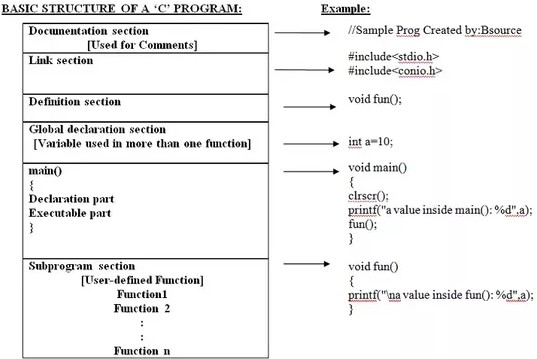
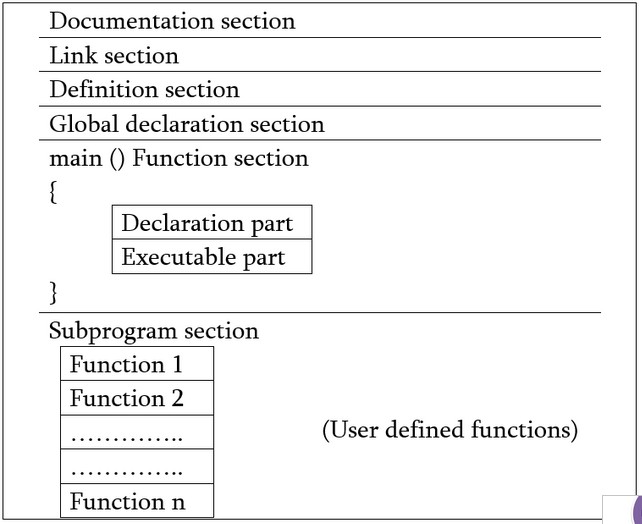
#### Syllabus

**Structure of a C program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in C – Managing Input and Output operations – Decision Making and Branching – Looping statements. Arrays – Initialization – Declaration – One dimensional and Two- dimensional arrays. Strings- String operations – String Arrays. Simple programs- sorting,searching – matrix operations.**

|  |  |  |
| --- | --- | --- |
| **S.no** | **Topic** | |
| **1** | **Structure of a C program** | |
| **2** | **compilation and linking processes** | |
| **3** | **Constants** | |
| **4** | **Variables** | |
| **5** | **Data Types** | |
| **6** | **Expressions using operators in C** | |
| **7** | **Managing Input and Output operations in C** | |
| **8** | **Decision Making and Branching in C** | |
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| **10** | **Arrays** | |
|  |  | **Initialization** |
|  |  | **Declaration** |
|  |  | **One dimensional array** |
|  |  | **Two-dimensional arrays** |
| **11** | **Strings** | |
|  |  | **String operations** |
|  |  | **String Arrays** |
|  |  |  |
| **12** | **Simple programs- sorting,searching – matrix operations** | |
|  |  | **sorting** |
|  |  | **searching** |
|  |  | **matrix operations** |

**STRUCTURE OF C PROGRAM**



**Documentation section:** The documentation section consists of a set of comment lines giving the name of the program, the author ,date on which program is written and other details, which the programmer would like to use later.

**Link section:**

The link section provides instruction to the compiler to link or include the required in-built functions from the system library such as using the [#include](http://www.onlineclassnotes.com/2015/04/what-is-include-directive.html?ref=Content%20Body) [directive](http://www.onlineclassnotes.com/2015/04/what-is-include-directive.html?ref=Content%20Body).Eg #include<stdio.h>, #include<string.h>,#include<math.h>.

**Definition section:**

The definition section defines all symbolic constants using the [#define](http://www.onlineclassnotes.com/2015/04/what-is-define-directive.html?ref=Content%20Body) [directive](http://www.onlineclassnotes.com/2015/04/what-is-define-directive.html?ref=Content%20Body)(optional). Having the constants being defined here, we can use them elsewhere in code.

# define N 100 /\* which means N’s value is 100\*/ # define pi 3.14

**Global declaration section :**

There are some variables that are used in more than one function. i.e common to more than one function.Such variables are called global variables and are declared in the global declaration section that is outside of all the functions.

**main () function section :**

Every C program must have one main function section. This section contains two parts; declaration part and executable part.

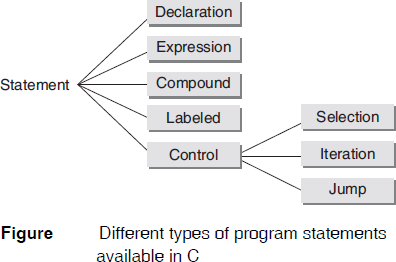
**Declaration part :** The declaration part declares all the variables used in the executable part.

**Executable part :** There is at least one or more statements in the executable part designed for some task\executing some logic.

These two parts must appear between the opening and closing braces. The program execution begins at the opening brace and ends at the closing brace. The closing brace of the main function is the logical end of the program. All statements in the declaration and executable part end with a semicolon(;).

**Sub program section:**

If the program is a [multi-function program](http://www.onlineclassnotes.com/2015/04/what-is-multi-function-program.html?ref=Content%20Body) then the subprogram section contains definition of all the [user-defined functions](http://www.onlineclassnotes.com/2015/04/what-are-necessities-or-advantages-of.html?ref=Content%20Body) which were declared earlier in the Definition Section. User-defined functions are generally placed immediately after the main () function, although they may appear in any order.



**Figure 1.2 main()**

A C program contains one or more functions, where a function is defined as a group of statements that perform a well- defined task.

Figure 1.2 shows the structure of a C program.

The statements in a function are written to perform a specific task.

The main() function is the most important function and is a part of every C program and is mandatory

The execution of a C program begins with main( )function.

A C program can have any number of functions depending on the number of independent tasks that have to be performed, and each function can have any number statements.

**{**

**Statement 1;**

**Statement 2;**

**............**

**Statement N;**

**}**

**Function1()**

**{**

**Statement 1;**

**Statement 2; Statement N;**

**}**

**Function2()**

**{**

**Statement 1;**

**Statement 2; Statement N;**

**}**

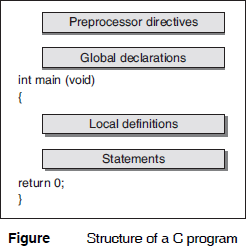
**FunctionN()**

**{**

**Statement 1;**

**Statement 2; Statement N;**

**}**



*Pre-processor directives* tells the preprocessor to look for special code libraries, make substitutions in the code and in other ways prepare the code for translation into machine language.

#### PROGRAM STATEMENT

A statement performs an action when a program is executed.

All C program statements are terminated with a semi-colon **(;).**

***Declaration statement:*** the name and type of the data objects needed during program execution.

## Example :-int a

***Expression statement:*** is the simplest kind of statement

**Example x = a+b\*c^4** is an expression

***Compound statement:*** is a sequence of statements that may be treated as a single statement

***Labeled statements:*** can be used to mark any statement so that control may be transferred to the statement by *switch* statement

## Case 1:

**labelABC:**

### ***Control statement:*** is a statement whose execution results in a choice being made as to which of two or more paths to execute.

**Eg:categories of if and if..else**

***Selection statements:*** allow a program to select a particular execution path from a set of one or more alternatives. **Eg Switch**

***Iteration statements:*** are used to execute a group of one or more statements repeatedly. ***while, for*, and *do..while*** statements falls under this group.

### ***Jump statements:*** cause an unconditional jump to some other place in the program. ***goto*** statement falls in this group.

EXAMPLE C PROGRAM

//sample.c// #include<stdio.h> main()

{

printf(“welcome to C”); return 0;

}

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# Compile and Link C Program

There are three basic phases occurred when we execute any C program.

* Preprocessing
* Compiling
* (assembler)
* Linking

**Preprocessing Phase :**A C pre-processor is a program that accepts C code with preprocessing statements and produces a pure form of C code that contains no preprocessing statements (like #include).

**Compilation Phase:**The C compiler accepts a preprocessed output file from the preprocessor and produces a special file called an object file. Object file contains machine code generated from the program.

**Linking Phase:**The link phase is implemented by the linker. The linker is a process that accepts as input object files and libraries to produce the final executable program.

**Compiling and Linking a C program is a multi-stage process.**

The process can be split into four separate stages: [**Preprocessing,**](https://www.calleerlandsson.com/the-four-stages-of-compiling-a-c-program/#preprocessing) [**compilation,**](https://www.calleerlandsson.com/the-four-stages-of-compiling-a-c-program/#compilation) [**assembly,**](https://www.calleerlandsson.com/the-four-stages-of-compiling-a-c-program/#assembly) **and** [**linking**.](https://www.calleerlandsson.com/the-four-stages-of-compiling-a-c-program/#linking)

/\*

\* "Hello, World!": A classic.

\*/

#include <stdio.h> int main(void)

{

puts("Hello, World!"); return 0;

}

#### Preprocessing

The first stage of compilation is called preprocessing. In this stage, lines starting with a # character are interpreted by the *preprocessor* as *preprocessor commands*. These commands form a simple macro language with its own syntax and semantics.

reduce repetition in source code invoke inline files

define macros

joining continued lines (lines ending with a \) removes comments.

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**To print the results of the preprocessing stage, pass the -E option to cc:**

**gcc -E hello\_world.c**

[lines omitted for brevity]

extern int vsnprintf\_chk (char \* restrict, size\_t, int, size\_t, const char \* restrict, va\_list);

# 493 "/usr/include/stdio.h" 2 3 4

# 2 "hello\_world.c" 2

int main(void) { puts("Hello, World!"); return 0;

}

#### Compilation

**In this stage, the preprocessed code is translated to *assembly instructions* These form an intermediate readable language.**

**Some compilers also supports the use of an integrated assembler, in which the compilation stage generates *machine code* directly, avoiding the overhead of generating the intermediate assembly instructions and invoking the assembler. *object code is directly produced by compiler.***

#### to view the result of the compilation stage, pass the -S option to cc:

**gcc -S hello\_world.c**

**This will create a file named hello\_world.s**

.section TEXT, text,regular,pure\_instructions

.macosx\_version\_min 10, 10

.globl \_main

.align 4, 0x90

\_main: ## @main

.cfi\_startproc ## BB#0:

pushq %rbp Ltmp0:

.cfi\_def\_cfa\_offset 16 Ltmp1:

.cfi\_offset %rbp, -16 movq %rsp, %rbp

Ltmp2:

.cfi\_def\_cfa\_register %rbp subq $16, %rsp

leaq L\_.str(%rip), %rdi movl $0, -4(%rbp) callq \_puts

xorl %ecx, %ecx

movl %eax, -8(%rbp) ## 4-byte Spill

movl %ecx, %eax

addq $16, %rsp

popq %rbp retq

.cfi\_endproc

.section TEXT, cstring,cstring\_literals

L\_.str: ## @.str

.asciz "Hello, World!"

#### Assembly

During the assembly stage, an assembler is used to translate the assembly instructions to machine code, or *object code*.

--The output consists of actual instructions to be run by the target processor.

#### Input to assembler :cc -c hello\_world.c Output of assembler phase: hello-worls.o

The contents of this file is in a binary format and can be viewed using hexdump or od commands:

**gcc -C hello\_world.c**

#### Linking

The object code generated in the assembly stage is composed of machine instructions that the processor understands but some pieces of the program are out of order or missing. To produce an executable program, the existing pieces have to be rearranged and the missing ones filled in. This process is called linking.

The result of this stage is the final executable program(.exe)

Finally to run

* 1. ut hello\_world.c

Commands to compile and execute C program

**Save the program file using .c extention To compile:**

**gcc filename.c**

**To run the program**

**./a.out**

# Constants/Literals

A constant is a value or an identifier whose value cannot be altered in a program. For example: 1, 2.5, "C programming is easy", ‘apple’ etc.

We can define constants in a C program in the following ways.

#### By “const” keyword

* + 1. **By “#define” preprocessor directive**

Syntax1: **const type constant\_name**;

Eg 1: **const double PI = 3.14** //variable *PI* is a constant ,3.14 cannot be changed

Eg-1

#include<stdio.h> main()

{

const int SIDE = 10; int area;

area = SIDE\*SIDE;

printf("The area of the square %d is: %d sq. units" , SIDE, area);

}

Output

The area of the square 10 is: 100 sq. Units

#### Syntax 2: #define variable value Eg-2 #define PI 3.14

Constants can be classified into broad categories

**Primary Constants**

-integer constant

-floating point constant

-character Constant

-String Constant

-Backslash Constant

**C constant**

1. **Integer constants**

An integer constant is a numeric constant (associated with number) without any fractional or exponential part. There are three types of integer constants in C programming:

* + **decimal constant(base 10)**
  + **octal constant(base 8)**
  + **hexadecimal constant(base 16)**

For example:

#### Decimal constants: 1,0, -9, 22 etc

**Octal constants: 021, 077, 033 etc Hexadecimal constants: 0x7f, 0x2a, 0x521 etc**

In C programming, octal constant starts with a 0 and hexadecimal constant starts with a 0x.

