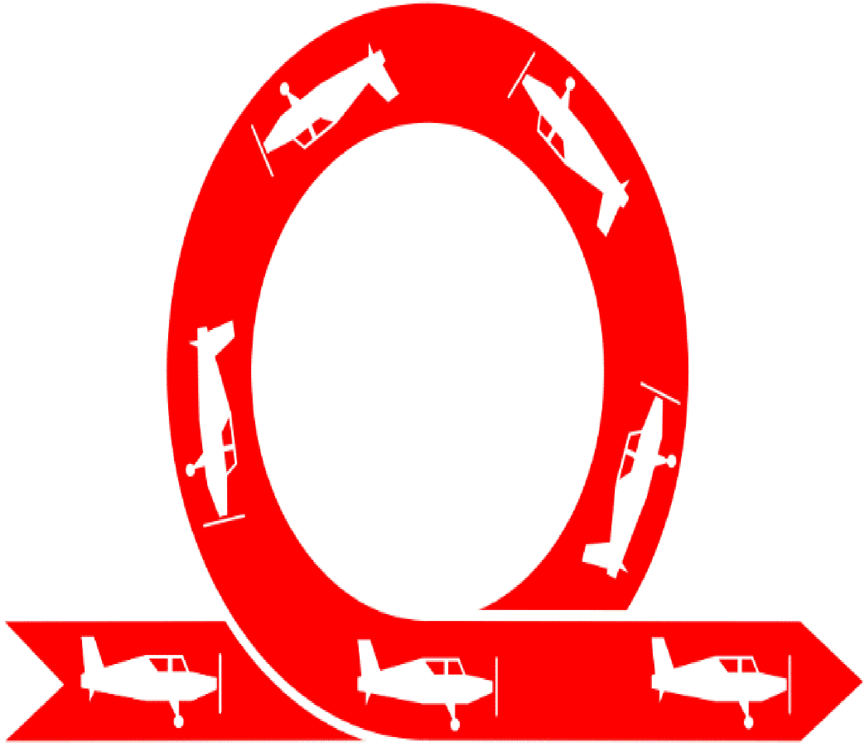
C Fundamental

Decision & Looping

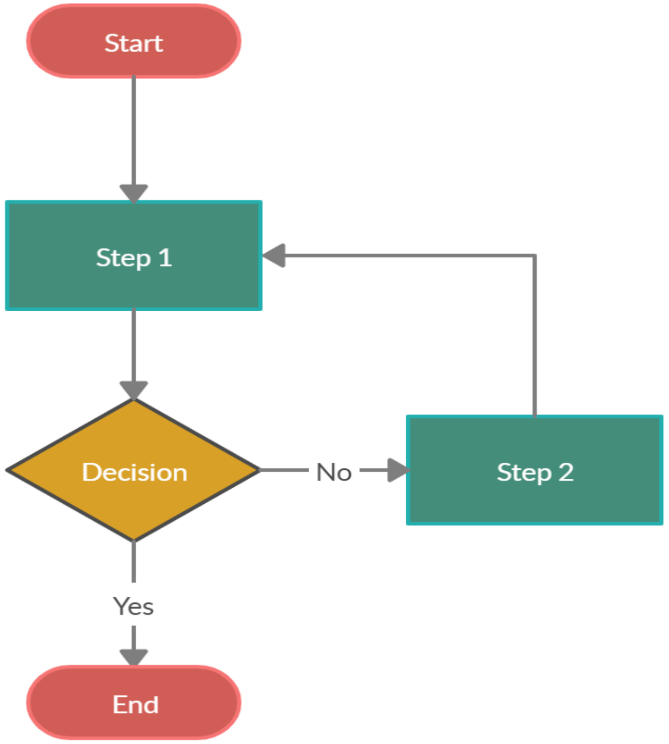
Objectives

- Flow Chart
- Explain the Selection Construct
  - ✓ If Statement
  - ✓ If – else statement
  - ✓ Multi if statement
  - ✓ Nested if statement
- Switch Statement
- Looping
- Control Loop Statements



