CSE101-Lec 7

Control Structures

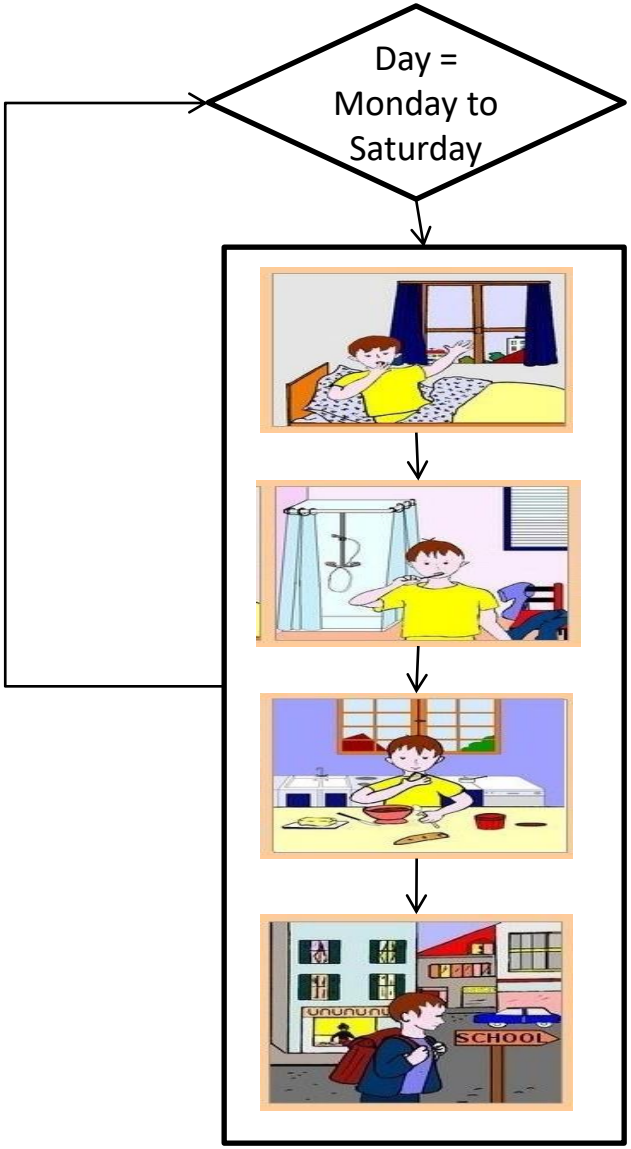
(Repetition structure)

Jump Statements

Outline

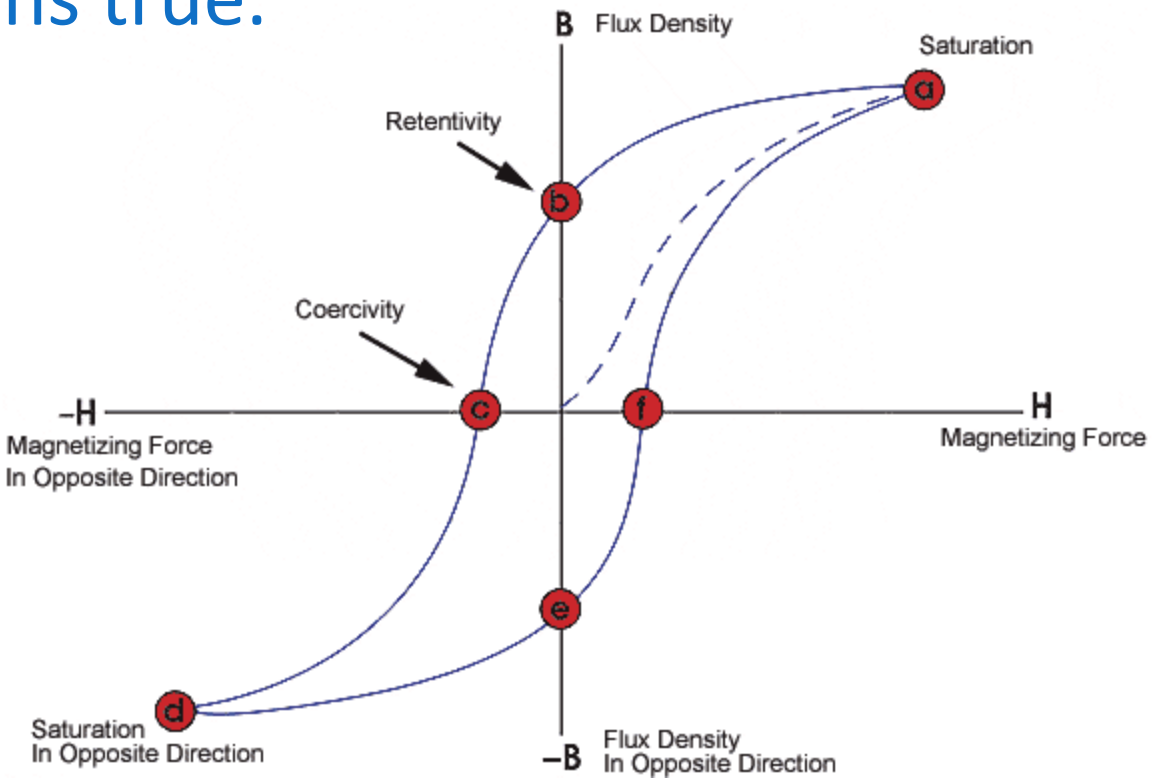
- Repetition structure/Control Loop Statements
  - for statement
  - while statement
  - do-while statement
- Jump Statements
  - break
  - continue
  - goto
  - return

Repetition(Going to School)



Repetition Statement

- A **repetition statement** allows you to specify that an action is to be repeated while some condition remains true.



Looping (repetition)

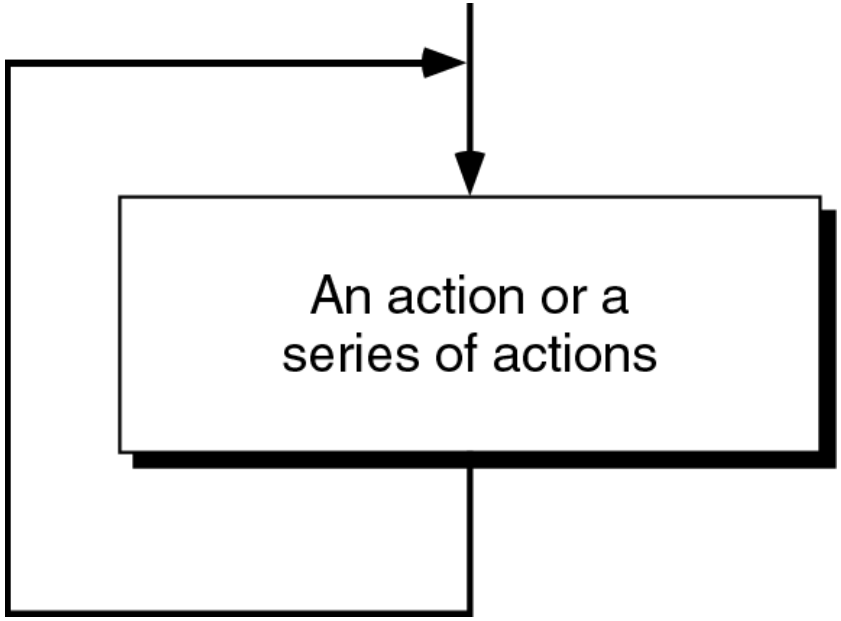
- *What if we want to display hello 500 times?*
  - Should we write 500 printf statements or equivalent ?