#### 55 /\*int constant \*/

**55l /\*unsigned int constant\*/ 55 ul /\*unsigned long constant\*/**

Rules for defining integer constants:

* An integer constant must have at least one digit.
* It must not have a decimal point.
* It can either be positive or negative.
* No commas or blanks are allowed within an integer constant.
* If no sign precedes an integer constant, it is assumed to be positive.
* The allowable range for integer constants is -32768 to 32767.

1. **Floating-point constants**

A floating point constant is a numeric constant that has either a fractional form or an exponent form(decimal point). For example**:**

6.333 –correct 633E-4L-correct

633E---illegal..incomplete exponent 633f—illegal..no decimal or exponent

.e633—illegal..missing integer

#### -2.0

**0.0000234**

**-0.22E-5**

Rules for defining floating point(real) constants:

* + A real constant must have at least one digit
  + It must have a decimal point
  + The mantissa part and exponential part should be separated by a letter e/E
  + The mantissa part must have a positive or negative sign. The default sign of mantissa part is positive.
  + No commas or blanks are allowed within a real constant.

1. **Character constants**

A character constant is a constant which uses single quotation around characters.

For example:

#### 'a' '6',

**'=', 'F'**

Rules for defining character constants

* + A character constant is a single alphabet, a single digit or a single special symbol enclosed within single quotes.
  + The maximum length of a character constant is 1 character.

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#### String constants

String constants are the constants which are enclosed in a pair of double-quote marks. For example:

"good" //string constant "" //null string constant

" " //string constant of six white space

"x" //string constant having single character. String constants are enclosed within double quotes.

1. Backslash Character Constants in C:
   * There are some characters which have special meaning in C language.
   * They should be preceded by backslash symbol.(\)

|  |  |
| --- | --- |
| **Backslash character** | **Meaning** |
| \b | Backspace |
| \f | Form feed |
| \n | New line |
| \r | Carriage return |
| \t | Horizontal tab |
| \” | Double quote |
| \’ | Single quote |
| \\ | Backslash |
| \v | Vertical tab |
| \a | Alert or bell |
| \? | Question mark |
| \N | Octal constant (N is an octal constant) |
| \XN | Hexadecimal constant (N – hex.dcml cnst) |

Example Program Using Const Keyword Using # Define

#include<stdio.h> int main( )

{

int const BASE ,HEIGHT; float area;

char NEWLINE=’\n’; area=0.5\*BASE\*HEIGHT printf(“The Area of Triangle is:”); printf(“%c”,NEWLINE); printf(“%f”,area);

return 0;

}

#include<stdio.h> #define BASE 100

#define HEIGHT 100 #define NEWLINE ‘\n’ int main( )

{

float area; area=0.5\*BASE\*HEIGHT printf(“The Area of Triangle is:”); printf(“%c”,NEWLINE); printf(“%f”,area);

return 0;

OUTPUT 10 20

The Area of Triangle is:

100

OUTPUT 10 20

The Area of Triangle is:

100

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*Example program using const keyword in C:*

#include <stdio.h> void main()

{

const int height = 100; /\*int constant\*/

const float number = 3.14; /\*Real constant\*/ const char letter = 'A'; /\*char constant\*/

const char letter\_sequence[10] = "ABC"; /\*string constant\*/ const char backslash\_char = '\?'; /\*special char cnst\*/ printf("value of height :%d \n", height );

printf("value of number : %f \n", number ); printf("value of letter : %c \n", letter );

printf("value of letter\_sequence : %s \n", letter\_sequence); printf("value of backslash\_char : %c \n", backslash\_char);

}

*Output:*

value of height : 100

value of number : 3.140000 value of letter : A

value of letter\_sequence : ABC value of backslash\_char : ?

1. *Example program using #define preprocessor directive in C:*

#include <stdio.h> #define height 100

*Output:*

value of height : 100

value of number : 3.140000 value of letter : A

value of letter\_sequence : ABC value of backslash\_char : ?

#define number 3.14 #define letter 'A'

#define letter\_sequence "ABC" #define backslash\_char '\?' void main()

{

printf("value of height : %d \n", height ); printf("value of number : %f \n", number ); printf("value of letter : %c \n", letter );

printf("value of letter\_sequence : %s \n",letter\_sequence); printf("value of backslash\_char : %c \n",backslash\_char);

}

------------------------------------------------------------------------------------------------------

#### Difference between variable and constants

The **difference between variables** and **constants** is that **variables** can change their value at any time but **constants** can never change their value.

**Variable int a =10; a++;**

**printf(“%d”,a);**

**-----------------------**

**o/p:= 11**

**Constant variable const int a =10; a++;**

**printf(“%d”,a);**

**---------------------**

**o/p:= 10**

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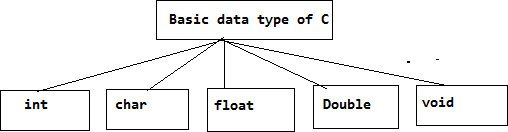
#### DATA TYPES IN C

The data type, of a variable determines a set of values that a variable might take and a set of operations that can be applied to those values.

Data type refer to the type and size of data associated with the variable and functions.

Data types can be broadly classified as shown in Figure

**Basic data type of C**



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Data Type** | **Size in Bytes** | **Range** | **Format- Specifier** |
| **int** | int | 2 | -32768 to +32767 | %d |
| short signed int (or) signed int | 2 | 32768 to +32767 | %d |
| short unsigned int (or)  unsigned int | 2 | 0 to 65535 | %u |
| long signed int (or) long int | 4 | -2147483648 to 2147483647 | %ld |
| long unsigned int | 4 | 0 to 4294967295 | %lu |
| **char** | char or signed char | 1 | -128 to 127 | %c |
| unsigned char | 1 | 0 to 255 | %c |
|  | **float**  Allows 6 digits after decimal point. | 4 | -3.4e-38 to +3.4e38 | %f |
|  | **double**  Allows 15 digits after decimal point. | 8 | -1.7e-308 to +1.7e308 | %lf |
|  | l**ong double**  Allows 15 digits after decimal point. | 10 | -1.7e-4932 to 1.7e4932 | %LF |

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**/\*Program\*/** #include<stdio.h> int main()

{

char a;

unsigned char b; int i;

unsigned int j; long int k;

unsigned long int m; float x;

double y

long double z;

printf(“\n char and unsigned char”);

scanf(“%c %c”,&a,&b) //get char and unsigned char value printf(“%c %c”,a,b) //display char and unsigned char value

printf(“\n int unsigned int”);

scanf(“%d %u”,&i,&j) //get int unsigned int value printf(“%d %u”,i,j) //display int unsigned int value

printf(“\n long int unsigned long int”);

scanf(“%ld %lu”,&i,&j) //get long int and long unsigned int value printf(“%ld %lu”,i,j) //display int unsigned int value

printf(“\n float,double and long double”);

scanf(“%f %lf %Lf”,&i,&j) //get float,double and long double value printf(“%f %lf %Lf”,i,j) //display float,double and long double value

return 0;

}

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### The specifiers and qualifiers for the data types can be broadly classified into three types

* + ***Size specifiers***— short and long
  + ***Sign specifiers***— signed and unsigned
  + ***Type qualifiers***— const, volatile and restrict.

**Size qualifiers** alter the size of the basic data types. There are two such qualifiers that can be used with the data type int; these are short and long.

**short,** when placed in front of the data type int declaration, tells the C compiler that the particular variable being declared is used to store fairly small integer values. **Long** specifies it is a very big integer value.Long integers require twice the memory of than small ints.

Table: Sizes (bytes) of short int ,int,long int

|  |  |  |  |
| --- | --- | --- | --- |
|  | **16-bit Machine**  **(size in bytes)** | **16-bit Machine**  **(size in bytes)** | **16-bit Machine**  **(size in bytes)** |
| **short int** | 2 | 2 | 2 |
| **int** | 2 | 4 | 4 |
| **long int** | 4 | 4 | 8 |

Table:Size and range of *long long* type (64-bit machine)

|  |  |  |
| --- | --- | --- |
| **Data type** | **Size (in**  **bytes)** | **Range** |
| **long long int** | 8 | -9, 223, 372, 036, 854, 775, 808 to  +9, 223, 372, 036, 854, 775, 808 |
| **unsigned long int or unsigned long** | 4 | 0 to + 4, 294, 967, 295 |
| **unsigned long long int or unsigned long long** | 8 | 0 to + 18, 446, 744, 073,709, 551, 615 |

**Sign specifiers:** for example fot int data type out of 2bytes(2\*8=16bits) of its size the highest bit(the sixtheenth bit) is used to store the sign of the integer value. The bit is 1 if number is negative and 0 if the number is positive.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bit  1 | Bit  2 | Bit  3 | Bit  4 | Bit  5 | Bit  6 | Bit  7 | Bit  8 | Bit  9 | Bit  10 | Bit  11 | Bit  12 | Bit  13 | Bit  14 | Bit  15 | Bit  16 |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Sign of number (1 for –ve and 0  for +ve0 |

**Type qualifiers** : There are two type qualifiers, const and volatile;

Eg: **const float pi = 3.14156;** // specifies that the variable pi can never be changed by the Program.

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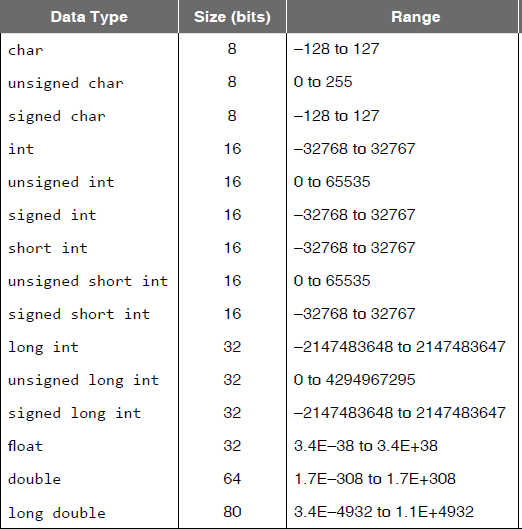
#### Table:Size and range in (16-bit machines)

|  |  |  |
| --- | --- | --- |
| **Data type** | **Size (in bits)**  **note:[1byte=8bits]** | **Range** |
| char | 8 | –128 to 127 |
| int | 16 | –32768 to 32767 |
| float | 32 | 1.17549 × 10–38 to 3.40282 × 1038 |
| double | 64 | 2.22507 × 10–308 to 1.79769 × 10 308 |
| Void | 8 | valueless |

**Table:Size and range of (32-bit machine)**

|  |  |  |
| --- | --- | --- |
| **Data type** | **Size (in bits) note:[1byte=8bits]** | **Range** |
| char | 8 | –128 to 127 |
| int | 32 | –2147483648 to 2147483647 |
| float | 32 | 1.17549 × 10–38 to 3.40282 × 1038 |
| double | 64 | 2.22507 × 10-308 to 1.79769 × 10 308 |
| Void | 8 | valueless |

**Allowed combinations of basic data types and modifi ers in C for a 16-bit computer**



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## VARIABLES

Variable is the name of memory location which holds the data. Unlike constant, variables are changeable, value of a variable can be changed during execution of a program. A programmer must chose a meaningful variable name.

Variables are used for holding data values so that they can be utilized for various computations in a program.A variable must be declaed and then used for coputation work in program./A variable is an identifier used for storing and holding some data(value).

All variables have three important attributes.

1.A ***data type: Like*** int, double, float. Once defined,the type of a C variable cannot be changed.

2.A ***name*** of the variable.

3.A ***value*** that can be changed by assigning a new value to the variable. The kind of values a variable can assume depends on its type.

Eg : for variable int salary,it can only take integer values can only take integer values like 65000 and not 6500.0

#### Rules For Constructing Variables

1. A variable name can be a combination of alphabets, numbers and special character underscore( \_ ).
2. The first character in the variable name must be an alphabet.
3. No commas or blank spaces are available are allowed within a variable name.
4. No special symbol other than an underscore is allowed.
5. Upper and Lower case names are treated as different, as C is case sensitive, so it is suggested to keep the variable names in lower case.

#### Declaring and Initializing a variable:=

Declaration of a variable must be done before it is used for any computation in the program.

Declaration tells the compiler what the variable name is.

 Declaration tells what type of data the variable will hold.

Until the variable is not defined/or/declared compiler will not allocate memory space to the variables.

 A variable can also be declared outside main() function.

A variable can also be declared in other program and declared using extern keyword.

**int yearly\_salary; float monthly\_salary; int a;**

**double x;**

**int ECE1111;**

#### Initializing a variable:=

Initializing a variable means to provide a value to variable

#### int yearly salary=5,00,000

**float monthly\_salary= 41666.66**

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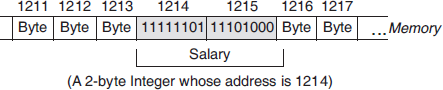
#### Difference between identifier and variable

|  |  |
| --- | --- |
| **Identifier** | **Variable** |
| Indentifier is the name given to a  variable,function etc. | While variable is used to name a memory  location which stores data |
| An identifier can be a variable ,but not all  identifiers are variables | All variables names are identifiers |
| Example : void average()  {  } | Example: int average |

Variables are a way of reserving memory to hold some data and assign names to them so that we don’t have to remember the numbers like REG46735 or memory address like FFFFoxFF and instead we can use the memory location by simply referring to the variable.