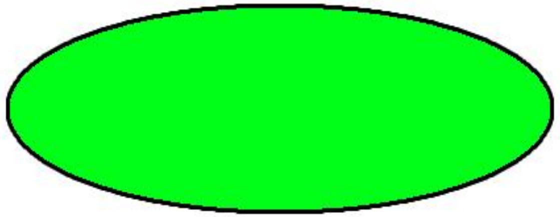
Section 1

FLOW CHART

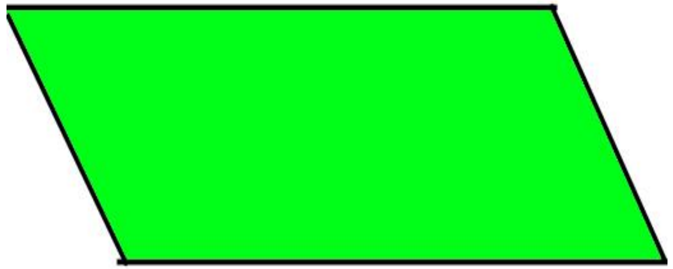


Flow Chart: Basic Symbols - 1

- **Terminal**: The oval symbol indicates Start, Stop and Halt in a program's logic flow. A pause/halt is generally used in a program logic under some error conditions. Terminal is the first and last symbols in the flowchart.

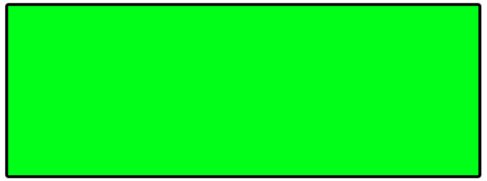


- **Input/Output**: A parallelogram denotes any function of input/output type. Program instructions that take input from input devices and display output on output devices are indicated with parallelogram in a flowchart.

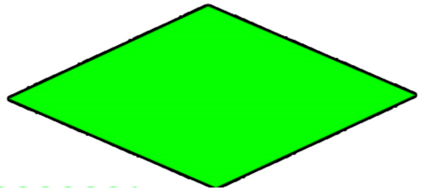


Flow Chart: Basic Symbols - 2

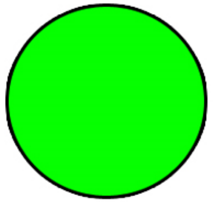
- **Processing:** A box represents arithmetic instructions. All arithmetic processes such as adding, subtracting, multiplication and division are indicated by action or process symbol.



- **Decision:** Diamond symbol represents a decision point. Decision based operations such as yes/no question or true/false are indicated by diamond in flowchart.



- **Connectors**: Whenever flowchart becomes complex or it spreads over more than one page, it is useful to use connectors to avoid any confusions. It is represented by a circle.



Flow Chart: Conditional Statement

- Conditional statements enable us to change the flow of the program
- A conditional statement evaluates to either a true or a false value

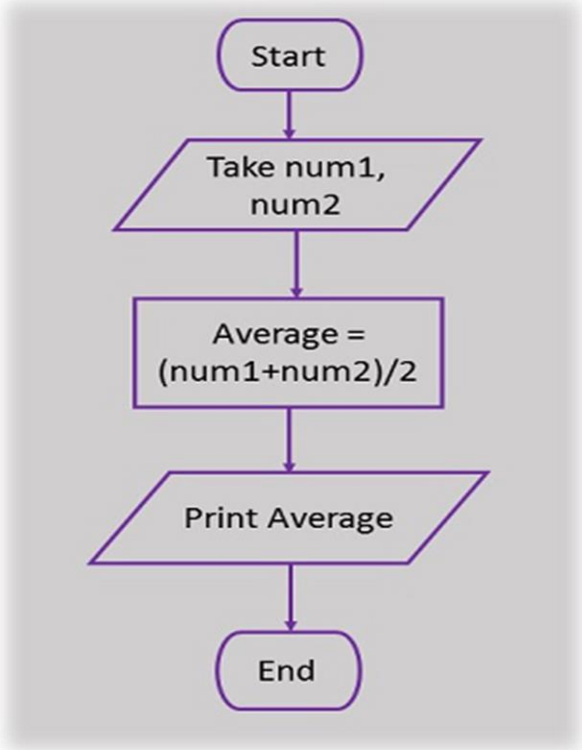
Example :

To find whether a number is even or odd we proceed as follows :

1. Accept a number
2. Find the remainder by dividing the number by 2
3. If the remainder is zero, the number is “EVEN”
4. Or if the remainder is not zero the number is “ODD”

Flow Chart: Example 1

Example: Here is a flowchart to calculate the average of two numbers.

