

ED1021 - Introduction to computation and visualisation

L7 - Loops in C

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Course web page: <https://ed.iitm.ac.in/~raman/introcomp.html>

Moodle page: Available at <https://courses.iitm.ac.in/>

When are they used

- To perform a task repeatedly.
- To run a program for a finitely large number of times.
- Loops can be written using one of the following:
 - while
 - do-while
 - for

while statement

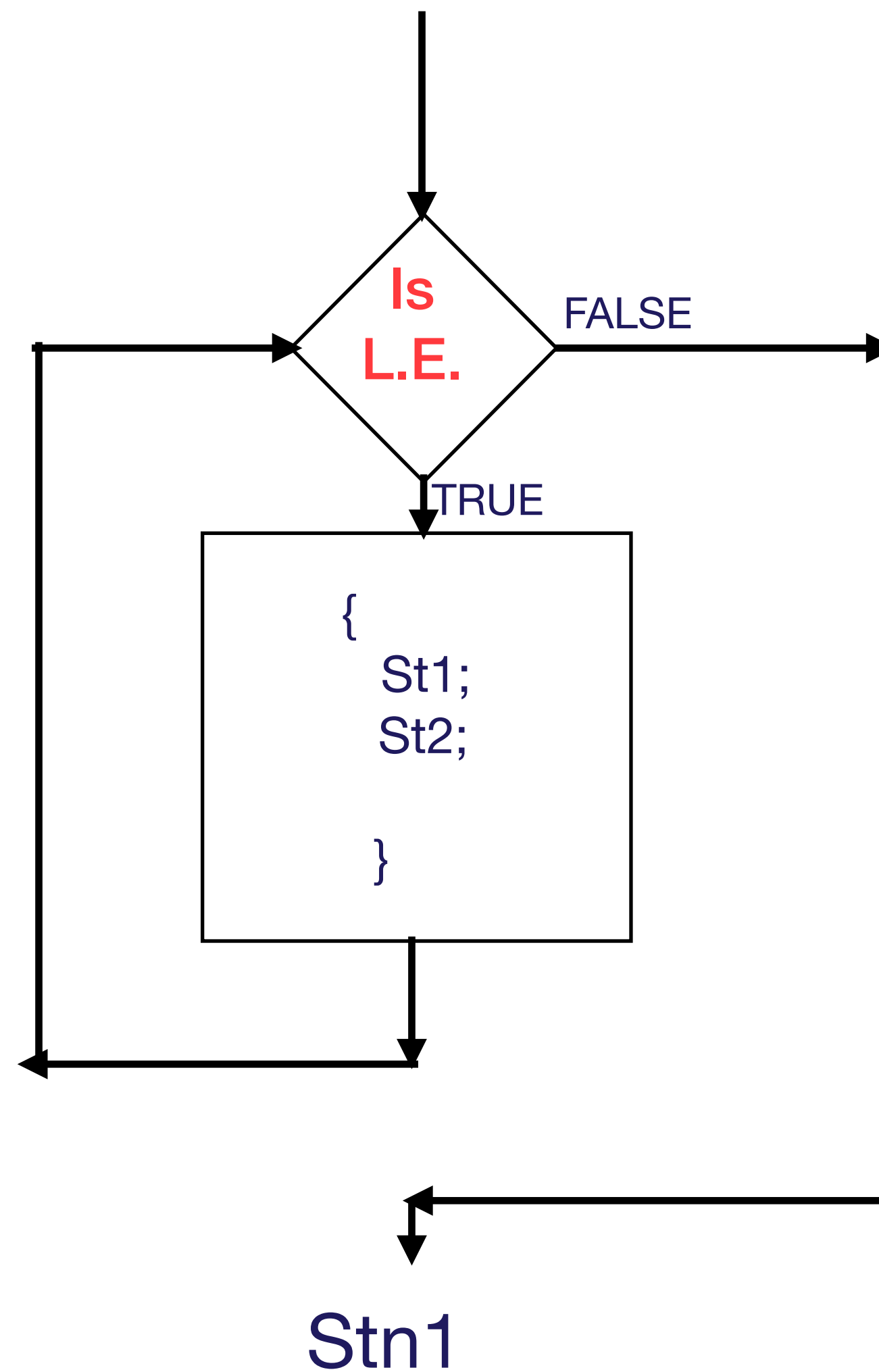
Syntax

```
while(L.E.) {  
    st1;  
    st2;  
    .....  
}
```

```
stn1;
```

- The block statements will be executed as long as the L.E. is true
- If the L.E. is false, the statement immediately after the closing bracket will get executed (i.e. stn1).