Every variable is mapped to a unique memory address. And variable will be having a data type associated

**int salary = 65000;**



**[[[[[[**note A computer memory is made up of registers and cells. It accesses data in a collection of bits, typically 8 bits, 16 bit, 32 bit or 64 bit. A computer memory holds information in the form of binary digits 0 and 1 (bits).**]]]]]]**

**EC8393**

## Operators in C

An operator is a symbol that tells the compiler to perform specific mathematical or logical functions. C language is rich in built-in operators and provides the following types of operators –

* + Arithmetic Operators
  + Relational Operators
  + Logical Operators
  + Bitwise Operators
  + Assignment Operators
  + Misc Operators

#### Arithmetic Operators

The following table shows all the arithmetic operators supported by the C language. Assume variable **A** holds 10 and variable **B** holds 20

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| + | Adds two operands. | A + B = 30 |
| − | Subtracts second operand from the first. | A − B = -10 |
| \* | Multiplies both operands. | A \* B = 200 |
| / | Divides numerator by de-numerator. | B / A = 2 |
| % | Modulus Operator and remainder of after an integer division. | B % A = 0 |
| ++ | Increment operator increases the integer value by one. | A++ = 11 |
| -- | Decrement operator decreases the integer value by one. | A-- = 9 |

#### Relational Operators

The following table shows all the relational operators supported by C. Assume variable **A** holds 10 and variable **B** holds 20 then

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| == | Checks if the values of two operands are equal or not. If yes, then the condition becomes true. | (A == B) is not true. |
| != | Checks if the values of two operands are equal or not. If the values are not equal, then the condition becomes true. | (A != B) is true. |
| > | Checks if the value of left operand is greater than the value of right operand. If yes, then the condition becomes true. | (A > B) is not true. |
| < | Checks if the value of left operand is less than the value of right operand. If yes, then the condition becomes true. | (A < B) is true. |
| >= | Checks if the value of left operand is greater than or equal to the value of right operand. If yes, then the condition becomes true. | (A >= B) is not true. |
| <= | Checks if the value of left operand is less than or equal to the value of right operand. If yes, then the condition becomes true. | (A <= B) is true. |

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#### Logical Operators

Following table shows all the logical operators supported by C language. Assume variable **A**

holds 1 and variable **B** holds 0, then −

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| && | Called Logical AND operator. If both the operands are non-zero, then the condition becomes true. | (A && B) is false. |
| || | Called Logical OR Operator. If any of the two operands is non-zero, then the condition becomes true. | (A || B) is true. |
| ! | Called Logical NOT Operator. It is used to reverse the logical state of its operand. If a condition is true, then Logical NOT operator will make it false. | !(A && B) is true. |

**Bitwise Operators**

Bitwise operator works on bits and perform bit-by-bit operation. The truth tables for &, |, and ^ is as follows −

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **p** | **q** | **p & q** | **p | q** | **p ^ q** |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 |

Assume A = 60 and B = 13 in binary format, they will be as follows − A = 0011 1100

B = 0000 1101

----------------- A&B = 0000 1100

A|B = 0011 1101

A^B = 0011 0001

~A = 1100 0011

The following table lists the bitwise operators supported by C. Assume variable 'A' holds 60 and variable 'B' holds 13, then −

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| **&** | Binary AND  **It takes 1 if both operands has value 1.** | (A & B) = 12, i.e., 0000 1100 |
| **|** | Binary OR  Operator copies a bit if it exists in either operan **The output of bitwise OR is 1 if at least one corresponding bit of two operands is 1.** | (A | B) = 61, i.e., 0011 1101 |
| **^** | Binary XOR  **1 if the corresponding bits of two operands are opposite** | (A ^ B) = 49, i.e., 0011 0001 |
| **~** | Binary Ones Complement  'flipping' bits- 0 changed to 1and 1 changed to 0 | (~A ) = -60, i.e,. 1100 0100 |
| **<<** | Binary Left Shift Operator.  The left operands value is moved left by the number of bits specified by the right operand. | A << 2 = 240 i.e., 1111 0000 |
| **>>** | Binary Right Shift Operator.  The left operands value is moved right by the number of bits specified by the right operand. | A >> 2 = 15 i.e., 0000 1111 |

#### Assignment Operators

The following table lists the assignment operators supported by the C language

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| = | Simple assignment operator. Assigns values from right side operands to left side operand | C = A + B will assign the value of A + B to C |
| += | Add AND assignment operator. It adds the right operand to the left operand and assign the result to the left operand. | C += A is equivalent to C = C + A |
| -= | Subtract AND assignment operator. It subtracts the right operand from the left operand and assigns the result to the left operand. | C -= A is equivalent to C = C - A |
| \*= | Multiply AND assignment operator. It multiplies the right operand with the left operand and assigns the result to the left operand. | C \*= A is equivalent to C = C \* A |
| /= | Divide AND assignment operator. It divides the left operand with the right operand and assigns the result to the left operand. | C /= A is equivalent to C = C / A |
| %= | Modulus AND assignment operator. It takes modulus using two operands and assigns the result to the left operand. | C %= A is equivalent to C = C % A |
| <<= | Left shift AND assignment operator. | C <<= 2 is same as C = C << 2 |
| >>= | Right shift AND assignment operator. | C >>= 2 is same as C = C >> 2 |
| &= | Bitwise AND assignment operator. | C &= 2 is same as C = C & 2 |
| ^= | Bitwise exclusive OR and assignment operator. | C ^= 2 is same as C = C ^ 2 |
| |= | Bitwise inclusive OR and assignment operator. | C |= 2 is same as C = C | 2 |

**Misc Operators**

|  |  |  |
| --- | --- | --- |
| **Operator** | **Description** | **Example** |
| sizeof() | Returns the size of a variable. | int a;  sizeof(a), where a is integer, will return 2. |
| & | Returns the address of a variable. | &a; returns the actual address of the variable a .(OxFFA) |
| \* | Pointer to a variable. | \*a; |
| ? : | Conditional Expression. | If Condition is true ? then value X : otherwise value Y |

**Operators Precedence in C**

For example, x = 7 + 3 \* 2; here, x is assigned 13, not 20 because operator \* has a higher precedence than +, so it first gets multiplied with 3\*2 and then adds into 7.

Table showing highest precedence to lowest precedence

|  |  |  |
| --- | --- | --- |
| **Category** | **Operator** | **Associativity** |
| Postfix | ( ) [ ] -> . ++ - - | Left to right |
| Unary | Unary +,unary-, (type) \* & sizeof | Right to left |
| Multiplicative | \* / % | Left to right |
| Additive | + - | Left to right |
| Shift | << >> | Left to right |
| Relational | < <= > >= | Left to right |
| Equality | = = != | Left to right |
| Bitwise AND | & | Left to right |
| Bitwise XOR | ^ | Left to right |
| Bitwise OR | | | Left to right |
| Logical AND | && | Left to right |
| Logical OR | || | Left to right |
| Conditional | ?: | Right to left |
| Assignment | = += -= \*= /= %= >>= | Right to left |
| Comma | , | Left to right |

## Expression

### Expression is a combination of variables(like a,b,m,n..), constants(3,2,1) and operators(+,/\*).

Eg : c+d

x/y+b+a\*a\*a

3.14 \*r \*r

|  |  |
| --- | --- |
| **Algebraic Expression** | **C Expression** |
| ab-c | a\*b-c |
| (m+n)(k+j) | (m+n)\*(k+j) |
| (ab/c) | a\*b/c |
| 3x2+2x+1 | 3\*x^2+2\*x+1 |

Example Program

**#include<stdio.h>**

**Program int main( )**

**{**

**int x=2,y=3,result; result=x\*5+y\*7; printf(“result =:%d”,result); return 0;**

**}**

**Expression evaluation result=x\*5 + y\*7; result=2\*5 + 3\*7; result=2\*5 + 3\*7; result=10 + 3\*7; result=10 + 21; result=31;**

#### Example program –find greatest of 3 numbers

Example of logical(&& logical AND) and relational operators(>)

#include<stdio.h> int main()

{

int num1,num2,num3;

printf("\nEnter value of a, b and c:"); scanf("%d %d %d",&a,&b,&c);

if((a>b)&&(a>c))

printf("\n %d is greatest",a); else if(b>c)

printf("\n %d is greatest",b "); else

printf("\n %d is greatest",c); return 0;

}

#### Example program –find odd or even number

Example of Arithmetic(% mod) and relational operators(==) #include<stdio.h>

int main()

{ int num,result; if(num%2==0)

printf(“even number \n”); else

printf(“odd number \n”); return 0;

}

**Bitwise XOR**

**Explanation**

**12 = 00001100 (In Binary)**

**25 = 00011001 (In Binary)**

**Bitwise XOR Operation of 12 and 25 00001100**

**00011001**

**00010101 = 21 (In decimal)**

#include <stdio.h> int main()

{

int a = 12, b = 25; printf("Output = %d", a^b); return 0;

}

#### Output = 21

**Bitwise complement 1’s compliment**

**Explanation**

**35 = 00100011 (In Binary)**

**Bitwise complement Operation of 35**

**~ 00100011**

**11011100 = 220 (In decimal)**

#include <stdio.h> int main()

{

printf("complement = %d\n",~35); return 0;

}

OutPut:

#### complement = 220

**Bitwise AND and OR operator**

12 = 00001100 (In Binary)

25 = 00011001 (In Binary)

Bitwise AND Operation of 12 and 25 00001100

& 00011001

00001000 = 8 (In decimal) Bitwise OR Operation of 12 and 25

00001100

| 00011001

00011101 = 29 (In decimal)

#include <stdio.h> int main()

{

int a = 12, b = 25; printf("OutputAND = %d", a&b); printf("OutputOR = %d", a|b); return 0;

}

#### OutputAND = 8

**OutputOR = 29**

**Managing Input and Output operations**

Constructs for getting input

1)scanf( ) 2)putchar() 3)puts()

1. getche( )
2. fgets( ) 6)fscanf( )

Constructs for displaying output

1)scanf( ) 2)getchar() 3)gets( )

4)fputs( ) 5)fprint( )

**C Input and Output**

**Input** means to provide the program with some data to be used in the program

**Output** means to display data on screen or write the data to a printer or a file.

#### Single character input and output[getchar( ) and putchar()]

* + **input- getchar()**
  + **output- putchar()**

The **int getchar(void)** function reads the next available character from the screen and returns it as an integer. This function reads only single character at a time.

The **int putchar(int c)** function puts the passed character on the screen and returns the same character. This function puts only single character at a time.

program

#include <stdio.h> int main( ) {

output

$./a.out

**Enter a value :** this is DS class

**You entered:** t

int c;

printf( "Enter a value :"); c = getchar( );

printf( "\nYou entered: "); putchar( c );

return 0;

}

#### String input and output[gets() and puts()

* + **Input--- gets (str)**
  + **Output---puts (str)**

The **gets( )** function reads a line from **stdin** into the buffer pointed to by **s** until either a terminating newline or EOF (End of File).

The **puts( )** function writes the string 's' and 'a' trailing newline to **stdout**.

Program

**#include <stdio.h>**

Output

$./a.out

**Enter a value :** this is DS class

**You entered:** this is DS class

int **main**( ) { char **str**[**100**];

**printf**( **"Enter a value :"**); **gets**( **str** );

**printf**( **"\nYou entered: "**); **puts**( **str** );

return **0**;

}

#### Formatted Input [ scanf ( ) ] and Formatted Output [ printf ( ) ]

Specifier Meaning

%c – Print a character

%d – Print a Integer

%i – Print a Integer

%u-- Unsigned int

%ld-- Long int

%e – Print float value in exponential form.

%f – Print float value

%g – Print using %e or %f whichever is smaller

|  |  |
| --- | --- |
| %lf | --Double |

%lf-- Long double

%o – Print octal value

%s – Print a string

%x – Print a hexadecimal integer (Unsigned) using lower case a – f

%X – Print a hexadecimal integer (Unsigned) using upper case A – F

%a – Print a unsigned integer.

%p – Print a pointer value

%hx – hex short

# scanf()

scanf() is a predefined function in "stdio.h" header file. It can be used to read the input value from the keyword.

Syntax of scanf() function

1. **& ampersand** symbol is the address operator specifying the address of the variable
2. **control string** holds the format of the data
3. **variable1**, **variable2**, ... are the names of the variables that will hold the input value.

**scanf("control string", &variable1, &variable2, ...);**

int a; float b;

Example

scanf("%d%f",&a,&b);

Example

double d; char c; long int l;

scanf("%c%lf%ld",&c&d&l);

#### Printf

Printf is a predefined function in "stdio.h" header file, by using this function, we can print the data or user defined message on console or monitor. While working with printf(), it can take any number of arguments but first argument must be within the double cotes (" ") and every argument should separated with comma ( , ) Within the double cotes, whatever we pass, it prints same, if any format specifies are there, then value is copied in that place.