➢ Obviously not.

- It means that we need some programming facility to repeat certain works.
- Such facility is available in form of ***looping statements.***

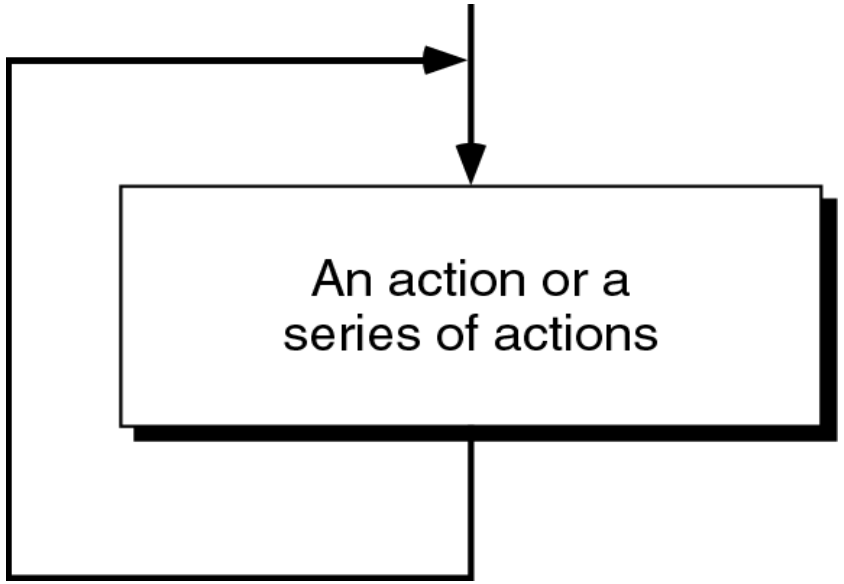
Loop

- The main idea of a loop is to repeat an action or a series of actions.



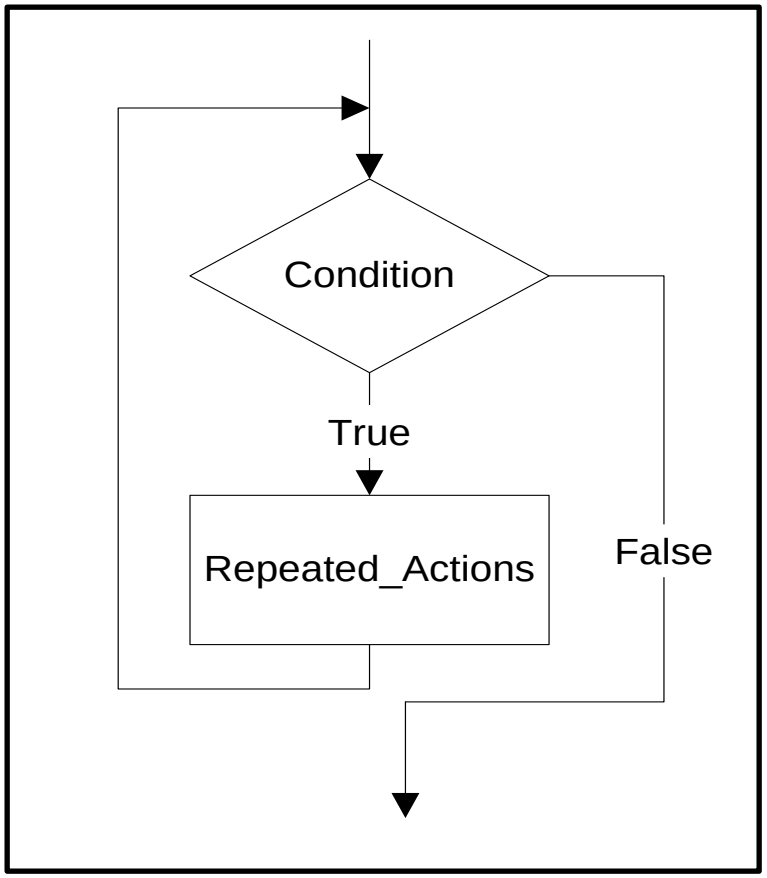
The concept of a loop without condition

- But, when to stop looping?
- In the following flowchart, the action is executed over and over again. It never stops – This is called an infinite loop
- **Solution** – put a condition to tell the loop either continue looping or stop.



