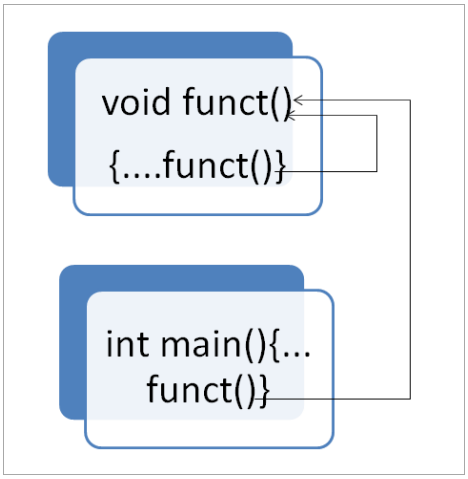
C++ Recursion with example

Recursion is a process in which a function calls itself. The function that implements recursion or calls itself is called a Recursive function. In recursion, the recursive function calls itself over and over again and keeps on going until an end condition is met.

The below image depicts how Recursion works:



As we see in the above diagram, the main function calls a function, funct(). Function funct() in turn calls itself inside its definition. This is how the recursion works. This process of the function calling itself will continue until we provide a terminating condition which will make it end.

Let's consider a classic example of Recursion, the Factorial notation.

We know that mathematically the factorial of a number n is:

n! = nxn-1x….x0!
given that 0! = 1;

So factorial for n=3 will be 3! = 3×2!

3! = 3x2x1!
3! = 3x2x2x0!
3! = 3x2x1x1 = 6

So programmatically we can express this calculation as follows:

```
#include <iostream>
using namespace std;
//Factorial function
int fact(int n){

  if (n <= 1)
      return 1;
  else
     return n*fact(n-1);
}
int main(){
  int num;
  cout<<"Enter a number: ";
  cin>>num;
  cout<<"Factorial of entered number: "<<fact(num);
  return 0;
}
```

Base condition

In the above program, you can see that we have provided a base condition in the recursive function. The condition is:

```
if (n <= 1)
      return 1;
```

The purpose of recursion is to divide the problem into smaller problems till the base condition is reached. If you do not define the base condition in the recursive function then you will get stack overflow error.

Direct recursion vs indirect recursion

Direct recursion: When function calls itself, it is called direct recursion, the example we have seen above is a direct recursion example.

Indirect recursion: When function calls another function and that function calls the calling function, then this is called indirect recursion. For example: function A calls function B and Function B calls function A.

Indirect Recursion Example in C++

```
#include <iostream>
using namespace std;
int fa(int);
int fb(int);
int fa(int n){
  if(n<=1)
    return 1;
  else
    return n*fb(n-1);
}
int fb(int n){
  if(n<=1)
    return 1;
  else
    return n*fa(n-1);
}
int main(){
  int num=5;
  cout<<fa(num);
  return 0;
}
```