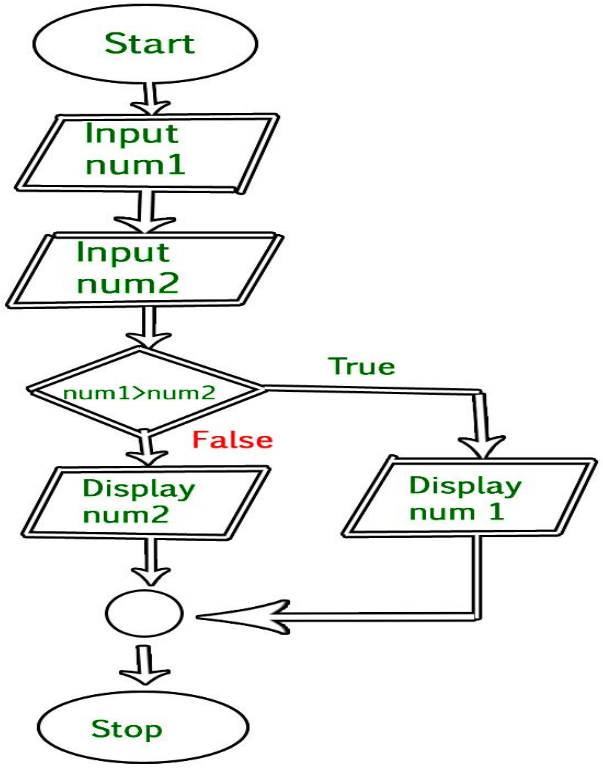


Flow Chart: Code example 1

```c
// C program to calculate the average of two numbers
#include <stdio.h>
int main() {
    int num1, num2, average;
    /*Input two numbers*/
    printf("Enter two numbers:\n");
    scanf("%d %d", &num1, &num2);
    /*Calculate the average*/
    average = (num1 + num2) / 2;
    printf("%d", average); /*Print the result*/
    return 0;
}
```

Flow Chart: Example 2

Example : Draw a flowchart to input two numbers from user and display the largest of two numbers =>



Flow Chart: Code example 2

```
// C program to find largest of two numbers
#include <stdio.h>
int main() {
    int num1, num2, largest;
    /*Input two numbers*/
    printf("Enter two numbers:\n");
    scanf("%d %d", &num1, &num2);
    /*check if a is greater than b*/
    if (num1 > num2)
        largest = num1;
    else
        largest = num2;
    printf("%d", largest); /*Print the largest number*/
    return 0;
}
```

Section 2

SELECTION CONSTRUCT

Selection Constructs

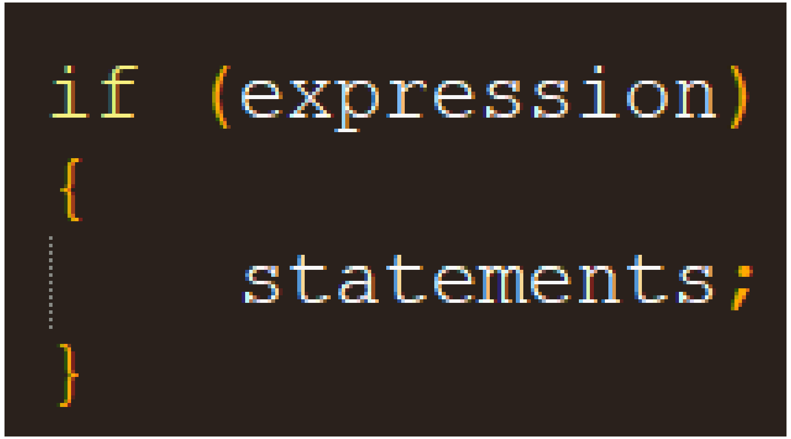
C supports two types of selection statements

The if statement

The switch statement

The if statement - 1

- Syntax:



```
if (expression)
{
    statements;
}
```

- If the if expression evaluates to true, the block following the if statement or statements are executed