#### Program

**#include <stdio.h> //This is needed to run printf() function.**

int **main**()

{

**printf**(**"C Programming"**); **//displays the content inside quotation**

return **0**;

}

**Output**

**C Programming**

Program(integer and float) **#include <stdio.h> #include <conio.h>**

void **main**();

{

int **a**; float **b**; **clrscr**();

**printf**(**"Enter any two numbers: "**); **scanf**(**"%d %f"**,&**a**,&**b**);

**printf**(**"%d %f \n"**,**a**,**b**); **getch**();

}

Output: Enter any two numbers:10 3.5 10

3.5

#### Program

#include <stdio.h> int main()

{

int integer = 9876; float decimal = 987.6543;

printf("4 digit integer right justified to 6 column: %6d\n", integer); printf("4 digit integer right justified to 3 column: %3d\n", integer); printf("Floating point number rounded to 2 digits: %.2f\n",decimal); printf("Floating point number rounded to 0 digits: %.f\n",987.6543); printf("Floating point number in exponential form: %e\n",987.6543);

4 digit integer right justified to 3 column: 9876 Floating point number rounded to 2 digits: 987.65 Floating point number rounded to 0 digits: 988 Floating point number in exponential form: 9.876543e+02

9876

**Output**

4 digit integer right justified to 6 column:

return 0;

}

FILE INPUT and OUTPUT

**4. File string input and output using fgets( )and fputs( )**

**The fgets() function**

The fgets() function is used to read string(array of characters) from the file.

fgets(char str[],int n,FILE \*fp);

**Syntax**

The fgets() function takes three arguments, first is the string read from the file, second is size of string(character array) and third is the file pointer from where the string will be read.

Example

File\*fp; Str[80];

fgets(str,80,fp)

Example program #include<stdio.h>

void main()

{

FILE \*fp; char str[80];

fp = fopen("file.txt","r"); // opens file in read mode (“r”)

while((fgets(str,80,fp))!=NULL) printf("%s",str); //reads content from file

fclose(fp);

}

Data in file...

C is a general-purpose programming language. It is developed by Dennis Ritchie.

C is a general-purpose programming language. It is developed by Dennis Ritchie.

Output :

#### The fputs() function

The fputs() function is used to write string(array of characters) to the file.

 The fputs() function takes two arguments, first is the string to be written to the file and second is the file pointer where the string will be written.

Syntax:

fputs(char str[], FILE \*fp);

include < stdio.h > nt main ()

#

i

{

FILE \*fp;

fp = fopen("proverb.txt", "w+"); //opening **fputs("Cleanliness is next to godliness.", fputs("Better late than never.", fp);**

file in write mode

**fp);**

**fputs("The pen is mightier than the sword.", fp);**

fclose(fp); return(0);

}

Output

Cleanliness is next to godliness. Better late than never.

The pen is mightier than the sword.

1. **File string input and output using fgets( )and fputs( )**

#### The fscanf() function

The fscanf() function is used to read mixed type(characters, strings and integers) form the file.

****The fscanf() function is similar to scanf() function except the first argument which is a file pointer that specifies the file to be read.

fscanf(FILE \*fp,"format-string",var-list);

Syntax:

Example program #include<stdio.h>

void main()

{

FILE \*fp; char ch;

int roll;

char name[25];

fp = fopen("file.txt","r"); printf("\n Reading from file...\n");

while((**fscanf(fp,"%d%s",&rollno,&name**))!=NULL) printf("\n %d\t%s",rollno,name);//reading data

fclose(fp);

}

Output :

Reading from file... 6666 keith

7777 rose

**EC8393**

**The fprintf() function:**

 The fprintf() function is used to write mixed type(characters, strings and integers) in the file.

The fprintf() function is similar to printf() function except the first argument which is a file pointer specifies the filename to be written.

Syntax

fprintf(FILE \*fp,"format-string",var-list);

Example program #include<stdio.h>

void main()

Output

6666

john

{

FILE \*fp; int roll;

char name[25];

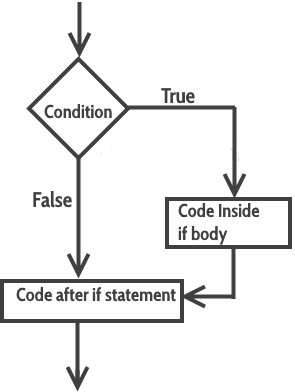
fp = fopen("file.txt","w"); scanf("%d",&roll);

scanf("%s",name);

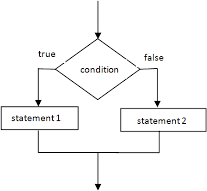
**fprintf(fp,"%d%s%",roll,name);**

close(fp);

}



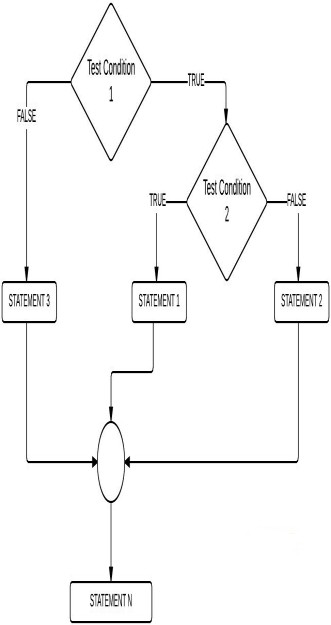
|  |  |  |  |
| --- | --- | --- | --- |
| **EC8393**  **Decision Making and Branching**  **Conditional Branching Conditional Branching**  if statement break  nested if statement continue  if ..else statement goto  nested if else statement  **These include conditional type branching and unconditional type branching.**  **if statement**  It takes the following form  **if(test-expression)**  **It allows the computer to evaluate the expression first and them depending on whether the value of the expression is "true" or "false", it transfer the control to a particular statements. This point of program has two paths to flow, one for the true and the other for the false condition.**  **if(test-expression)**  **{**  **statement-block**  **}**  **statement-x;**  **The statement-block may be a single statement or group of statements. If the test expression is true, the statement-block will be executed; otherwise the statement-block will be skipped and the execution will jump to the statement-x. But when is condition true both the statement-block and the statement-x are executed in sequence.** | | | |
|  |  | **Eg: Example program: C Program to check equivalence of** |  |
|  |  | **two numbers using if statement** |
|  |  | **#include<stdio.h>** |
|  |  | **void main()** |
|  |  | **{** |
|  |  | **int m,n;** |
|  |  | **clrscr();** |
|  |  | **printf(" \n enter two numbers:");** |
|  |  | **scanf(" %d %d", &m, &n);** |
|  |  | **if(m-n= = 0)** |
|  |  | **{** |
|  |  | **printf(" \n two numbers are equal");** |
| **Eg-2** |  | **}** |
| **if (code = = 1)** |  | **getch();** |
| **{** |  | **}** |
| **salary = salary + 500;** |  |  |
| **}** |  |  |
| **printf("%d",salary);** |  | **o/p** |
|  |  | **4 4** |
|  |  | **two numbers are equal** |
|  | ww | .AUNewsBlog.net |
|  | |  |  |



|  |  |  |
| --- | --- | --- |
| **EC8393**  **Nested if**  **The syntax for a nested if statement is as follows**  **if( cond 1)**  **{**  **/\* Executes boolean expression when cond 1 is true \*/ if(cond 2) {**  **/\* Executes when the boolean expression 2 is true \*/**  **}**  **}**  **Example:**  **#include <stdio.h>**  int **main** ()  {  int **a** = **100**; int **b** = **200**;  if( **a** == **100** ) {  **/\* if condition is true then check the following \*/**  if( **b** == **200** ) {  **/\* if condition is true then print the following \*/ printf**(**"Value of a is 100 and b is 200\n"** );  }  }  **printf**(**"Exact value of a is : %d\n"**, **a** );  **printf**(**"Exact value of b is : %d\n"**, **b** ); return **0**;  }  **The if-else statement**  **The if-else statement is an extension of the simple if statement. The general form is If the test- expression is true, then true-block statements immediately following if statement are executed otherwise the false-block statements are executed.**  **if(test-expression) Example: C program to find largest of two numbers {true-block statements #include<stdio.h> }**  **int main() else**  **{ {**  **int m,n,large; false-block statements**  **printf(" \n enter two numbers:"); }statement-x scanf(" %d %d", &m, &n);** | | |
| **if(m>n)**  **large=m; else large=n;**  **printf(" \n large number is = %d", large); return 0;**  **}** |  |  |

**Nested if-else statement**

Nested if construct is also known as **if-else-if** construct. Syntax-1 Syntax-2



**If(test-condition-1)**

**{**

**if(test-condition-2)**

**{**

**statement-1;**

**}**

**else**

**{**

**statement-2;**

**}**

**}**

**else**

**{**

**statement-3;**

**}**

**statement-x**

**if(test-condition-1)**

**{**

**(stmts) else**

**{**

**if(condition 2)**

**{**

**Statement-1;**

**}**

**else**

**{**

**statement-2;**

**}**

**}**

**}**

**statement-x**

#### If the test-condition-1 is false, the statement-3 will be executed; other wise it continues the second test. If the condition-2 is true, the statement-2 will be evaluated and then the control is transferred to the statement-x.

**Example:Program to relate two integers using =, > or <**

**#include <stdio.h> int main()**

**{**

**int number1, number2; printf("Enter two integers: "); scanf("%d %d", &number1, &number2);**

**//checks if two integers are equal. if(number1 == number2)**

**{**

**printf("Result: %d = %d",number1,number2);**

**}**

**//checks if number1 is greater than number2.**

**else if (number1 > number2)**

**{**

**}**

**else**

**{**

**}**

**printf("Result: %d > %d", number1, number2);**

**// if both test expression is false printf("Result: %d < %d",number1, number2);**

**return 0;**

**}**

## The switch statement:

When many conditions are to be checked then using nested if...else is very difficult, confusing and cumbersome.So C has another useful built in decision making statement known as switch.

This statement can be used as multiway decision statement.The switch statement tests the value of a given variable or expression against a list of case values and when a match is found, a block of statements associated with that case is executed.

#### Eg-1

**umbers**

**int i = 1; switch(i)**

**{**

**case 1:**

**printf("A"); break;**

**case 2:**

**printf("B"); break;**

**case 3:**

**printf("C"); break;**

**default:**

**}**

**Example2: C program to find largest of two n**

**}**

**switch( code)**

**{**

**case 1:**

**stmts1; break;**

**case 2:**

**stmts2; break;**

**case 3:**

**stmts3 break;**

**default:**

**stmtsx**

**#include<stdio.h>**

**For case 1,da=10% of basic salary. For case 2, da=15% of basic salary. For case 3, da=20% of basic salary.**

**For default case >3 da is not given.(da=0**)

**void main ()**

**{**

**float basic , da , salary ; int code ;**

**char name[25]; da=0.0;**

**printf("Enter employee name\n"); scanf("%[^\n]",name); printf("Enter basic salary\n"); scanf("%f",&basic);**

**o/p**

**Enter name of employee: Kartiyani**

**Enter Basic salary 5000**

**Enter code of employee 1**

**Employee name is Kartiyani**

**DA is 500 and total salary is 5500**

**printf("Enter code of the Employee\n"); scanf("%d",&code);**

**switch (code)**

**{**

**case 1:**

**da = basic \* 0.10; break;**

**case 2:**

**da = basic \* 0.15; break;**

**case 3:**

**da = basic \* 0.20; break; default :**

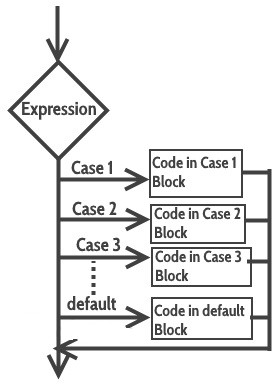
**da = 0;**

**}**

**salary = basic + da; printf("Employee name is\n"); printf("%s\n",name);**

**printf ("DA is %f and Total salary is =%f\n",da, salary); getch();**

**}**



**Rules for using switch statement**

* 1. The expression (after switch keyword) must yield an **integer** value
  2. The case **label** values must be unique.
  3. The case label must end with a colon(**:**)

**Difference between switch and if**

* if statements can evaluate float conditions. switch statements cannot evaluate

float conditions.

* if statement can evaluate relational operators. switch statement cannot evaluate relational operators i.e they are not allowed in switch statement.

## BREAK

**The break statement in C programming has the following two usages −**

#### When a break statement is encountered inside a loop, the loop is immediately terminated and the program control resumes at the next statement following the loop.

