectangular frame with given coordinates*

```
#include <stdio.h>                                          // implementation in C

      #include <windows.h>          // library available only in MS Windows operating system
      #include <conio.h>            // nonstandard conio library (console input / output) DOS / Windows

      void gotoxy(int x, int y)     // example implementation of the "cursor positioning" in the text console
      {
         HANDLE hConsole = GetStdHandle(STD_OUTPUT_HANDLE);
         struct COORD pos;     pos.X = x;      pos.Y = y;
         SetConsoleCursorPosition(hConsole, pos);
      }

int main()
{
   int x1, y1, x2, y2, x, y;
   printf("Enter the coordinates of first corner \n\r X1 = ");        scanf("%d", &x1);
   printf("\n Y1 = ");                                               scanf("%d", &y1);
   printf("\n The coordinates of second corner \n\r X2 = ");        scanf("%d", &x2);
   printf("\n Y2 = ");                                               scanf("%d", &y2);
   gotoxy(x1, y1);
   for (x = x1; x <= x2; ++x )                                      // drawing the top border
      printf("-");
   gotoxy(x1, y2);
   for (x = x1; x <= x2; ++x )                                      // drawing the bottom border
      printf("-");
   for ( y = y1 + 1; y < y2; ++y )
   {
      gotoxy(x1, y);   printf("|");                                 // drawing the left border
      gotoxy(x2, y);   printf("|");                                 // drawing the left border
   }
   while ( kbhit() )  getch();  // the kbhit () checks, if there is anything in the keyboard buffer
   getch();                     //  getch ()reads and removes one character from the keyboard buffer
}
```

example 10: *Displaying all numbers from range 1÷1000 divisible by 13*

```
#include <stdio.h>                                   // implementation in C
int main( )
{
   for( int number=13; number<=1000; number+=13 )
      printf( "%3d \n " , number );
}
```

example 11: *Display all pairs of numbers (2-tuples) x,y∈[1,100] satisfying the equation:* $x^2 + y^2 < 500$

```
#include <stdio.h>
int main( )
{
   for( int x=1; x<100; ++x )
      for( int y=1; y<100; ++y )
         if( x*x + y*y < 500 )
            printf( "\n x=%d  y=%d" , x, y);
}
```

example 12: *The program which classifies keystrokes*

```
#include <stdio.h>                                   // implementation in C
#include <conio.h>
#define ESC  27                                      // definition of a keyboard code for «Escape»
int main(void)
   {
      int key=0;
      while( key != ESC )
         {
            printf( "\n\nPress any key (ESC->to finish): " );
            key = getch();
            if(  'a'<=key  &&  key<='z'  )
               printf( "=> This is lowercase letter " );
            else if(  'A'<=key  &&  key<='Z'  )
               printf( "=> This is uppercase letter " );
            else if(  '0'<=key  &&  key<='9'  )
               printf( "=> This is digit " );
            else if( key == 13 )
               printf( "=> This is ENTER key " );
            else if( key == ' ' )
               printf( "=> This is space key ");
            else
               printf( "=> Unrecognized key ");
         }
   }
```

```
#include <stdio.h>          // Example 13 : program which classifies "function" keys
#include <conio.h>
#include "my_key_definition.h"          // including the file with my private definitions
int main( void )
  {
    int key, key2;
    do
      {
        printf( "\n\n Press any key:  " );
        key = getch( );
        switch( key )
          {
            case ENTER  :  printf( "This is ENTER" );    break;
            case ESC    :  printf( "This is ESCAPE" );   break;
            case PREFIX :  // is first code equal to prefix (224 or 0) ?
                  key2 = getch( );
                  switch( key2 )
                  {
                    case DELETE      :  printf( "Delete" );      break;
                    case UP_ARROW    :  printf( "Up arrow" );    break;
                    case DOWN_ARROW  :  printf( "Down arrow" );  break;
                  }
                  break;
            case BACKSPACE :  printf( "This is BACKSPACE" );    break;
            default  : printf( "Another – unrecognized key " );   break;
          }
      }
    while( key != ESC );
  }
```

```
// File «my_key_definitions.h»  which contains my definitions of codes for selected keys
#ifndef   MY_KEY_DEFINITIONS
      #define   MY_KEY_DEFINITIONS
      #define   PREFIX            224

      // single code keys
      #define   ESC               27
      #define   ENTER             13
      #define   BACKSPACE          8

      // additional "function" keys – encoded with two numbers
      #define   DELETE            83          //  224, 83
      #define   UP_ARROW          72          //  224, 72
      #define   DOWN_ARROW        80          //  224, 80
      #define   LEFT_ARROW        75          //  224, 75
      #define   RIGHT_ARROW       77          //  224, 77
      #define   HOME              71          //  224, 71
      #define   END               79          //  224, 79
#endif
```