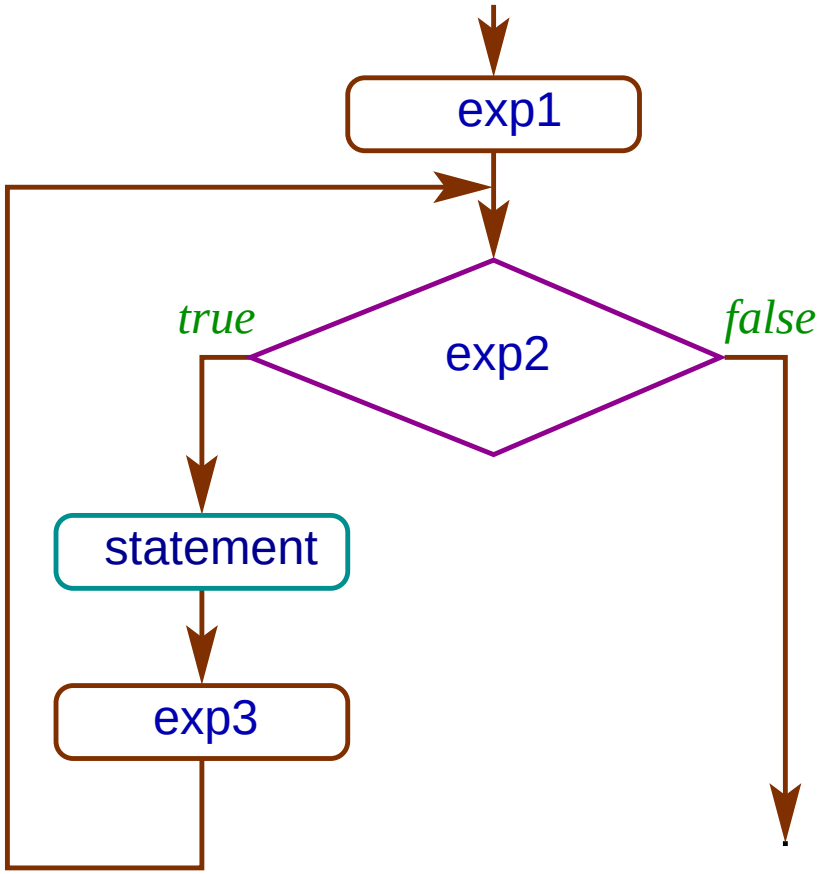
`for` Statement

Another iterative construct in C language is the `for`-statement (loop). The structure or the syntax of this statement is,

`for` (exp_1; exp_2; exp_3) statement

for Loop



`for` Statement

- The expression_1 is used for initialization before entering the loop.
- The expression_2 is to control the loop, whether to enter the loop or to skip it.
- The expression_3 is executed after the execution of the statement part of the loop. Used essentially to update the loop control condition.

`for` Statement

- All three expressions can be omitted. The condition is true if the control expression $expression_2$ is omitted.
- The statement can also be null ';'.

Example III

Write a program to compute the following sum using a for-loop:

$$S_n = 1 + 2 + 3 + \cdots + n,$$

where n is an input.

```
#include <stdio.h>
int main() // temp29.c
{
    int n, i, sum = 0;
    printf("Enter a +ve integer: ");
    scanf("%d", &n);
    for(i=1, sum=0; i<=n; ++i)
        sum += i;
    printf("0+ ... + %d = %d\n", n, sum);
    return 0;
}
```

for Statement

```
for (i=1, sum=0; i<=n; ++i)
        sum += i;
```

expression$_1$

expression$_1$ is '`i=1, sum=0`'. We have used the comma operator (,). This is evaluated left to right and is of lowest precedence among the operators. The value of the expression is the value of the rightmost operand. It is `sum = 0` in this case.

while and for Loops

A while-statement can be simulated by a for-statement.

```
while(exp) stmt ≡ for(; exp;) stmt
```

while andfor Loops

Similarly a `for`-statement can be simulated by a `while`-statement and expression statements.

```
for(exp1; exp2; exp3) stmt

≡

exp1; while(exp2) {stmt exp3;}
```

This equivalence is not true if there is a continue statement in stmt.

Example IV

Read n `int` data and print the largest among them.

The first input is the number of data, n.
Following inputs are a sequence of n `int` data.
It is essential to print the input.

Inductive Definition

$$\text{lrgst}(d_1, d_2, \cdots, d_n) = \begin{cases} d_1 & \text{if } n = 1, \\ max(d_1, \text{lrgst}(d_2, \cdots, d_n)) & \text{if } n > 1. \end{cases}$$

Sequence of Operations

- Read the number of data $n(\geq 1)$.
- Read the first data in a variable named `largest`[a].
- In a `for`-loop read the i^{th} data $(i = 2 \cdots n)$. If it is larger than the data present in `largest`, copy it to `largest`.

[a] Upto this point of execution, this is the largest data.

```
#include <stdio.h>
int main() // temp30.c
{
    int n, largest, i;

    printf("Enter a +ve integer: ");
    scanf("%d", &n);
    printf("Enter %d integers:\n", n);
    scanf("%d", &largest);
    printf("Input data: %d ", largest) ;
    for(i=2; i<=n; ++i) {
        int temp ; // local to block

        scanf("%d", &temp);
```

```
        printf("%d ", temp) ;
        if (temp > largest) largest = temp ;
    }
    printf("\nLargest: %d\n", largest);
    return 0;
}
```

Note

- It is not necessary to know the number of data a priori.
- We shall use EOF (end-of-file) from the keyboard (Ctrl+D) to terminate the input.
- Every call to `scanf()` returns the number of data read. If the Ctrl+D is pressed, `scanf()` returns a special constant EOF (end-of-file, defined in `stdio.h`).

```
#include <stdio.h>
int main() // temp31.c
{
    int largest, count = 0, temp;

    printf("Enter integer data\n");
    printf("Terminate by Ctrl+D\n");
    scanf("%d", &largest); // at least one data
    printf("Input data: %d ", largest) ;
    ++count ;
    for(; scanf("%d", &temp) != EOF;) {
        printf("%d ", temp);
        if (temp > largest) largest = temp ;
        ++count;
```

```
    }
    printf("\nLargest among %d data: %d\n",
                    count, largest);
    return 0;
}
```