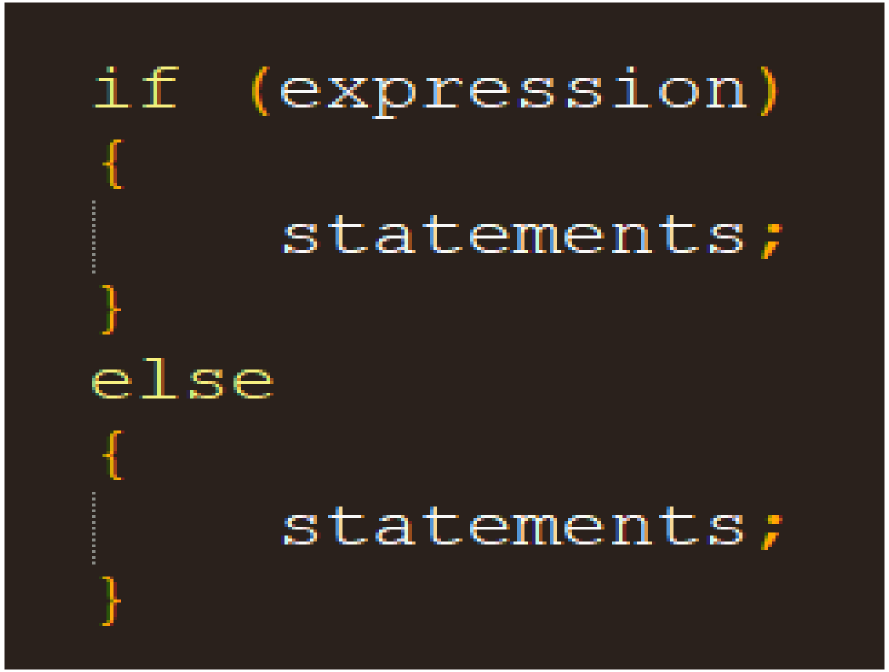
The if statement - 2

Program to display the values based on a condition

```
#include <stdio.h>
void main()
{
    int x, y;
    char a = ‘y’;
    x = y = 0;
    if (a == ‘y’){
        x += 5;
        printf(“The numbers are %d and \t%d”, x, y);
    }
}
```

The if – else statement-1

- <u>Syntax:</u>



```
if (expression)
{
      statements;
}
else
{
      statements;
}
```

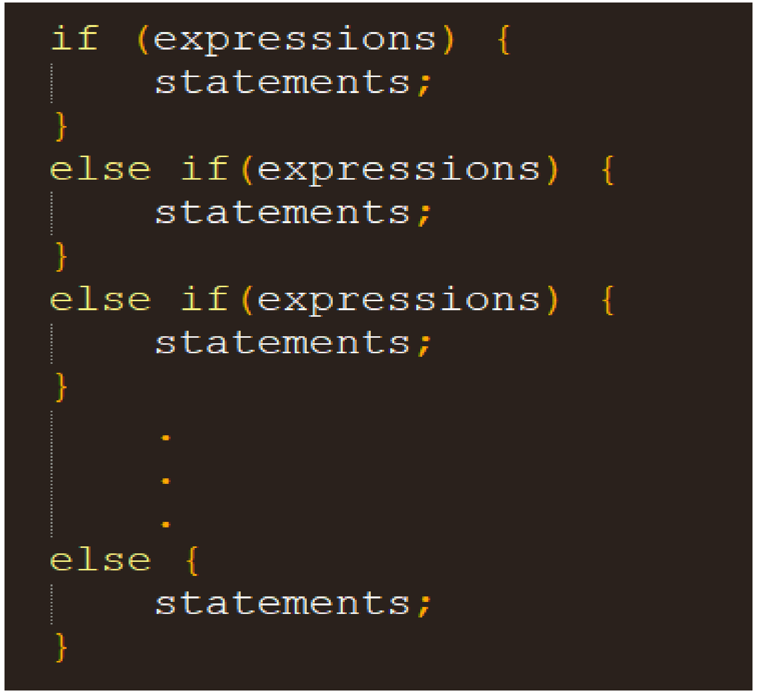
The if – else statement -2

Program to display whether a number is Even or Odd

```
#include <stdio.h>
void main()
{
   int num , res ;
   printf(“Enter a number :”);
   scanf(“%d”,&num);
   res = num % 2;
   if (res == 0)
     printf(“Then number is Even”);
   else
     printf(“The number is Odd”);
}
```

The if–else–if statement-1

- Syntax:



```
if (expressions) {
     statements;
}
else if(expressions) {
     statements;
}
else if(expressions) {
     statements;
}
      .
      .
      .
else {
     statements;
}
```

- The if – else – if statement is also known as the if-else-if ladder or the if-else-if staircase.
- The conditions are evaluated from the top downwards.