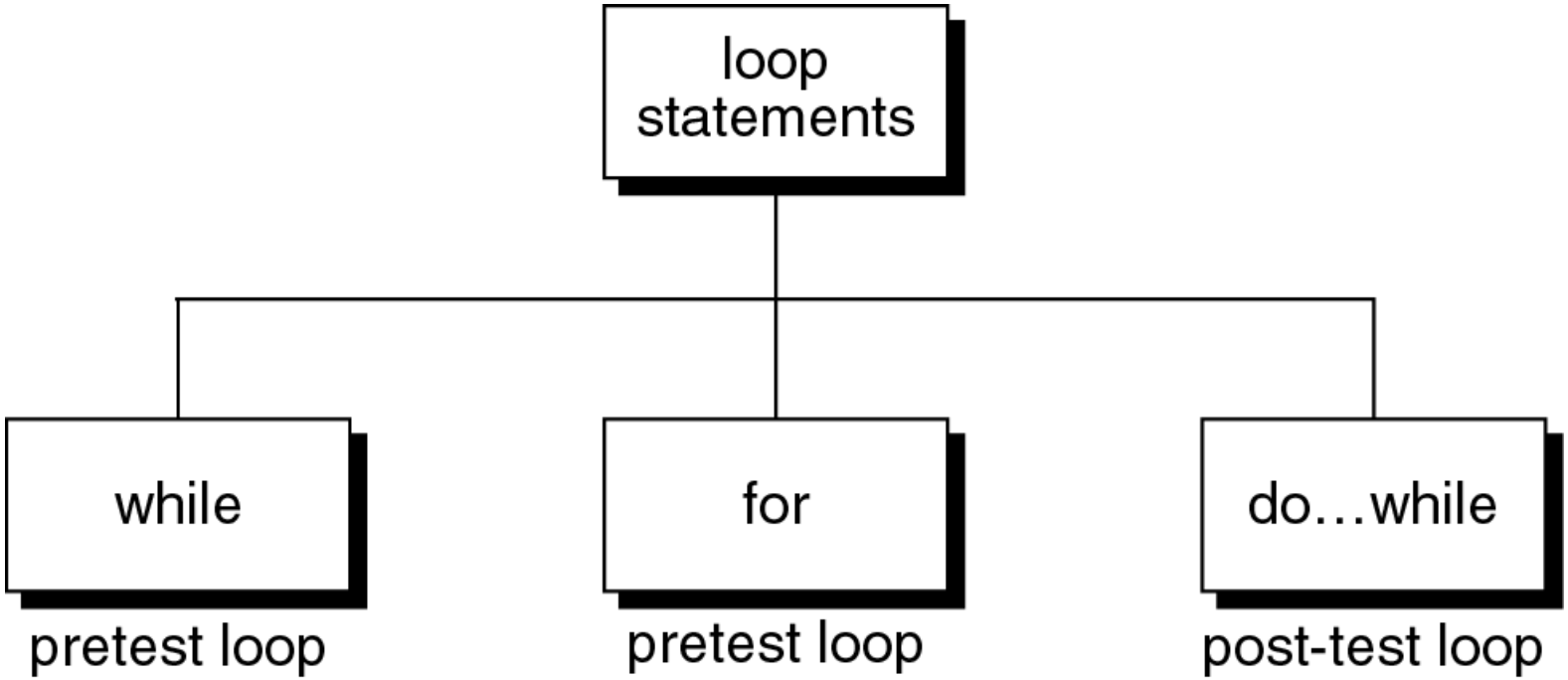
Loop

- A loop has two parts – **body** and **condition**
- **Body** – a statement or a block of statements that will be repeated.
- **Condition** – is used to control the iteration – either to continue or stop iterating.



Loop statements

- C provides three loop statements:

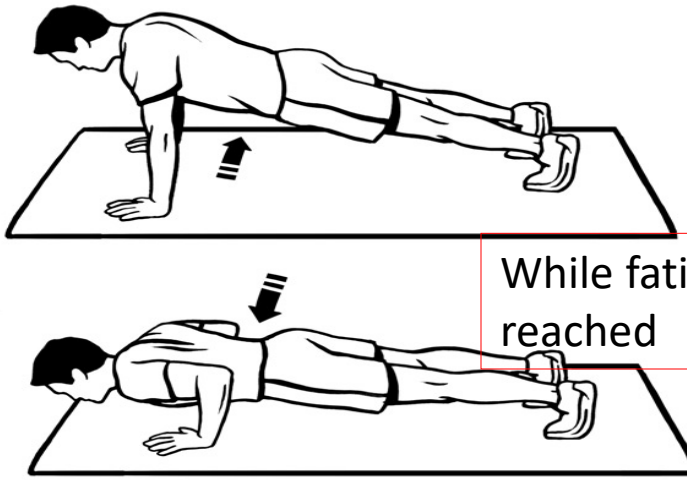


The "while" Statement in C

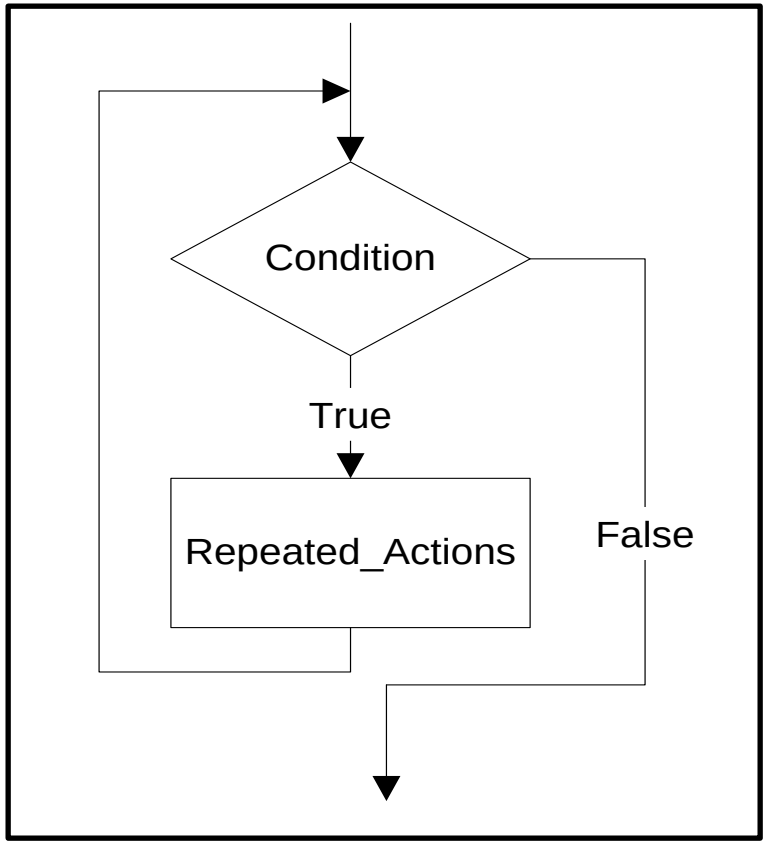
- The syntax of **while** statement in C:

Syntax

```
while (loop repetition condition){
   statement;
   updating control;
}
```



While fatigue level is not reached



while statement

```
while(loop repetition condition)
{
   Statements;
}
```

Loop repetition condition is the condition which controls the loop.

- The ***statement*** is repeated as long as the loop repetition condition is **true**.
- A loop is called an **infinite loop** if the loop repetition condition is always true.