* **It can be used to terminate a case in the switch statement**

**BREAK is a keyword that allows us to jump out of a loop instantly, without waiting to get back to the conditional test.**

**The syntax for a break statement in C is as follows −**

**break;**

**Example program #include <stdio.h>** int **main** ()

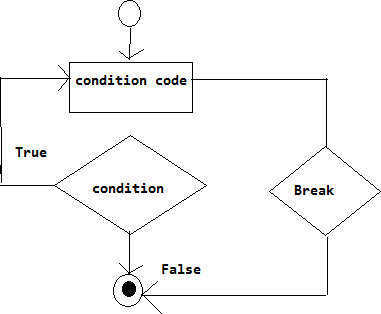
{

int **a** = **10**; while( **a** < **20** )

{

#### Output

**value of a: 10 value of a: 11 value of a: 12 value of a: 13 value of a: 14 value of a: 15**



**printf**(**"value of a: %d\n"**, **a**); **a**++;

if( **a** > **15**)

{

break;

}

}

return **0**;

}

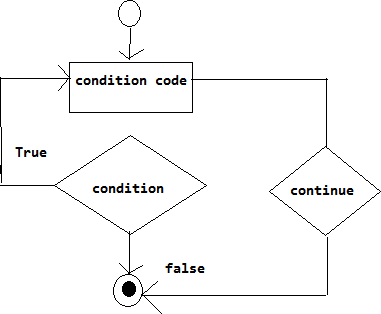
#### Continue

**The continue statement in C programming works somewhat like the break statement. Instead of forcing termination, it forces the next iteration of the loop to take place, skipping any code in between.**

**For the for loop, continue statement causes the conditional test and increment portions of the loop to execute. For the while and do...while loops, continue statement causes the program control to pass to the conditional tests.**

**Syntax**:

**continue;**



**Example program**

**#include <stdio.h>**

**Output**

**value of a: 10 value of a: 11 value of a: 12 value of a: 13 value of a: 14 value of a: 16 value of a: 17 value of a: 18 value of a: 19**

int **main** ()

{

int **a** = **10**; do {

if( **a** == **15**)

### {

**/\* skip the iteration \*/ a** = **a** + **1**;

continue;

}

**printf**(**"value of a: %d\n"**, **a**); **a**++;

} while( **a** < **20** ); return **0**;

### }

|  |  |
| --- | --- |
| **Break** | **Continue** |
| **The break statement can be used in both switch and loop (for, while, do while) statements.** | **The continue statement can appear only in loops. You will get an error if this appears in switch statement.** |
| **A break causes the switch or loop statements to terminate the moment it is executed. Loop or switch ends abruptly when break is encountered.** | **A continue doesn't terminate the loop, it causes the loop to go to the next iteration. The continue statement is used to skip statements in the loop that appear after the continue.** |
| **The break statement can be used in both**  **switch and loop statements.** | **The continue statement can appear only in loops. You will get an error if this appears in switch statement.** |
| **When a break statement is encountered, it terminates the block and gets the control out of the switch or loop.** | **When a continue statement is encountered, it gets the control to the next iteration of the loop.** |

**GOTO**

**GOTO STATEMENT**

‘C’ supports goto statement to branch unconditionally from one point to another in the program.

A **goto** statement in C programming provides an unconditional jump from the 'goto' to a labeled statement.

**NOTE** − Use of **goto** statement is highly discouraged in any programming language because it makes difficult to trace the control flow of a program, making the program hard to understand and hard to modify. Any program that uses a goto can be rewritten to avoid them.

**Syntax**

The syntax for a **goto** statement in C is as follows −

**goto label;**

**..**

**.**

**label: statement**;

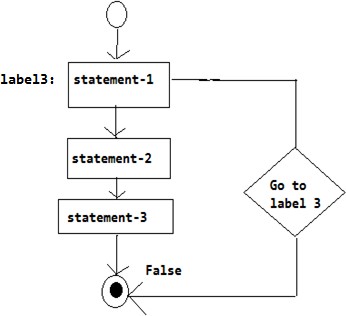
Or

**label: statement**;

...

...

**goto label;**



**Example program #include <stdio.h>**

Output

value of a: 10 value of a: 11 value of a: 12 value of a: 13 value of a: 14 value of a: 16 value of a: 17 value of a: 18 value of a: 19

int **main** ()

{

int **a** = **10**; **ABCL**:do

{

if( **a** == **15**)

{

**a** = **a** + **1**; goto **ABCL**;

}

**printf**(**"value of a: %d\n"**, **a**); **a**++;

}while( **a** < **20** ); return **0**;

}

**program to print ‘n’ natural number**

|  |
| --- |
| **#include<stdio.h>**  **void main( )** |
| **{** |
| **int n,i=1;** |
| **clrscr();** |
| **printf("enter number");** |
| **scanf("%d\t",n);** |
| **printf("natural numbers from 1 to %d", n);** |
| **lb: printf("%d\t",i);** |
| **i++;** |
| **if(i<=n)** |
| **goto lb;** |
| **getch();**  **}** |

LOOPING STATEMENTS

Loop constructs supports repeated execution of statements when a condition match.

If the loop Test Condition is true, then the loop is executed, the sequence of statements to be executed is kept inside the curly braces { } is known as the **Loop body**. After every execution of the loop body, **condition** is verified, and if it is found to be **true** the loop body is executed again. When the condition check returns **false**, the loop body is not executed, and execution breaks out of the loop.

**Types of Loop**

There are 3 types of Loop in C language, namely:

1. while loop
2. for loop
3. do while loop

**while loop**

Repeats a statement or group of statements while a given condition is true. It tests the condition before executing the loop body.

while(condition)

{

statements;

}

**Example-- Example: Program to print first 10 natural numbers**

#include<stdio.h> void main( )

{

int x; x = 1;

while(x <= 10)

{

printf("%d\t", x); x++;

}

}

**Output:** 1 2 3 4 5 6 7 8 9 10

## do while loop

### In some situations it is necessary to execute body of the loop before testing the condition. Such situations can be handled with the help of do-while loop. do statement executes the body of the loop first and at the end, the condition is checked using while statement. It means that the body of the loop will be executed at least once, even though the starting condition inside while is initialized to be false.

do

{

.....

.....

}

while(condition)

General syntax

***Example: Program to print first 10 multiples of 5.***

#include<stdio.h> void main()

{

int a, i; a = 5;

i = 1;

do

{

printf("%d\t", a\*i); i++;

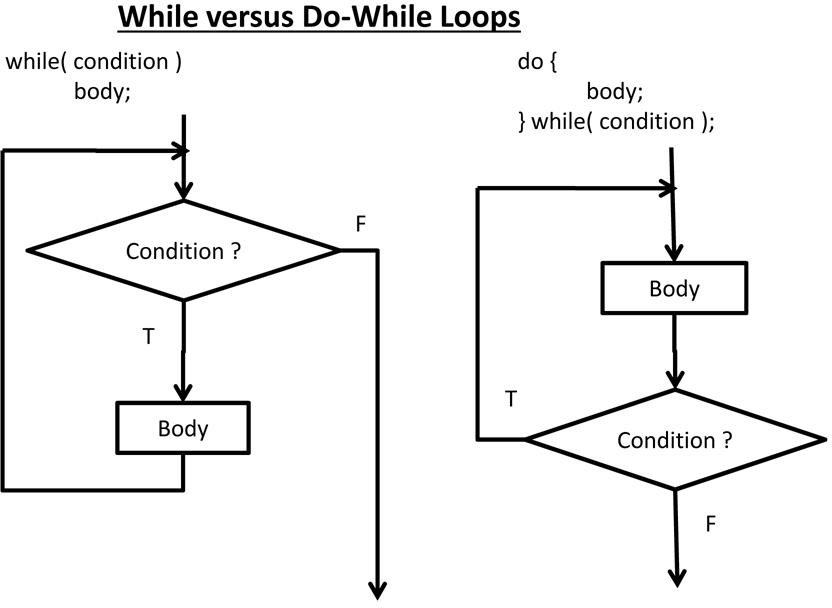
}

while(i <= 12);

}

Output

5 10 15 20 25 30 35 40 45 50 55 60

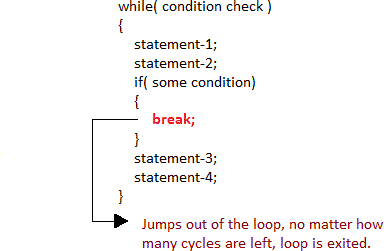


**Jumping Out of Loops**

Sometimes, while executing a loop, it becomes necessary to skip a part of the loop or to leave the loop

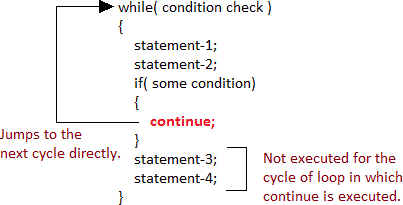
1. ***break statement***

When break statement is encountered inside a loop, the loop is immediately exited and the program continues with the statement immediately following the loop.



1. ***continue statement***

It causes the control to go directly to the test-condition and then continue the loop process. On encountering continue, cursor leave the current cycle of loop, and starts with the next cycle.



**For Loop**

for loop is used to execute a set of statements repeatedly until a particular condition is satisfied. We can say it is an **open ended loop.**. General format is,

**for(initialization; condition; increment/decrement)**

**{**

**statement-block;**

**}**

In for loop we have exactly two semicolons, one after initialization and second after the condition. In this loop we can have more than one initialization or increment/decrement, separated using comma operator. But it can have only one **condition**.

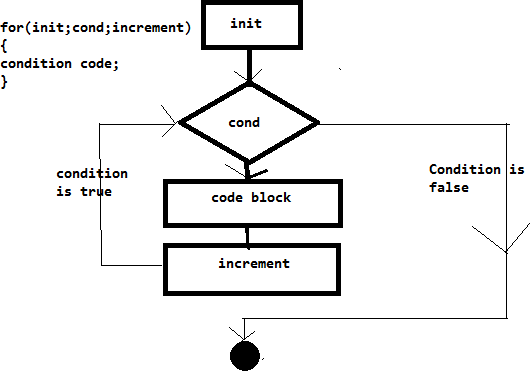
The for loop is executed as follows:

* 1. It first evaluates the initialization code.
  2. Then it checks the condition expression.
  3. If it is **true**, it executes the for-loop body.
  4. Then it evaluate the increment/decrement condition and again follows from step 2.
  5. When the condition expression becomes **false**, it exits the loop.

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***Example: Program to print first 10 natural numbers***

### #include<stdio.h> void main( )



{

int x;

for(x = 1; x <= 10; x++)

{

printf("%d\t", x);

}

}

Output: 1 2 3 4 5 6 7 8 9 10

**Nested for loop**

We can also have nested for loops, i.e one for loop inside another for loop. Basic syntax is,

**for(initialization; condition; increment/decrement)**

**{**

**for(initialization; condition; increment/decrement)**

**{**

**statement ;**

**}**

**}**

***Example: Program to print half Pyramid of numbers***

#include<stdio.h>

void main( )

Output

1

2 1

3 2 1

4 3 2 1

5 4 3 2 1

{

int i, j;

for(i = 1; i < 5; i++) /\* first for loop \*/

{ printf("\n");

/\* second for loop inside the first \*/ for(j = i; j > 0; j--)

{

printf("%d", j);

}

}

}

**EC8393 ARRAYS**

**<Arrays – Initialization – Declaration – One dimensional and Two-dimensional arrays.>**

1. ONE DIMENTIONAL ARRAY
2. TWO DIMENTIONAL ARRAY
3. STRING ARRAYS (ONE DIMENTIONAL ARRAY and TWO DIMENTIONAL ARRAY)
4. MULTIDIMENTIONAL ARRAYS

An **array** is a collection of similar data items, accessed using a common name. The collection of element can all be integers or be all decimal value or be all characters or be all strings.

* + A one-dimensional **array** is like a list
  + A two dimensional **array** is like a table
  + The **C** language places no limits on the number of dimensions in an **array**

**ONE DIMENTIONAL ARRAY**

# Array Declaration:

To declare an array in C, a programmer specifies the type of the elements and the number of elements required. The **arraySize** must be an integer constant greater than zero and **datatype** can be any valid C data type.

Syntax1:

datatype arrayName[ arraySize ];

**Example-1**

**int n; Scanf(“%d”,&n);**//get size **int x[n];** //array declaration

**int n=25;**

**double x[n], y[n];** //array

declaration

**int number[20]; int marks[44]; float salary[10]; double value[25];**

#include<stdio.h> int main( )

{

int N=10,M=20;

int marks[N\*M];//array dec

....

return 0;

}

#include<stdio.h> #define N 100

int main( )

{

int marks[N];//array dec

....

return 0;

}

**Syntax-2**

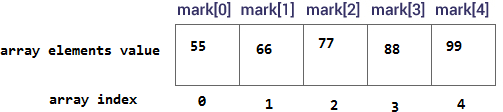
<storage class> datatype arrayName[ arraySize ];

**Example: static int marks[20];**

**EC8393**

# Array intitialization:

|  |  |  |
| --- | --- | --- |
| **Example-1** | **int mark[5] = {55,** | **66, 77, 88, 99};** |
| mark[0] = | 55 |  |
| mark[1] = | 66 |  |
| mark[2] = | 77 |  |
| mark[3] = | 88 |  |
| mark[4] = | 99 |  |



**Example-2 double balance[] = {1000.0, 2.0, 3.4, 7.0, 50.0};**

it means....