The if–else–if statement-2

Program to display a message based on a value

```
#include <stdio.h>
void main()
{
    int x;
    x = 0;
    clrscr ();
    printf(“Enter Choice (1 - 3) : “);
    scanf(“%d”, &x);
    if (x == 1)
        printf (“\nChoice is 1”);
    else if ( x == 2)
        printf (“\nChoice is 2”);
    else if ( x == 3)
        printf (“\nChoice is 3”);
    else
        printf (“\nInvalid Choice “);
}
```

Nested if-1

- Syntax:

```
if (exp1)
{
    if (exp2) statement1;
    if (exp3) statement2;
    else statement3;            /*with if (exp3) */
}
else statement4;                /* with if (exp1) */
```

- Note that the inner else is associated with **if(exp3)**

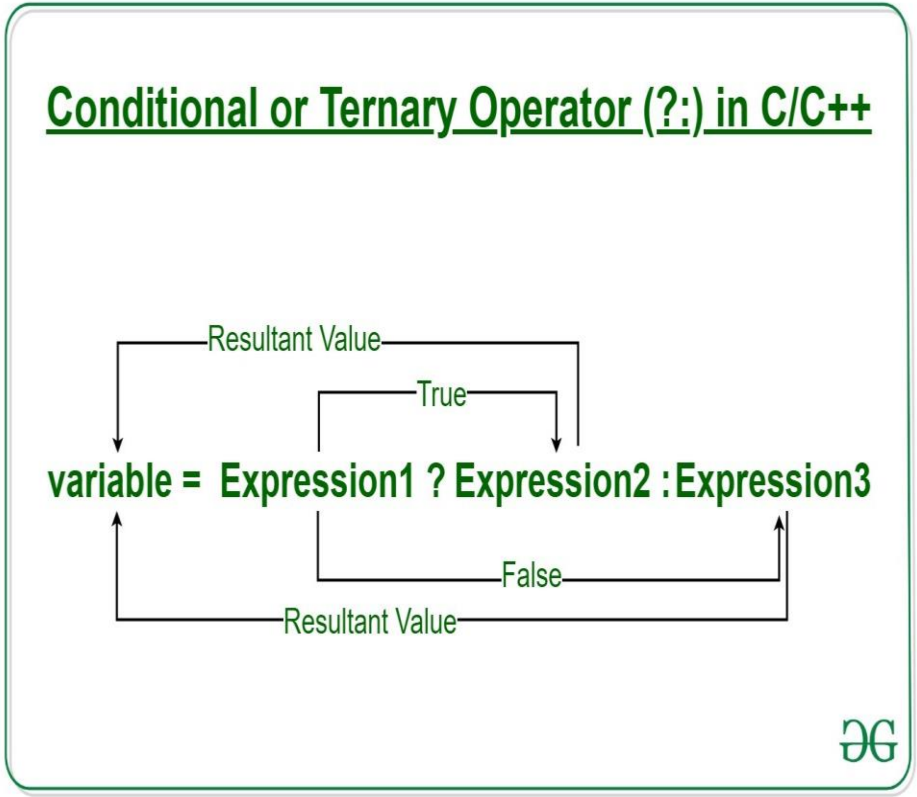
- According to ANSI standards, a compiler should support at least 15 levels of nesting

Nested if-2

```
#include <stdio.h>
void main (){
 int x, y;
 x = y = 0;
 clrscr ();
 printf ("Enter Choice (1 - 3) : ");
 scanf ("%d", &x);
 if (x == 1){
       printf("\nEnter value for y (1 - 5) : ");
       scanf ("%d", &y);
       if (y <= 5)
             printf("\nThe value for y is : %d", y);
       else
             printf("\nThe value of y exceeds 5 ");
 }
 else
       printf ("\nChoice entered was not 1");
}
```

The if–else: Ternary Operator - 1

- The conditional operator is kind of similar to the **if-else** statement as it does follow the same algorithm as of **if-else** statement but the conditional operator takes less space and helps to write the **if-else** statements in the shortest way possible.