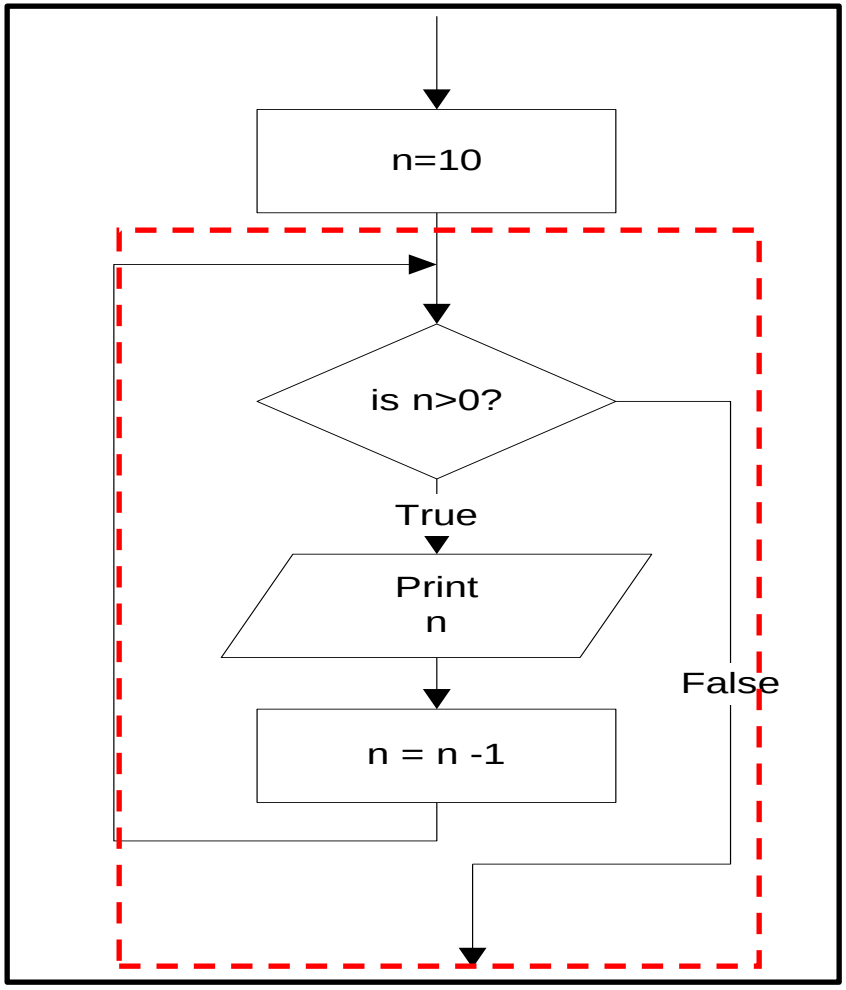
while statement

Example: This while statement prints numbers 10 down to 1

```
#include<stdio.h>
int main()
{
 int n=10;
 while (n>0){
  printf("%d ", n);
  n=n-1;
 }
}
```

```
10 9 8 7 6 5 4 3 2 1
```

count condition



The for Statement in C

- The syntax of `for` statement in C:

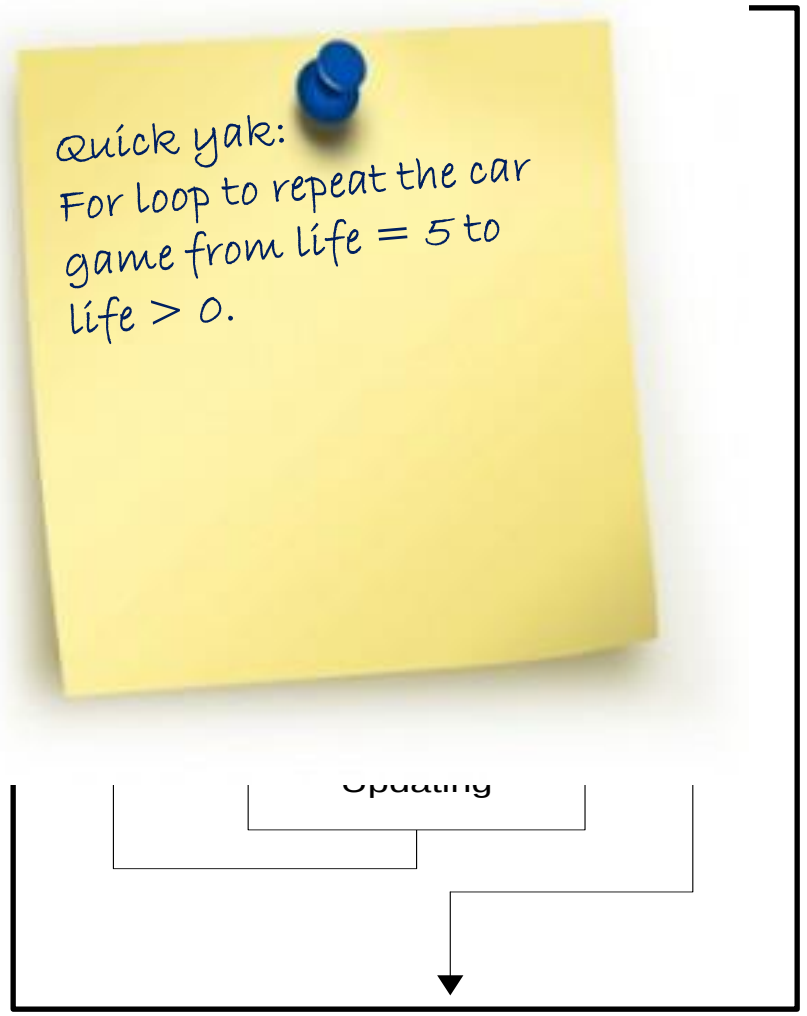
Syntax

```
for (initialization-expression;
        loop-repetition-condition;
        update-expression){
  statement;
}
```

- The **initialization-expression** set the initial value of the loop control variable.
- The **loop-repetition-condition** test the value of the loop control variable.
- The **update-expression** update the loop control variable.

for statement

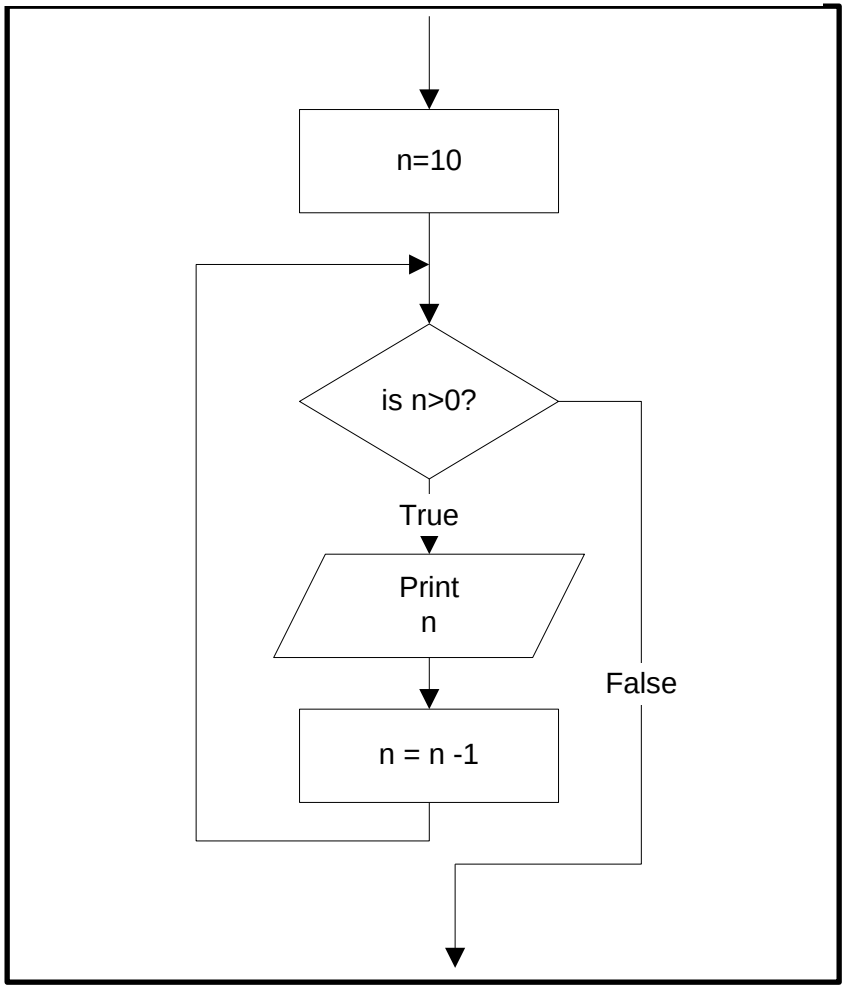
```
for (Initialization; Condition; Updating)
{
   Repeated_Actions;
}
```