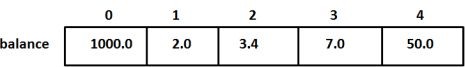
balance[0] = 1000.0;

balance[1] = 2.0;

balance[2] = 3.4;

balance[3] = 7.0;

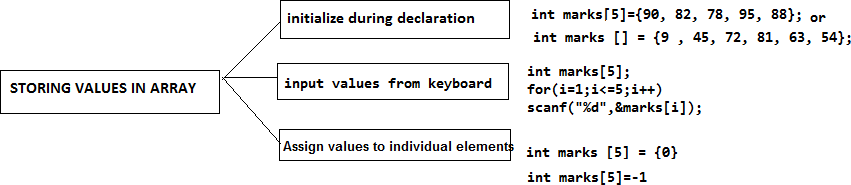
balance[4] = 50.0;



#### Automatic sizing

**int arr[] = {3,1,5,7,9};**

Here, the C compiler will deduce the size of the array automatically based on the number of elements. Array size is deduced to be 5



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**OPERATIONS ON ARRAYS**

* **Traversing an array**
* **Inserting an element in an array**
* **Searching an element in an array**
* **Deleting an element from an array**
* **Merging two arrays**
* **Sorting an array in ascending or descending order**

**Working with one dimensional array STORE and DISPLAY VALUES IN AN ARRAY (traversing an array)** #include<stdio.h>

Output:

**Enter the array elements 2**

**4**

**3**

**1**

**8**

**Display the array elements 2**

**4**

**3**

**1**

**8**

int main( )

{

int k,array[10];//array declaration printf(“Enter the array elements:”); for(k=0;k<5;k++)

{

scanf(“%d ”,&array[i]); // storing values in array

}

printf(“\n Display the array elements:”); for(k=0;k<5;k++)

{

printf(“%d \n”,array[i]);//displaying values of array

}

return 0;

}

#### FIND SUM AND AVERAGE OF N NUMBERS

#include<stdio.h> int main( )

Output:

**Enter the array size: 6 Enter the array elements 9**

**2**

**4**

**3**

**1**

**8**

**sum=27 and avg=4.50000**

{

int k,n,sum=0;array[10];//array declaration float avg;

printf(“\n Enter the array size:”); scanf(“%d”,&n);

printf(“\n Enter the array elements:”); for(k=0;k<n;k++)

{

scanf(“%d ”,&array[i]); // storing values in array

}

for(k=0;k<n;k++)

{

sum=sum+array[i]; //sum of array elements

}

avg=sum/n;

printf(“\n sum=%d and avg=%f ”,sum,avg);

}

Output:

**Enter the array elements 2**

**4**

**3**

**1**

**8**

**Display the array elements 8**

**1**

**3**

**4**

**2**

return 0;

}

#### REVERSE OF ARRAY ELEMENTS

#include<stdio.h> int main( )

{

int k,n,array[10];//array declaration printf(“\n Enter the array size:”); scanf(“%d”,&n);

printf(“\n Enter the array elements:”); for(k=0;k<n;k++)

**EC8393**

{

scanf(“%d ”,&array[i]); // storing values in array

}

printf(“\n array elements in reverse order:”); for(k=n-1;k>=0;k--)

{

printf(“%d \n”,array[i]);//displaying values of array

}

return 0;

}

#### Write a program to print the position of the smallest number of *n* numbers using arrays.

#include <stdio.h> int main()

{

int i, n, arr[20], small, pos;

printf("\n Enter the number of elements in the array : "); scanf("%d", &n);

printf("\n Enter the elements : "); for(i=0;i<n;i++) scanf("%d",&arr[i]);

**Output**

Enter the number of elements in the array : 5 Enter the elements : 7 6 5 14 3

The smallest element is : 3

The position of the smallest element in the array is : 4

small = arr[0] for(i=1;i<n;i++)

{

if(arr[i]<small)

{

small = arr[i]; pos = i;

}

}

printf("\n The smallest element is : %d", small);

printf("\n The position of the smallest element in the array is:

%d", pos); return 0;

}

#### Program example-1 Printing binary equivalent of a decimal number using array

***Logic*** Here the remainders of the integer division of a decimal number by 2 are stored as consecutive array elements.The division procedure is repeated until the number becomes 0.

#include <stdio.h> int main()

Output:

Enter the decimal Integer: 12 Binary equivalent of 12 is: 1100

{

int bi[20],i,m,num,rem;

printf(“\n Enter the decimal Integer”); scanf(“%d”,&n);

m=n; for(i=0;i>n;i++)

{

rem=num%2;

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bi[i]=rem; num=num/2;

}

printf(“\n Binary equivalent of %d is: \t”,m); for(i--;i>=0;i--)

printf(“%d”,a[i]); return 0;

}

#### Program example- Fibonacci series using an array

***Logic*** In **Fibonacci series** each element is the sum of the previous two elements. This program stores the series in an array

**Display the fibonacci elements**

0

1

1

2

3

5

8

13

21

34

55

89

144

233

377

#include <stdio.h> int main()

{

int fib[15]; // array declaration int i;

fib[0] = 0; // first array element value=0

fi b[1] = 1;// second array element value=1 for(i = 2; i < 15; i++)

{

fib[i] = fib[i-1] + fib[i-2];

}

#### printf(“\n Display the fibonacci elements:”);

for(i = 0; i < 15; i++)

{

printf(“%d\n”, fi b[i]);

}

return 0;

}

**Example- Inserting an Element in an Array**

If an element has to be inserted at the end of an existing array, then the task of insertion is quite simple. We just have to add 1 to the upper\_ bound and assign the value. Here, we assume that the memory space allocated for the array is still available. For example, if an array is declared to contain 10 elements, but currently it has only 8 elements, then obviously there is space to accommodate two more elements. But if it already has 10 elements, then we will not be ableto add another element to it.

**Program to insert a number at a given location in an array**

#include <stdio.h> int main()

{

int i, n, num, pos, arr[10]; clrscr();

printf("\n Enter the number of elements in the array : "); scanf("%d", &n);

for(i=0;i<n;i++)

{

printf("\n arr[%d] = ", i);

scanf("%d", &arr[i]);

}

printf("\n Enter the number to be inserted : "); scanf("%d", &num);

printf("\n Enter the position at which the number has to be added: ");

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scanf("%d", &pos);

for(i=n–1;i>=pos;i––)

arr[i+1] = arr[i]; arr[pos] = num;

n = n+1;

printf("\n The array after insertion of %d is :num "); for(i=0;i<n;i++)

printf("\n arr[%d] = %d", i, arr[i]); getch();

return 0;

}

#### Output

Enter the number of elements in the array : 5 arr[0] = 1

arr[1] = 2

arr[2] = 3

arr[3] = 4

arr[4] = 5

Enter the number to be inserted : 0

Enter the position at which the number has to be added : 3 The array after insertion of 0 is :

arr[0] = 1

arr[1] = 2

arr[2] = 3

arr[3] = 0

arr[4] = 4

arr[5] = 5

1. **Deleting an Element from an Array**

Algorithm to delete an element from the middle of an array Step 1: [INITIALIZATION] SET I = POS

Step 2: Repeat Steps 3 and 4 while I <= N – 1 Step 3: SET A[I] = A[I + 1]

Step 4: SET I = I + 1 [END OF LOOP] Step 5: SET N = N – 1 Step 6: EXIT

#### Write a program to delete a number from a given location in an array.

#include <stdio.h> int main()

{

int i, n, pos, arr[10];

printf("\n Enter the number of elements in the array : "); scanf("%d", &n);

for(i=0;i<n;i++)

{

printf("\n arr[%d] = ", i);

scanf("%d", &arr[i]);

}

printf("\nEnter the position from which the number has to be deleted : ");

scanf("%d", &pos); for(i=pos; i<n–1;i++) arr[i] = arr[i+1];

n– –;

printf("\n The array after deletion is : "); for(i=0;i<n;i++)

printf("\n arr[%d] = %d", i, arr[i]); getch();

return 0;

}

#### LINEAR SEARCH

*Searching an element within an array* Consider element is a key (e.g., a number). The task is to find a p

an array of n elements, where each articular key(number) in the array.

**Output**

Enter the number of elements in the array : 5

arr[0] = 1

arr[1] = 2

arr[2] = 3

arr[3] = 4

arr[4] = 5

Enter the position from which the number has to be deleted : 3

The array after deletion is : arr[0] = 1

arr[1] = 2

arr[2] = 3

arr[3] = 5

The simplest method is a sequential search or linear search. The idea is to simply search the array, element by element, from the beginning until the key is found or the end of the list is reached. If found, the corresponding position in the array is printed; otherwise, a message will have to be displayed that the key(number) is not found. Now, the implementation of the program will be

Program:

#include <stdio.h> #include <stdlib.h> int main()

{

int n,i,key, FOUND=0, a[30]; // array declaration printf(“\n How many numbers:”); scanf(“%d”,&n); // array size

Output

How many numbers: 6 Enter the array elements: 21

33

46

52

27

Enter the key to be searched: 73 NOT FOUND

printf(“\n Enter the array elements: \n”); for(i=0 ; i<n; i++)

{

scanf(“%d”, &a[i]);

}

printf(“\n Enter the key to be searched: ”); scanf(“%d”,&key);

for(i=0 ; i<n; i++) // searching an element in an array if(a[i] == key)

{

printf(“\n Found at %d”,i); FOUND=1;

}

Output

How many numbers: 6 Enter the array elements: 21

33

46

52

27

Enter the key to be searched: 52 Found at 3

if(FOUND = = 0)

printf(“\n NOT FOUND...”); return 0;

}

#### BINARY SEARCHING

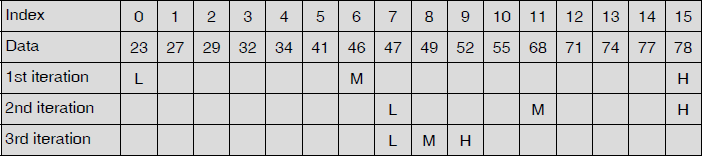
In ***Binary searching*** the drawbacks of sequential search can be eliminated The binary search halves the size of the list to search in each Iteration

Logic : Binary search can be explained simply by the analogy of searching for a page in a book. Suppose a reader is searching for page 90 in a book of 150 pages. The reader would first open the book at random towards the latter half of the book. If the page number is less than 90, the reader would open at a page to the right; if it is greater than 90, the reader would open at a page to the left, repeating the process till page 90 was found.

Binary search requires sorted data(in ascending order) to operate on.

In binary search, the following procedure is implemented.

* + Look at the middle element of the list.
  + If it is the value being searched, then the job is done.
  + If the value that is being searched is smaller than the middle element, then continue with the bottom half of the list.
  + If the value that is being searched is larger than the middle element, then continue with the top half of the list.

Eg:-Depiction of binary search algorithm (the number to be searched is greater than mid value)

***Algorithm****:* The algorithm determines the position of T in the LIST.

1. START
2. PRINT “ENTER THE NO. OF ELEMENTS IN THE ARRAY”
3. INPUT N 4. I=0
4. PRINT “ENTER ARRAY ELEMENT”
5. INPUT LIST(I) 7. I=I+1
6. IF I<N THEN GOTO STEP 5
7. PRINT “ENTER THE ELEMENT TO SEARCH”
8. INPUT T
9. HIGH = N - 1
10. LOW = 0
11. FOUND = 0
12. MID = (HIGH + LOW)/ 2
13. IF T = LIST [MID]

FOUND = 1 ELSE IF T < LIST[MID]

HIGH = MID-1

ELSE

LOW = MID+1

1. IF (FOUND =0) and (HIGH > = LOW) THEN GOTO STEP 14
2. IF FOUND =0 THEN PRINT “NOT FOUND”
3. ELSE PRINT “FOUND AT”, MID.
4. STOP

The C program for this algorithm is as follows:

#include <stdio.h> #include <stdlib.h> int main()

{

int a[30],n,i,t,low,mid,high,found=0;

printf(“\n Enter the number of elements in the array:”); scanf(“%d”,&n);

printf(“\n Enter the elements of the array:”); for(i=0 ; i< n; i++)

scanf(“%d”, &a[i]);

printf(“\n Enter the element to search :”); scanf(“%d”,&t);

low = 0; high = n - 1;

while(high >= low)

{

mid = (low + high) / 2; if(a[mid] == t)

{

found = 1; break;

}

else if (t < a[mid]) high = mid - 1; else

low = mid + 1;

}

if(found==0)

printf(“\n NOT FOUND”); else

printf(“\n FOUND AT %d”,mid); return 0;

}

#### Output

Enter the number of elements in the array: 9 Enter the number of elements in the array 9 Enter the elements of the array: Enter the elements of the array:

1 1

2 2

3 3

4 4

5 5

6 6

7 7

8 8

9 9

Enter the element to search: 7 Enter the element to search: 7

FOUND AT 6 NOT FOUND

**C PROGRAM FOR BUBBLE SORT**

Bubble sort is a simple sorting algorithm in which each element is compared with adjacent element and swapped if their position is incorrect. It is named as bubble sort because same as like bubbles the lighter elements come up and heavier elements settle down.

It is less efficient as its average and worst case complexity is high, there are many other fast sorting algorithms like quick-sort, heap-sort, etc. Sorting simplifies problem-solving in computer programming.

**Step by Step**

**– First Pass:**

( 5 1 4 2 8 ) ( 1 5 4 2 8 ), Here, algorithm compares the first two elements, and swaps them.