While st - as flowchart



Example program

Demo using L7_Loop1.c

```
#include <stdio.h>
//Print the numbers starting from 0 and up to 100
int main( )
{
    int i = 0;
    while (i < 100) {
        printf("i = %d\n", i);
        i++;
    }
    printf("out of the while loop %d\n", i);
}
```

Example program

L7_Loop1.c

```
#include <stdio.h>
//Print the summation of 'n' numbers
int main( )
{
    int i = 0,n, sum=0;
    scanf("%d", &n);
    while (i <= n) {
        sum += i;
        i++;
    }
    printf("sum = %d\n", sum);
}
```

do-while statement

Syntax

```
do{  
    st1;  
    st2;  
    .....  
}
```

```
while(L.E.);  
  
stn1;
```

- The block statements will be executed as long as the L.E. is true
- If the L.E. is false, the statement immediately after the closing bracket will get executed (i.e. stn1).
- Key difference between while and do-while?

Example program

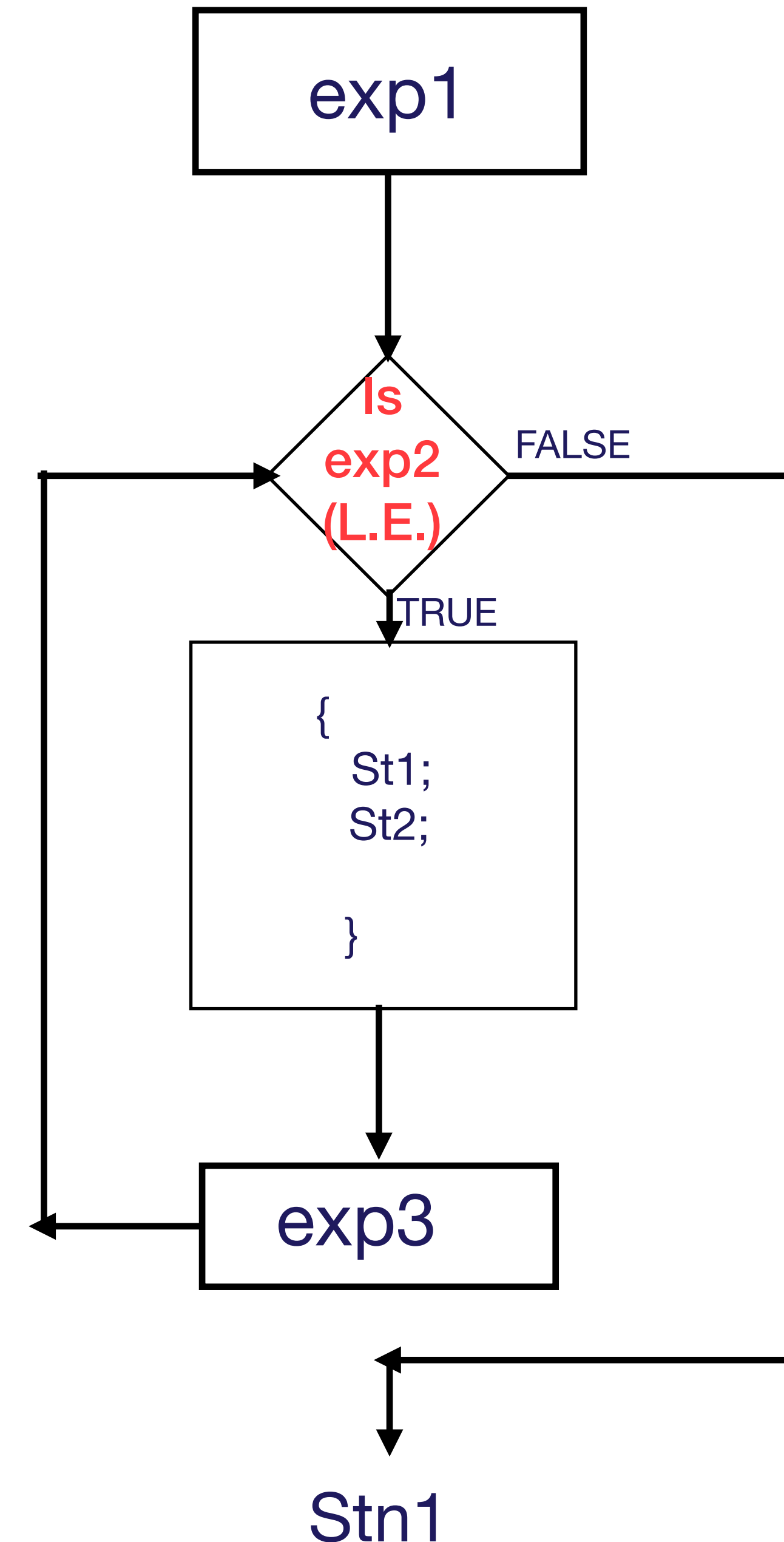
L7_Loop1.c

```
#include <stdio.h>
//Print the numbers starting from 0 and up to 100
int main( )
{
    int i = 0;
    do
    {
        printf("i = %d\n", i);
        i++;
    } while (i < 100);
    printf("out of the while loop %d\n", i);
}
```


for statement

Syntax

```
for(exp1;exp2;exp3) {  
    st1;  
    st2;  
    .....  
}  
stn1;
```