for statement

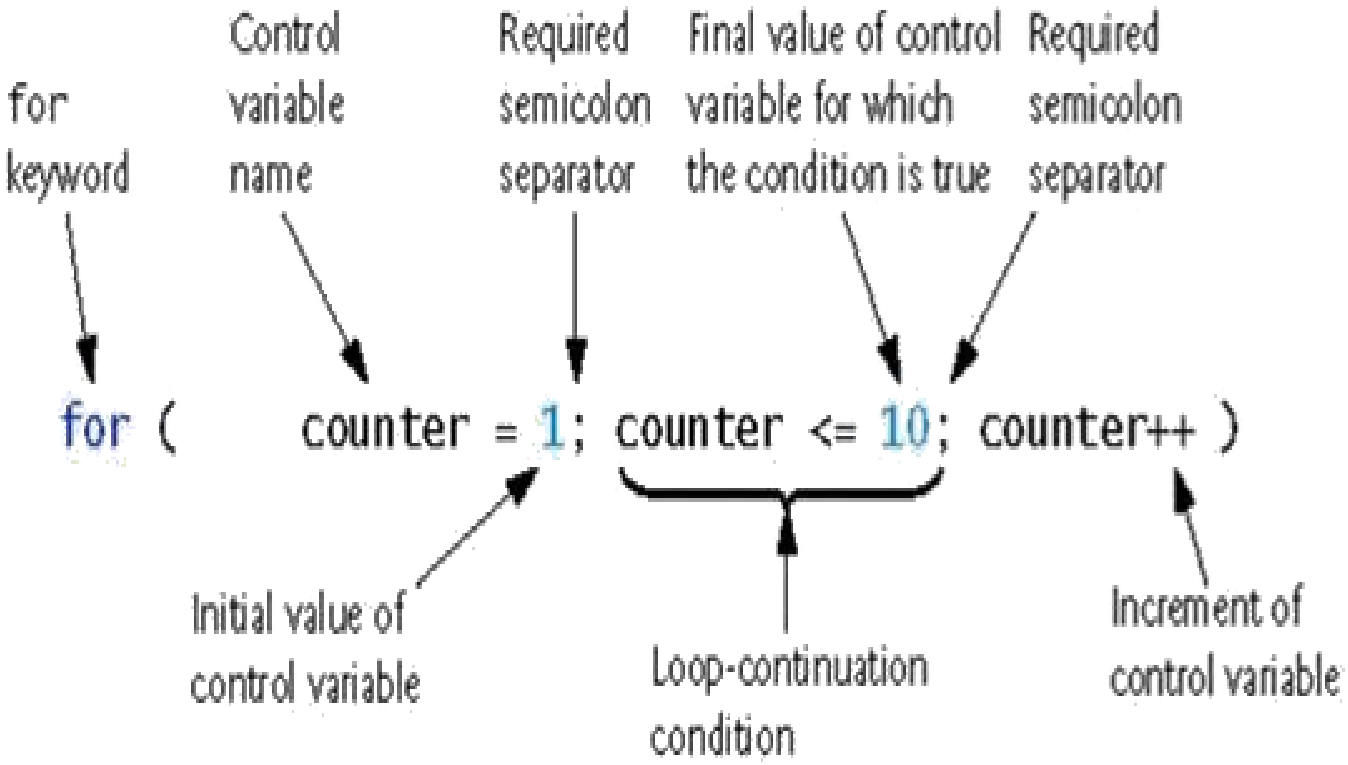
Example: This for statement prints numbers 10 down to 1

```
#include<stdio.h>
int main()
{
 int n;
 for (n=10; n>0; n=n-1){
  printf("%d ", n);
 }
}
```




```
10 9 8 7 6 5 4 3 2 1
```

Do TEN push ups = for count=1; count<=10; count++


for keyword
Control variable name
Required semicolon separator
Final value of control variable for which the condition is true
Required semicolon separator
for (counter = 1; counter <= 10; counter++)
Initial value of control variable
Loop-continuation condition
Increment of control variable

Nested Loops

- Nested loops consist of an **outer loop** with one or more **inner loops**.
  - Eg:

```
for (i=1;i<=100;i++){
      for(j=1;j<=50;j++){
            …
      }
}
```

Outer loop

Inner loop

- The above loop will run for 100*50 iterations.

Program to print tables up to a given number.

```
#include<stdio.h>
void main()
{
 int i,j,k ;
 printf("Enter a number:");
 scanf("%d", &k);
 printf("the tables from 1 to %d: \n",k);
 for(i=1; i<k; i++){
   for(j=1; j<=10; j++){
     printf("%d ",i*j);
    } //end inner for loop
   printf("\n");
 } //end outer for loop
getch();
} //end main
```

```
Enter a number
4
The tables from 1 to 4
1 2 3 4 5 6 7 8 9 10
2 4 6 8 10 12 14 16 18 20
3 6 9 12 15 18 21 24 27 30
4 8 12 16 20 24 28 32 36 40
```