( 1 5 4 2 8 ) ( 1 4 5 2 8 ), Swap since 5 > 4

( 1 4 5 2 8 ) ( 1 4 2 5 8 ), Swap since 5 > 2

( 1 4 2 5 8 ) ( 1 4 2 5 8 ), Now, since these elements are already in order (8 > 5), algorithm does not swap them.

* **Second Pass:**

( 1 4 2 5 8 ) ( 1 4 2 5 8 )

( 1 4 2 5 8 ) ( 1 2 4 5 8 ), Swap since 4 > 2

( 1 2 4 5 8 ) ( 1 2 4 5 8 )

( 1 2 4 5 8 ) ( 1 2 4 5 8 )

Now, the array is already sorted, but our algorithm does not know if it is completed. The algorithm needs one whole pass without any swap to know it is sorted.

**-Third Pass:**

( 1 2 4 5 8 ) ( 1 2 4 5 8 )

( 1 2 4 5 8 ) ( 1 2 4 5 8 )

( 1 2 4 5 8 ) ( 1 2 4 5 8 )

( 1 2 4 5 8 ) ( 1 2 4 5 8 )

Finally, the array is sorted, and the algorithm can terminate.

**Program** #include <stdio.h> int main()

{

**Sorted list in ascending order:**

**1 2 4 5 8**

**8**

Output

**Enter number of elements 5**

**Enter 5 integers**

**5 1 4 2**

int array[100], n, c, d, swap; printf("Enter number of elements\n"); scanf("%d", &n);

printf("Enter %d integers\n", n); for (c = 0; c < n; c++) scanf("%d", &array[c]);

for (c = 0 ; c < n - 1; c++)

{

for (d = 0 ; d < n - c - 1; d++)

{

if (array[d] > array[d+1]) */\* For decreasing order use < \*/*

{

swap = array[d]; array[d] = array[d+1]; array[d+1] = swap;

}

}

}

printf("Sorted list in ascending order:\n"); for (c = 0; c < n; c++)

printf("%d\n", array[c]); return 0;

}

**INSERTION SORT**

This is an in-place comparison-based sorting algorithm. Here, a sub-list is maintained which is always sorted. For example, the lower part of an array is maintained to be sorted. An element which is to be 'insert'ed in this sorted sub-list, has to find its appropriate place and then it has to be inserted there. Hence the name, **insertion sort**.

The array is searched sequentially and unsorted items are moved and inserted into the sorted sub-list (in the same array). This algorithm is not suitable for large data sets as its average and worst case complexity are of Ο(n2), where **n** is the number of items.

##### How Insertion Sort Works?

We take an unsorted array for our example.



Insertion sort compares the first two elements.



It finds that both 14 and 33 are already in ascending order. For now, 14 is in sorted sub-list.



Insertion sort moves ahead and compares 33 with 27.



And finds that 33 is not in the correct position.



It swaps 33 with 27. It also checks with all the elements of sorted sub-list. Here we see that the sorted sub-list has only one element 14, and 27 is greater than 14. Hence, the sorted sub- list remains sorted after swapping.



By now we have 14 and 27 in the sorted sub-list. Next, it compares 33 with 10. and so on.



**Algorithm**

Now we have a bigger picture of how this sorting technique works, so we can derive simple steps by which we can achieve insertion sort.

|  |  |  |
| --- | --- | --- |
| **Step** | **1** | − If it is the first element, it is already sorted. return 1; |
| **Step** | **2** | − Pick next element |
| **Step** | **3** | − Compare with all elements in the sorted sub-list |
| **Step** | **4** | − Shift all the elements in the sorted sub-list that is greater than |
| the |  |  |
|  |  | value to be sorted |
| **Step** | **5** | − Insert the value |
| **Step** | **6** | − Repeat until list is sorted |

**Program**

#include<stdio.h> int main()

{

int data[100],n,temp,i,j;

printf("Enter number of terms(should be less than 100): "); scanf("%d",&n);

Enter number of terms(should be less than 100):5 Enter elements: 33 12 4 26 77

In ascending order: 4 12 26 33 77

printf("Enter elements: "); for(i=0;i<n;i++)

{

scanf("%d",&data[i]);

}

for(i=1;i<n;i++)

{

temp = data[i]; j=i-1;

while(temp<data[j] && j>=0)

/\*To sort elements in descending order, change temp<data[j] to temp>data[j] in above line.\*/

{

data[j+1] = data[j];

--j;

}

data[j+1]=temp;

}

printf("In ascending order: "); for(i=0; i<n; i++)

printf("%d\t",data[i]);

return 0;

}

**Ascending order**

Step by step descriptive logic to sort array in ascending order.

* 1. [Input size of array and elements](https://codeforwin.org/2015/07/c-program-to-read-and-print-elements-in-array.html) in array. Store it in some variable say size and arr.
  2. To select each element from array, run an outer loop from 0 to size - 1. The loop structure must look like for(i=0; i<size; i++).
  3. Run another inner loop from i + 1 to size - 1 to place currently selected element at its correct position. The loop structure should look like for(j = i + 1; j<size; j++).
  4. Inside inner loop to compare currently selected element with subsequent element and [swap two array elements](https://codeforwin.org/2016/01/c-program-to-swap-two-numbers-using-bitwise-operator.html) if not placed at its correct position.

Which is if(arr[i] > arr[j]) then swap arr[i] with arr[j].

Program

#include <stdio.h>

#define MAX\_SIZE 100 // Maximum array size int main()

{

int arr[MAX\_SIZE]; int size;

int i, j, temp;

printf("Enter size of array: "); scanf("%d", &size);

/\* Input elements in array \*/ printf("Enter elements in array: "); for(i=0; i<size; i++)

{

scanf("%d", &arr[i]);

}

for(i=0; i<size; i++)

{

/\* Place currently selected element array[[i]to its correct place\*/

for(j=i+1; j<size; j++)

{

/\* Swap if currently selected array element is not at its correct position.

\*/

if(arr[i] > arr[j])

{

temp = arr[i]; arr[i] = arr[j]; arr[j] = temp;

}

}

}

/\* Print the sorted array \*/

printf("\nElements of array in ascending order: "); for(i=0; i<size; i++)

{

printf("%d\t", arr[i]);

}

return 0;

}

OUTPUT

Enter size of array: 10

Enter elements in array: 20 2 10 6 52 31 0 45 79 40 Elements of array in ascending order:

0 2 6 10 20 31 40 45 52 79

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**/\*C program to sort an one dimensional array in descending order.\*/**

#include <stdio.h> #define MAX 100 int main()

{

int arr[MAX],n,i,j; int temp;

printf("Enter total number of elements: "); scanf("%d",&n);

//read array elements printf("Enter array elements:\n"); for(i=0;i< n;i++)

{

printf("Enter element %d: ",i+1); scanf("%d",&arr[i]);

}

//sort array for(i=0;i< n;i++)

{

for(j=i+1;j< n;j++)

{

if(arr[i]< arr[j])

{

temp =arr[i]; arr[i] =arr[j]; arr[j] =temp;

}

}

}

printf("\nArray elements after sorting:\n"); for(i=0;i< n;i++)

{

printf("%d\n",arr[i]);

}

return 0;

}

**EC8393 TWO DIMENTIONAL ARRAY**

Two dimentional arrays stores data in tabular column format represented as rows and columns

**Array Declaration:**

**datatype arrayname[size][size];**

## Array Initialization:

**int a[2][2]={ {1,4 },{2,3}} int b[2][2]={1,4,2,3}**

**1 4**

**2 3**

**float[ ][ ]={12.3, 45.2,19.3,23.4}**

**12.3 45.2**

**19.3 23.4**

**Accessing two-dimensional Arrays**

Program-sample two dimnentional array

#include <stdio.h> int main()

{

int i,j;

int a[3][2] = {{4,7},{1,0},{6,2}};

for(i = 0; i < 3; i++)

{

for(j = 0; j < 2; j++)

{

printf(“%d”, a[i][j]);

}

printf(“\n”);

}

return 0;

}

|  |  |  |
| --- | --- | --- |
| **Row-1**  **Row -2** | **4** | **7** |
| **1** | **0** |
| **Row-3** | **6** | **2** |
|  | | |

**The above array actually ‘looks’ like this**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
| **Row 0** | | | **Row 1** | | | **Row 2** | | |

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**WORKING WITH TWO-DIMENSIONAL ARRAYS**

**Transpose of a matrix**

Example program:-Transpose of a matrix

Transpose of *A* is *AT*=(*aji*), where *i* is the row number and *j* is the column number.

**Program**



**#include <stdio.h> int main()**

**{**

**int a[10][10], transpose[10][10], r, c, i, j; printf("Enter rows and columns of matrix: "); scanf("%d %d", &r, &c);**

**Sample output**

Enter rows and columns of matrix: 2

3

Enter element of matrix: Enter element a11: 2 Enter element a12: 3 Enter element a13: 4 Enter element a21: 5 Enter element a22: 6 Enter element a23: 4

Entered Matrix: 2 3 4

5 6 4

Transpose of Matrix: 2 5

3 6

4 4

**// getting elements of the matrix printf("\nEnter elements of matrix:\n"); for(i=0; i<r; ++i)**

**for(j=0; j<c; ++j)**

**{**

**printf("Enter element a%d%d: ",i+1, j+1); scanf("%d", &a[i][j]);**

**}**

**// Displaying the matrix a[][] \*/ printf("\n Entered Matrix: \n"); for(i=0; i<r; ++i)**

**for(j=0; j<c; ++j)**

**{**

**printf("%d ", a[i][j]); if (j == c-1)**

**printf("\n\n");**

**}**

**// Finding the transpose of matrix a for(i=0; i<r; ++i)**

**for(j=0; j<c; ++j)**

**{**

**transpose[j][i] = a[i][j];**

**}**

**// Displaying the transpose of matrix a printf("\nTranspose of Matrix:\n"); for(i=0; i<c; ++i)**

**for(j=0; j<r; ++j)**

**{**

**printf("%d ",transpose[i][j]); if(j==r-1)**

**printf("\n\n");**

**}**

**return 0;**

**}**

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#### Program -2(Transpose)

#include <stdio.h>

void main()

{

int array[10][10]; int i, j, m, n;

printf("Enter the order of the matrix \n"); scanf("%d %d", &m, &n);

printf("Enter the coefiicients of the matrix\n"); for (i = 0; i < m; ++i)

{

for (j = 0; j < n; ++j)

{

scanf("%d", &array[i][j]);

}

}

printf("The given matrix is \n"); for (i = 0; i < m; ++i)

{

for (j = 0; j < n; ++j)

{

printf(" %d", array[i][j]);

}

printf("\n");

}

printf("Transpose of matrix is \n"); for (j = 0; j < n; ++j)

{

for (i = 0; i < m; ++i)

{

printf(" %d", array[i][j]);

}

printf("\n");

}

$ cc pgm85.c

$ a.out

Enter the order of the matrix 3 3

Enter the coefiicients of the matrix 3 7 9

2 7 5

6 3 4

The given matrix is 3 7 9

2 7 5

6 3 4

Transpose of matrix is 3 2 6

7 7 3

9 5 4

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**Matrix addition and subtraction**

***Addition*** If *A* and *B* above are matrices of the same type



***Subtraction*** If *A* and *B* are matrices of the same type, then



**Program to Add Two Matrices**

#include <stdio.h> int main(){

int r, c, a[100][100], b[100][100], sum[100][100], i, j;

printf("Enter number of rows (between 1 and 100): "); scanf("%d", &r);

printf("Enter number of columns (between 1 and 100): "); scanf("%d", &c);

printf("\nEnter elements of 1st matrix:\n"); for(i=0; i<r; ++i)

**Output**

Enter number of rows (between 1 and 100): 2

Enter number of columns (between 1 and 100): 3

Enter elements of 1st matrix: Enter element a11: 2

Enter element a12: 3 Enter element a13: 4 Enter element a21: 5 Enter element a22: 2 Enter element a23: 3

Enter elements of 2nd matrix: Enter element a11: -4

Enter element a12: 5 Enter element a13: 3 Enter element a21: 5 Enter element a22: 6 Enter element a23: 3

Sum of two matrix is:

-2 8 7

10 8 6

for(j=0; j<c; ++j)

{

printf("Enter element a%d%d: ",i+1,j+1); scanf("%d",&a[i][j]);

}

printf("Enter elements of 2nd matrix:\n"); for(i=0; i<r; ++i)

for(j=0; j<c; ++j)

{

printf("Enter element a%d%d: ",i+1, j+1); scanf("%d", &b[i][j]);

}

// Adding Two matrices for(i=0;i<r;++i)

for(j=0;j<c;++j)

{

sum[i][j]=a[i][j]+b[i][j];

}

// Displaying the result

printf("\nSum of two matrix is: \n\n"); for(i=0;i<r;++i)

for(j=0;j<c;++j)

{

printf("%d ",sum[i][j]); if(j==c-1)

{

printf("\n\n");

}

}

return 0;

}

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#### Matrix multiplication

Matrix multiplication for two 2 × 2 matrices.