Conditional or Ternary Operator (?:) in C/C++
Resultant Value
True
variable = Expression1 ? Expression2 : Expression3
False
Resultant Value

The if–else: Ternary Operator

- Syntax:

The conditional operator is of the form :

```
variable = Expression1 ? Expression2 : Expression3
```

It can be visualized into if-else statement as:

```
if(Expression1) {
    variable = Expression2;
}
Else {
    variable = Expression3;
}
```

Since the Conditional Operator ‘?:’ takes three operands to work, hence they are also called ternary operators.

Section 3

SWITCH STATEMENT

The switch statement - 1

```
switch (expression)
{
        case constant1:
                statement sequence
                break;
        case constant2:
                statement sequence
                break;
        case constant3:
                statement sequence
                break;
        .
        .
        .
        default:
                statement sequence
}
```

The switch statement - 2

Program to check whether the entered lowercase character is vowel or ‘z’ or a consonant

```
#include <stdio.h>
   main ()
   {
    char ch;
    clrscr ();

    printf ("\nEnter a lower cased alphabet (a - z) : ");
    scanf("%c", &ch);
```

continued…….

The switch statement - 3

```
if (ch < ‘a’ || ch > ‘z’)
   printf(“\nCharacter not a lower cased alphabet”);
else
   switch (ch) {
    case ‘a’ :
    case ‘e’ :
    case ‘i’ :
    case ‘o’ :
    case ‘u’ :
        printf(“\nCharacter is a vowel”);
        break;
    case ‘z’ :
        printf (“\nLast Alphabet (z) was entered”);
        break;
    default :
        printf(“\nCharacter is a consonant”);
        break;
        }
   }
```

Section 4

LOOPING

What is a Loop?

Section of code in a program which is executed repeatedly, until a specific condition is satisfied

3 types of Loop Structures

The for loop

The while loop

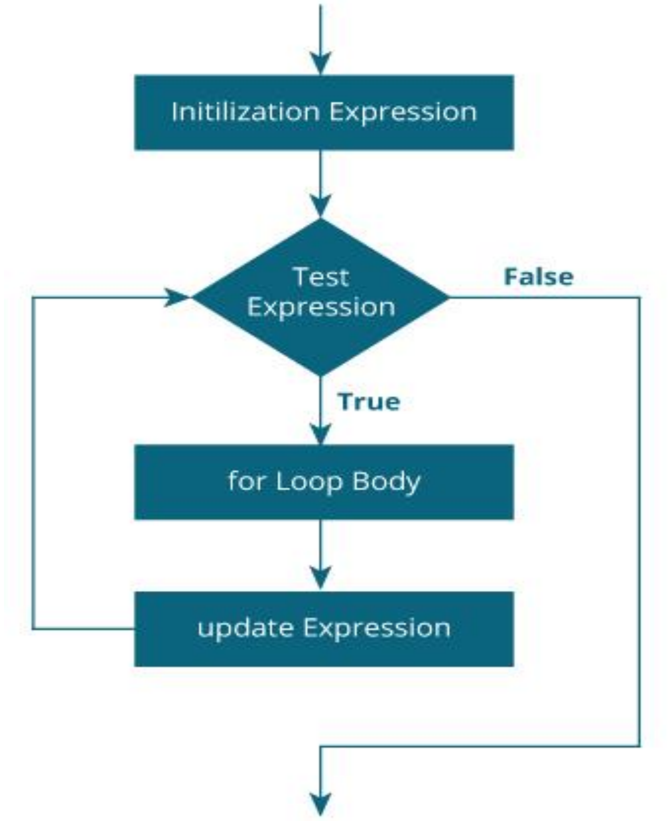
The do….while loop

The for loop

```
for (initialize counter; conditional test; re-evaluation parameter)
{
        statement
}
```

- The initialize counter is an assignment statement that sets the loop control variable, before entering the loop
- The conditional test is a relational expression, which determines, when the loop will exit
- The evaluation parameter defines how the loop control variable changes, each time the loop is executed

The for loop: Flow Diagram



The for loop: example 1

```
/*This program demonstrates the for loop in a C program
   */
#include <stdio.h>

void main()
{
    int count;
    printf("\tThis is a \n");

    for(count = 1; count <=6 ; count++)
        printf("\n\t\t nice");

    printf("\n\t\t world. \n");
}
```