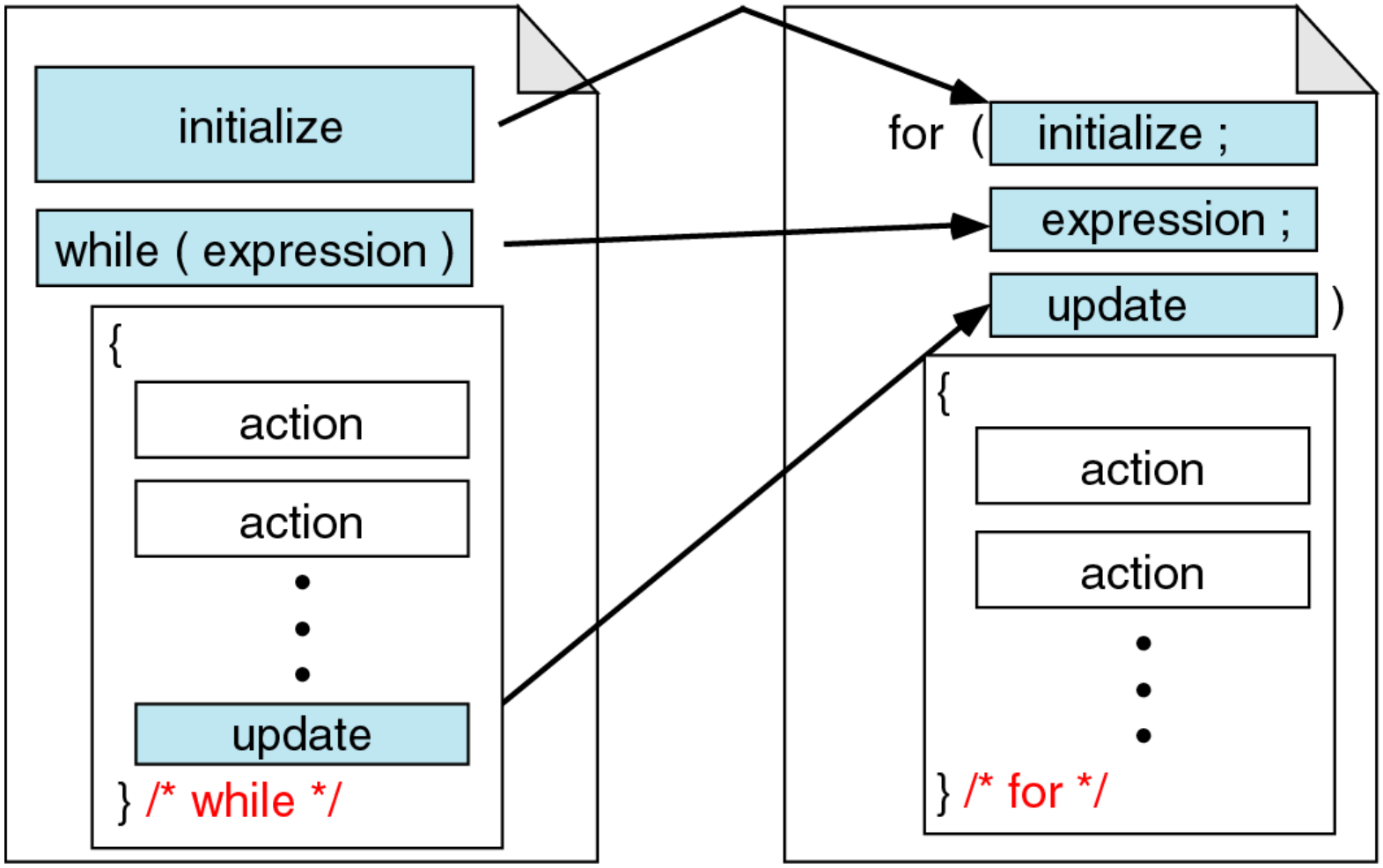
Program to display a pattern.

```
#include<stdio.h>
#include<conio.h>
void main()
{
 int i,j;
 printf("Displaying right angled triangle for 5 rows");
 for(i=1 ; i<=5 ; i++) {
   for(j=1 ; j<=i ; j++)
       printf("* ");
   printf("\n");
 }
}
```

Displaying right angled triangle for 5 rows

```
*
* *
* * *
* * * *
* * * * *
```

While vs. for statements



Comparing `for` and `while` loops

The `do-while` Statement in C

- The syntax of do-while statement in C:

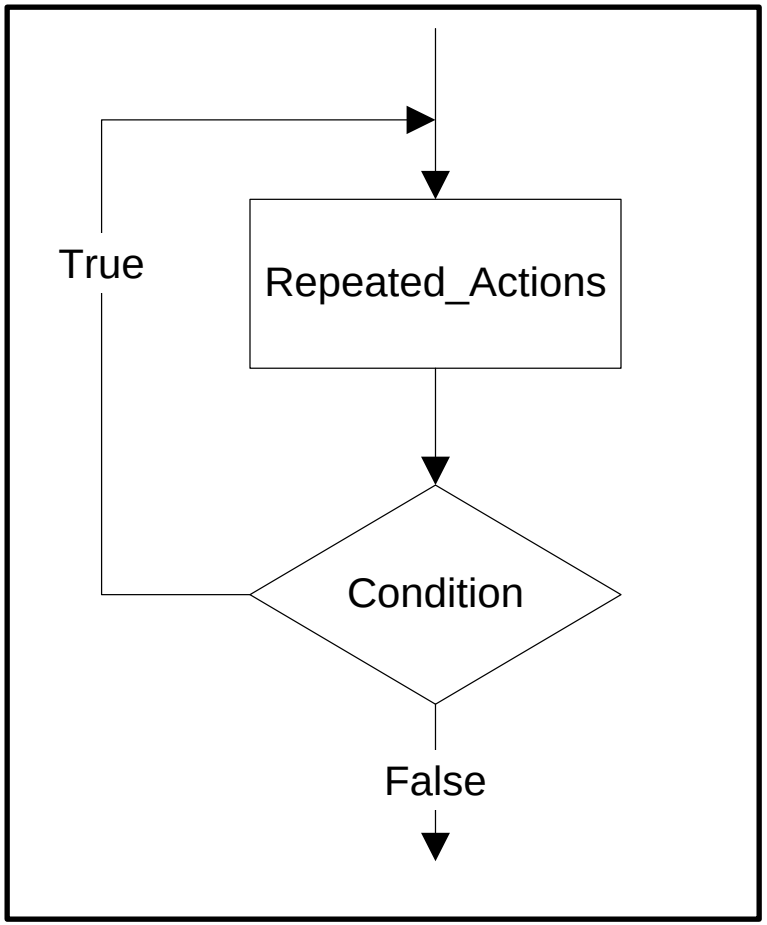
Syntax

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

- The *statement* executed at least one time.
- For second time, If the **condition** is true, then the *statement* is repeated else the loop is exited.