Example program

Demo using L7_Loop1.c

```
#include <stdio.h>
```

```
//Print the numbers starting from 0 and up to  
//100
```

```
int main( )  
{  
    int i = 0;  
    while (i < 100) {  
        printf("i = %d\n", i);  
        i++;  
    }  
    printf("out of the while loop %d\n", i);  
}
```

```
#include <stdio.h>
```

```
//Print the numbers starting from 0 and up to  
//100
```

```
int main( )  
{  
    int i;  
    for (i =0; i < 100; i++) {  
        printf("i = %d\n", i);  
    }  
    printf("out of the while loop %d\n", i);  
}
```

Example program

Demo using L7_Loop1.c

```
#include <stdio.h>
```

```
//Print the numbers starting from 0 and up to  
//100
```

```
int main( )
```

```
{
```

```
    int i;
```

```
    for (i =0; i < 100; i++) {
```

```
        printf("i = %d\n", i);
```

```
    }
```

```
    printf("out of the while loop %d\n", i);
```

```
}
```

How many time $i = 0$ is executed?

What is the value of i after the 'for' loop ends?

Example program

Another way to write the same program

```
#include <stdio.h>
```

```
//Print the numbers starting from 0 and up to  
//100
```

```
int main( )
```

```
{
```

```
    int i;
```

```
    for (i =0; i < 100; i++) {
```

```
        printf("i = %d\n", i);
```

```
    }
```

```
    printf("out of the while loop %d\n", i);
```

```
}
```

```
#include <stdio.h>
```

```
//Print the numbers starting from 0 and up to  
//100
```

```
int main( )
```

```
{
```

```
    int i = 0;
```

```
    for ( ; i < 100; ) {
```

```
        printf("i = %d\n", i);
```

```
        i++;
```

```
    }
```

```
    printf("out of the while loop %d\n", i);
```

```
}
```

HWs(Do each one with all three (for) loop formats)

1) $1 + x + x^2 + x^3 + \dots$

2) $1 - x + x^2 - x^3 + \dots$

3) $x + x^2 / 2 + x^3 / 3 + \dots$

4) $x - x^2 / 2 + x^3 / 3 - \dots$

5) Factorial of a given number

6) Print all the even and odd numbers from 1 to 100

Nested - while statement

Example.

- Take the following example:
 - $1+x + x^2 + x^3 + \dots$
 - How many number of loops did you use?
- Imagine now you want to solve this for $x = 0$ to 1 , with increments of 0.1 .
 - How do you solve this?

Nested Loops - while-while statement

Syntax

```
while(L.E.1) {  
    st0;  
    st1;  
    while(L.E.2) {  
        st2;  
        st3;  
        .....  
    }  
    stn1;  
}  
stn2;
```

- HW - Draw the flowchart for nested-while statement

Nested while example

L7_NestedLoop.c

```
#include <stdio.h>
int main( )
{
    int i;
    float x, mult, sum;
    x = 0.0;
    while (x <= 1.0) {
        i = 0;
        sum = 1.0;
        mult = 1.0;
        while (i < 5) { // Computing for a few terms
            mult *= x;
            sum += mult;
            printf("x = %f, mult=%f, sum = %f\n", x, mult, sum);
            i++;
        }
        printf("x = %f, sum = %f\n", x, sum);
        x+=0.1;
    }
}
```


Replace one while with a 'for' loop

Variation nested loop example

```
#include <stdio.h>
int main( )
{
    int i;
    float x, mult, sum;

    for (x = 0.0; x <= 1.0; x+=0.1) {
        i = 0;
        sum = 1.0;
        mult = 1.0;
        while (i < 5) { // Computing for a few terms
            mult *= x;
            sum += mult;
            printf("x = %f, mult=%f, sum = %f\n", x, mult, sum);
            i++;
        }
        printf("x = %f, sum = %f\n", x, sum);
    }
}
```

HW: Do the problem $1 + x + x^2 + x^3 + \dots$ using nested loops (while/while, (do-while)*2, for/for, while/for, while/do-while, for/while combinations.