The for loop: example 2

```
// Program to calculate the sum of first n natural numbers
// Positive integers 1,2,3...n are known as natural numbers
#include <stdio.h>
int main()
{
    int num, count, sum = 0;
    printf("Enter a positive integer: ");
    scanf("%d", &num);
    // for loop terminates when num is less than count
    for(count = 1; count <= num; ++count)
    {
        sum += count;
    }
    printf("Sum = %d", sum);
    return 0;
}
```

The Comma Operator

The scope of the **for** loop can be extended by including more than one initializations or increment expressions in the for loop specification

The format is : exprn1 , exprn2 ;

```
#include <stdio.h>
void main()
{
     int i, j , max;
     printf("Please enter the maximum value \n");
     printf("for which a table can be printed: ");
     scanf("%d", &max);

     for(i = 0 , j = max ; i <= max ; i++, j--)
         printf("\n%d  +  %d  =  %d",i, j, i + j);
}
```

Nested for Loops-1

- The **for** loop will be termed as a **nested for** loop when it is written as follows

```
for(i = 1; i<max1; i++)
{
                .
                .
    for(j = 0; j < = max2; j++)
    {
        .
        .
    }
    .
    .
}
```

Nested for Loops-2

```
#include <stdio.h>
void main()
{
    int i, j, k;
    i = 0;
    printf("Enter no. of rows :");
    scanf("%d", &i);
    printf("\n");
    for (j = 0; j < i ; j++)
    {
        printf("\n");
        for (k = 0; k <= j; k++) /*inner for loop*/
            printf("*");
    }
}
```

The while Loop-1

```
while (condition is true) {
    statement;
}
```

The while loop repeats statements while a certain specified condition is True

The while Loop-2

```
/* A simple program using the while loop */

#include <stdio.h>
void main()
{
	int count = 1;
	while(count <= 10)
	{
		printf("\n This is iteration %d\n",count);
		count++;
	}

	printf("\n The loop is completed. \n");
}
```

do…while Loop-1

```
do{
        statements;
} while (conditions);
```

- In the **do while** loop the body of the code is executed once before the test is performed
- When the condition becomes False in a **do while** the loop will be terminated, and the control goes to the statement that appears immediately after the **while** statement

do...while Loop-2

```
#include <stdio.h>
void main ()
{
   int num1, num2;
   num2 = 0;
   do
   {
     printf( "\nEnter a number : ");
     scanf("%d",&num1);
     printf( " No. is %d",num1);
     num2++;
   } while (num1 != 0);
   printf ("\nThe total numbers entered were %d",--num2);

/*num2 is decremented before printing because count for last
integer (0) is not to be considered */
}
```

Section 5

CONTROL LOOP STATEMENTS

Jump Statements-1

return expression

- The return statement is used to return from a function
- It causes execution to return to the point at which the call to the function was made
- The return statement can have a value with it, which it returns to the program

Jump Statements-2

goto label

- The goto statement transfers control to any other statement within the same function in a C program
- It actually violates the rules of a strictly structured programming language
- They reduce program reliability and make program difficult to maintain

Jump Statements-3

break statement

- The break statement is used to terminate a case in a switch statement
- It can also be used for abrupt termination of a loop
- When the break statement is encountered in a loop, the loop is terminated immediately and control is passed to the statement following the loop

Jump Statements-4

continue statement

- The continue statement causes the next iteration of the enclosing loop to begin
- When this statement is encountered, the remaining statements in the body of the loop are skipped and the control is passed on to the re-initialization step

Break statement

```
#include <stdio.h>
 void main ()
 {
   int count1, count2;
   for(count1 = 1, count2 = 0;count1 <=100;
 count1++)
   {
     printf("Enter %d count2 : ",count1);
     scanf("%d", &count2);
     if(count2==100) break;
   }
 }
```

continue statement

```
#include <stdio.h>
 void main ()
 {
   int num;
   for(num = 1; num <=100; num++)
   {
      if(num % 9 == 0)
         continue;
      printf("%d\t",num);
   }
 }
```

Exit Function

exit() function

- The exit() is used to break out of the program
- The use of this function causes immediate termination of the program and control rests in the hands of the operating system

Thank you

Q&A