do…while statement

```
do
{
   Repeated_Actions;
} while (Condition);
```

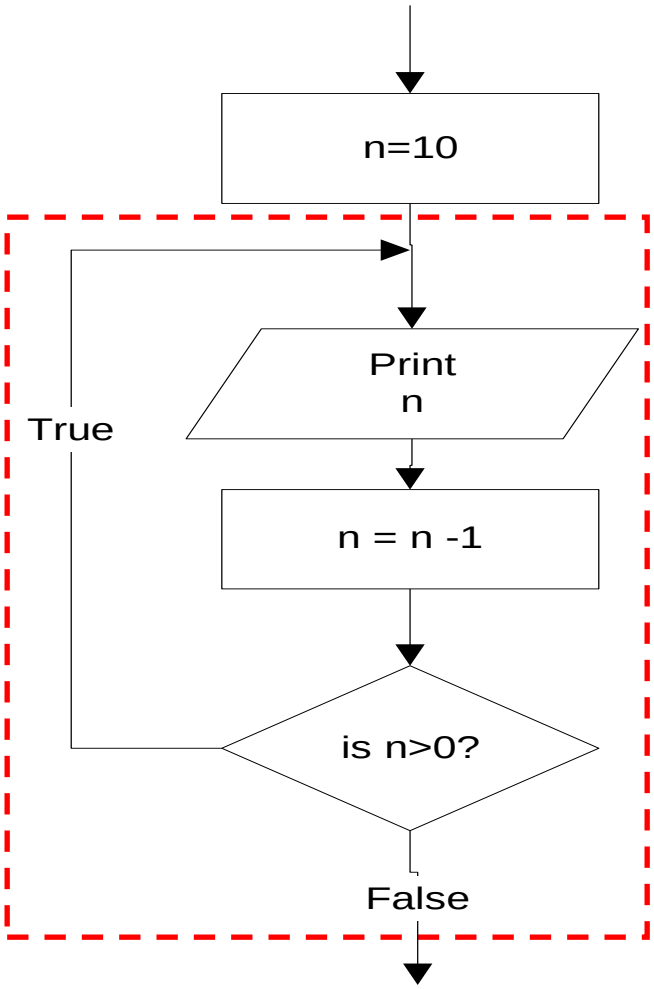


do…while statement

Example: this do…while statement prints numbers 10 down to 1

```
#include<stdio.h>
int main()
{
 int n=10;
 do{
  printf("%d ", n);
  n=n-1;
 }while (n>0);
}
```

```
10 9 8 7 6 5 4 3 2 1
```

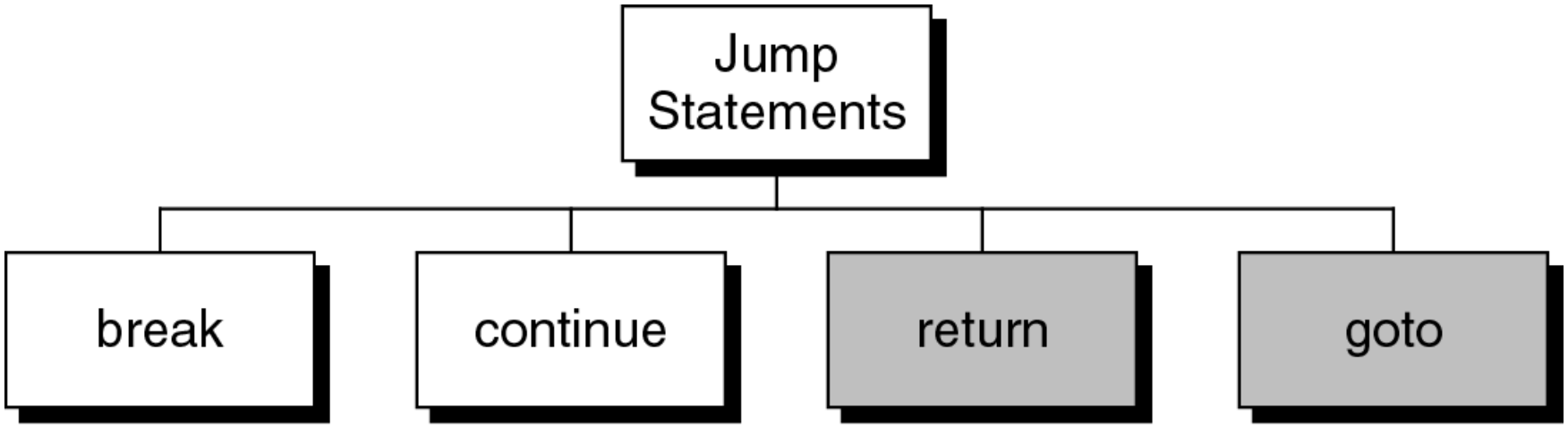


Difference between while and do..while

while loop	do..while loop
1. Condition is specified at the **top**	1. Condition is mentioned at the **bottom**
2. Body statements are executed when the condition is satisfied	2. Body statements are executed at least once even if the expression value evaluates to false
3. It is an **entry controlled** loop	3. It is an **exit controlled** loop
4.Syntax: **while** (**condition**) *statement;*	4.Syntax: **do** **{** *statements;* **}** **while** (**condition**);**

Jump statements

- You have learn that, the repetition of a loop is controlled by the loop condition.
- C provides another way to control the loop, by using **jump statements.**
- There are four jump statements:



`break` statement

- `break` is a keyword.
- `break` allows the programmer to **terminate** the loop.
- A `break` statement causes control to transfer to the first statement after the loop or block.
- The `break` statement can be used in nested loops. If we use `break` in the innermost loop then the control of the program is terminated only from the innermost loop.

break statement

```
##include<stdio.h>
int main()
{
 int n;
 for (n=10; n>0; n=n-1){
  if (n<8)
   break;
  printf("%d ", n);
 } //end for
}
```

Program to show use of break statement.

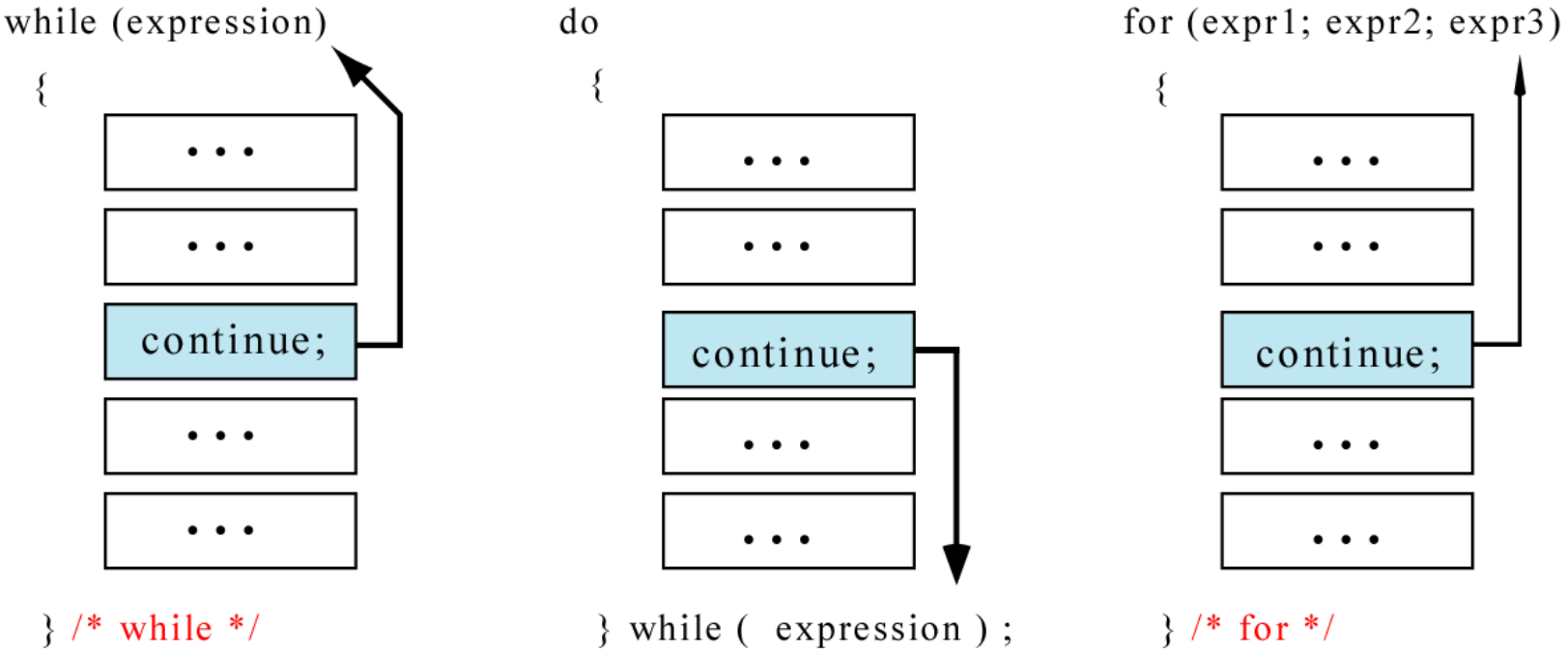
```
10 9 8
```

`continue` statement

- `continue` statement is exactly opposite to `break`.
- `continue` statement is used for continuing the next iteration of the loop statements
- When it occurs in the loop, it does not terminate, but skips the statements after this statement

`continue` statement

- In `while` and `do…while` loops, the continue statement transfers the control to the loop condition.
- In `for` loop, the continue statement transfers the control to the updating part.



continue statement

```
#include<stdio.h>
int main()
{
 int n;
 for (n=10; n>0; n=n-1){
  if (n%2==1)
     continue;
   printf("%d ", n);
 }
}
```

```
10 8 6 4 2
```

Program to show the use of continue statement in for loop

continue statement

```
#include<stdio.h>
int main()
{
 int n = 10;
 while(n>0){
  printf("%d", n);
  if (n%2==1)
    continue;
  n = n -1;
 }
}
```

For n=9, loop goes to infinite execution

Program to show the use of continue statement in for loop

```
10 9 9 9 9 9 ……
```

The loop then prints number 9 over and over again. It never stops.

goto

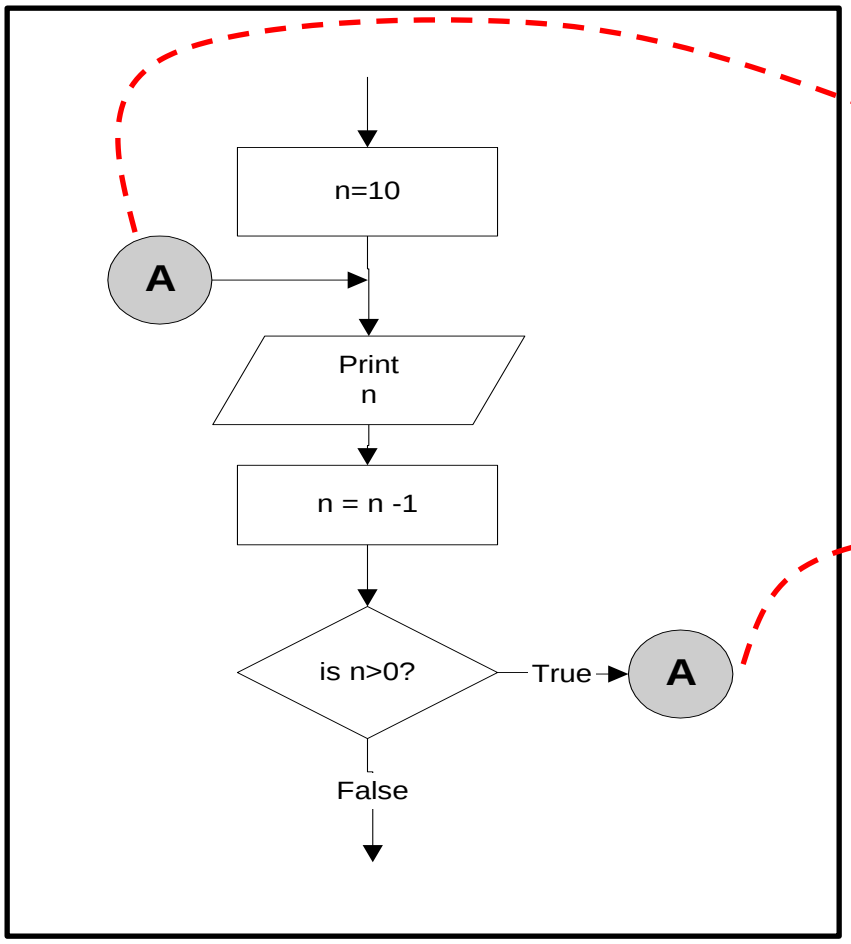
- **Unconditionally transfer control.**
- `goto` may be used for transferring control from one place to another.
- The syntax is:

```
goto identifier;
```

Control is unconditionally transferred to the location of a local label specified by *identifier*. For example,

```
Again:
...
goto Again;
```

goto statement




```
n=10;

A:
   printf("%d ", n);
   n = n -1;

   if (n>0)
         goto A;
```

```
Output:

10 9 8 7 6 5 4 3 2 1
```

Program to show goto statement.

```
#include<stdio.h>
void main()
{
 int x;
 printf("enter a number: ");
 scanf("%d",&x);
 if(x%2==0)
       goto even;
 else
       goto odd;
 even:
   printf(" %d is even", x);
   return;
 odd:
   printf("%d is odd", x);
}
```

```
enter a number: 18
18 is even
```

`return` statement

- **Exits the function.**
- return exits immediately from the currently executing function to the calling routine, optionally returning a value. The syntax is:
- return [*expression*];
- For example,

```
int sqr (int x){
    return (x*x);
 }
```