***Finding norm of a matrix***

The norm of a matrix is defi ned as the square root of the sum of the squares of the elements of a matrix.

#include <stdio.h> #include <math.h> #defi ne row 10 #defi ne col 10 int main()

{

fl oat mat[row][col], s; int i,j,r,c;

printf(“\n Input number of rows:”); scanf(“%d”, &r);

printf(“\n Input number of cols:”); scanf(“%d”, &c);

for(i = 0 ; i< r; i++)

{

for(j = 0 ;j<c; j++)

{

scanf(“%f”, &mat[i][j]);

}

}

printf(“\n Entered 2D array is as follows:\n”); for(i = 0; i < r; i++)

{

for(j = 0; j < c; j++)

{

printf(“%f”, mat[i][j]);

}

printf(“\n”);

}

s = 0.0;

for(i = 0; i < r; i++)

{

for(j = 0; j < c; j++)

{

s += mat[i][j] \* mat[i][j];

}

}

printf(“\n Norm of above matrix is: %f”, sqrt(s));

return 0;

}

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**C Program to read a matrix and find sum, product of all elements of two dimensional (matrix) array**

include <stdio.h> #define MAXROW 10

Enter number of Rows :3 Enter number of Cols :3

Enter matrix elements : Enter element [1,1] : 1

Enter element [1,2] : 1

Enter element [1,3] : 1

Enter element [2,1] : 2

Enter element [2,2] : 2

Enter element [2,3] : 2

Enter element [3,1] : 3

Enter element [3,2] : 3

Enter element [3,3] : 3

SUM of all elements : 18 Product of all elements :216

#define MAXCOL 10

**int** main()

{

**int** matrix[MAXROW][MAXCOL];

**int** i,j,r,c;

**int** sum,product;

printf("Enter number of Rows :"); scanf("%d",&r);

printf("Enter number of Cols :"); scanf("%d",&c);

printf("\nEnter matrix elements :\n");

**for**(i=0;i< r;i++)

{

**for**(j=0;j< c;j++)

{

1,j+1);

}

}

sum=0; product=1;

printf("Enter element [%d,%d] : ",i+ scanf("%d",&matrix[i][j]);

**for**(i=0;i< r;i++)

{

**for**(j=0;j< c;j++)

{

sum+=matrix[i][j]; product\*= matrix[i][j];

} }

printf("\nSUM of all elements : %d \nProduct of all elements :%d",sum,product);

**return** 0;

}

**Find the sum of diagonal elements of a matrix**

**1 2 3**

**2 4 6**

**3 5 8**

**Sum of diagonal=13**

#include < stdio.h > int main()

{

int a[10][10],i,j,sum=0,r,c; clrscr();

printf("\n Enter the number of rows and column "); scanf("%d%d",&r,&c);

printf("\nEnter the %dX%d matrix",r,c); for(i=0;i < r;i++)

{

for(j=0;j < c;j++)

{

}//for

}//for

scanf("%d",&a[i][j]);

for(i=0;i < r;i++)

{ for(j=0;j < c;j++)

{ if(i==j)

{

}

}//for

sum+=a[i][j];

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}//for

printf("\nThe sum of diagonal elements is %d",sum); return 0;

}//main

**Sum of rows and columns**

#include <stdio.h> void main ()

Output

Enter the order of the matrix 2 2

Enter the co-efficients of the matrix 23 45

80 97

Sum of the 0 row is = 68 Sum of the 1 row is = 177 Sum of the 0 column is = 103 Sum of the 1 column is = 142

{

int array[10][10];

int i, j, m, n, sum = 0;

printf("Enter the order of the matrix\n"); scanf("%d %d", &m, &n);

printf("Enter the co-efficients of the matrix\n"); for (i = 0; i < m; ++i)

{

for (j = 0; j < n; ++j)

{

scanf("%d", &array[i][j]);

}

}

for (i = 0; i < m; ++i)

{

for (j = 0; j < n; ++j)

{

sum = sum + array[i][j] ;

}

printf("Sum of the %d row is = %d\n", i, sum);

sum = 0;

}

sum = 0;

for (j = 0; j < n; ++j)

{

for (i = 0; i < m; ++i)

{

sum = sum + array[i][j];

}

printf("Sum of the %d column is = %d\n", j, sum);

sum = 0;

}

}

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**C Program to do the Sum of the Main & Opposite Diagonal Elements of a MxN Matrix**

#include <stdio.h> void main ()

Enter the order of the matix 2 2

Enter the co-efficients of the matrix 40 30

38 90

The given matrix is 40 30

38 90

The sum of the main diagonal elements is

= 130

The sum of the off diagonal elements is

= 68

{ static int array[10][10]; int i, j, m, n, a = 0, sum = 0;

printf("Enetr the order of the matix \n"); scanf("%d %d", &m, &n);

if (m == n )

{

printf("Enter the co-efficients of the matrix\n"); for (i = 0; i < m; ++i)

{

for (j = 0; j < n; ++j)

{

scanf("%d", &array[i][j]);

}

}

printf("The given matrix is \n"); for (i = 0; i < m; ++i)

{

for (j = 0; j < n; ++j)

{

printf(" %d", array[i][j]);

}

printf("\n");

}

for (i = 0; i < m; ++i)

{

sum = sum + array[i][i]; a = a + array[i][m - i - 1];

}

printf("\nThe sum of the main diagonal elements is = %d\n", sum); printf("The sum of the off diagonal elements is = %d\n", a);

}

else

printf("The given order is not square matrix\n");

}

**C Program to Find the Frequency of Odd & Even Numbers in the given Matrix**

#include <stdio.h> void main()

{

static int array[10][10];

int i, j, m, n, even = 0, odd = 0;

printf("Enter the order ofthe matrix \n"); scanf("%d %d", &m, &n);

printf("Enter the coefficients of matrix \n"); for (i = 0; i < m; ++i)

{

for (j = 0; j < n; ++j)

{

scanf("%d", &array[i][j]);

if ((array[i][j] % 2) == 0)

{

++even;

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}

else

++odd;

}

}

printf("The given matrix is \n"); for (i = 0; i < m; ++i)

{

for (j = 0; j < n; ++j)

{

printf(" %d", array[i][j]);

}

printf("\n");

}

printf("\n The frequency of occurrence of odd number = %d \n", odd); printf("The frequency of occurrence of even number = %d\n", even);

}

Enter the order of the matrix 3 3

Enter the coefficients of matrix 34 36 39

23 57 98

12 39 49

The given matrix is 34 36 39

23 57 98

12 39 49

The frequency of occurrence of odd number = 5 The frequency of occurrence of even number = 4

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#### STRINGS:



Strings in C are represented by arrays of characters. The end of the string is marked with a special character, the *null character*

* + **string.h :** collection of functions for string manipulation.

**DECLARATION OF STRINGS**

**char s[5];**

* + Strings are declared in a similar manner as [arrays](https://www.programiz.com/c-programming/c-arrays)
  + Strings can also be declared using [pointer](https://www.programiz.com/c-programming/c-pointers)

datatype string name[size];

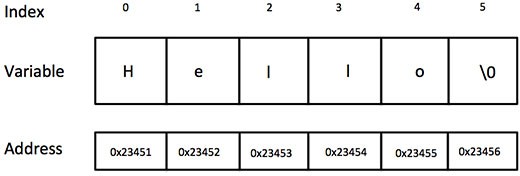
**char \*p;**

Syntax:

char str[30]; char text[80];

**STRING INITIALIZATION**

**char var[ ]=“hello”;**



‘\0’ (NULL) charater would automatically be inserted at the end of string.

**char arr[4]={‘s’,'h’,'b',’r‘,’\0’}**

**char arr[]={‘hello’, ‘good’ ,‘day’, ‘please’} char Str = “abcdefg”**

**char greeting[] = “welcome";**

**char greeting[6] = {'H', 'e', 'l', 'l', 'o'}; char \*c = "abcd";**

**char str=“100” char str=“3.4” Char str=“111000”**

**EC8393 STRING INPUT /OUTPUT**

#include <stdio.h> #include <string.h> int main()

{

char nickname[20]; **scanf("%s", nickname); printf("%s",nickname);** return 0;

}

* **printf("%s",str), scanf("%s",str)**
* **gets(str),puts(str)**
* **fgets with stdin and fputs with stdout**
* **fgets( ) and fputs( )…for files**

Eg **char s[1000] ; fgets(s,1000,stdin);**

#include <stdio.h> #include <string.h> int main()

{

char nickname[20]; f**gets(nickname,20,stdin); fputs(nickname,stdout**);

return 0;

}

#include <stdio.h> #include <string.h> int main()

{

char nickname[20]; **gets(nickname); puts(nickname);** return 0;

}

**Example program** #include <stdio.h> int main()

{

char name[10]; printf("Who are you? "); **fgets(name,10,stdin);**

printf("Glad to meet you, %s \n",name); return(0);

}

##### String input and output using fscanf() and fprintf()

C program has three I/O streams.

* stdin,
* stdout, and
* stderr

--The input stream is called standard-input (stdin); the usual output stream is called standard- output (stdout); and the side stream of output characters for errors is called standard error (stderr).

--Internally they represent file descriptors 0, 1, and 2 respectively.

--Calls to fprinf() and fscanf() differ significantly from calls to printf() and scanf().

--fprintf() sends formatted output to a stream and fscanf() scans and formats input from a stream.

Example program #include <stdio.h> int main()

{

int fi rst, second;

fprintf(stdout,“Enter two ints in this line: ”); fscanf(stdin,“%d %d”, &fi rst, &second); fprintf(stdout,“Their sum is: %d.\n”, fi rst + second); return 0;

}

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#### Character Manipulation

Table: Character functions in <ctype.h> where c is the character argument

|  |
| --- |
| **ialnum(c)** Returns a non-zero if c is alphabetic or numeric |
| **isalpha(c)** Returns a non-zero if c is alphabetic |
| **scntrl(c)** Returns a non-zero if c is a control character |
| **isdigit(c)** Returns a non-zero if c is a digit, 0 – 9 |
| **isgraph(c)** Returns a non-zero if c is a non-blank but printing character |
| **islower(c)** Returns a non-zero if c is a lowercase alphabetic character, i.e., a – z |
| **isprint(c)** Returns a non-zero if c is printable, non-blanks and white space included |
| **ispunct(c)** Returns a non-zero if c is a printable character, but not alpha, numeric, or blank |
| **isspace(c)** Returns a non-zero for blanks and these escape sequences: ‘\f’, ‘\n’, ‘\r’, ‘\t’, and ‘\v’ |
| **isupper(c)** Returns a non-zero if c is a capital letter, i.e., A – Z |
| **isxdigit(c)** Returns a non-zero if c is a hexadecimal character: 0 –9, a – f, or A – F |
| **tolower(c)** Returns the lowercase version if c is a capital letter; otherwise returns c |
| **toupper(c)** Returns the capital letter version if c is a lowercase character; otherwise returns c |

**This program counts the number of words in a string**

#include <stdio.h> #include <ctype.h> int main()

{

char s[30];

int i=0,count=0;

printf(“\n enter the string\n”); scanf(“%[^\n]”,s);

while(s[i]!=‘\0’)

{

while(isspace(s[i])) i++;

if(s[i]!=‘\0’)

{

++count;

**while(!isspace(s[i]) && s[i] != ‘\0’)**

i++;

}

}

printf(“\n NO. of words in the string is %d:”, count); return 0;

}

**Output:**

**enter the string how are you**

**NO. of words in the string is 3**

**converts a given text into a capital letter using toupper() function**

#include <stdio.h> #include <string.h> int main()

{

char a[30]; int i=0;

printf(“\n enter the string\n”); gets(a);

while(a[i]!=‘\0’)

{

**a[i]=toupper(a[i]);**

i++;

} a[i]=‘\0’; puts(a); return 0;

}

**Output:**

**enter the string how**

**HOW**

Disadvantage : C has the weakest character string capability. Strictly speaking, there are no character strings in C, just arrays of single characters.

What character manupilation cannot do

* Assign one to the other: s1 = s2;
* Compare them for collating sequence: s1 < s2
* Concatenate them to form a single longer string: s1 + s2
* Return a string as the result of a function

**Source string = APPLE Target string = LIME**

**Target string after strcat( ) = LIME APPLE**

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#### String Manipulation

A set of standard C library functions that are contained in <string.h> provides the following.

|  |  |
| --- | --- |
| **Function** | **Description** |
| **strcpy(s1,s2)** | Copies s2 into s1 |
| **strncpy(s1,s2,n)** | **It copies first n characters of str2 into str1.** |
| **strcat(s1,s2)** | Concatenates s2 to s1. That is, it appends the string contained by s2 to  the end of the string pointed to by s1. The terminating null character |
| **strncat(s1,s2,n)** | **First n characters of str2 is concatenated at the end of str1** |
| **strlen(s1)** | Returns the length of s1. That is, it returns the number of characters in  the string without the terminating null character. |
| **strcmp(s1,s2)** | Returns 0 if s1 and s2 are the same Returns less than 0 if s1<s2  Returns greater than 0 if s1>s2 |
| **strncmp(s1,s2,n)** | Returns 0 if s1 and s2 are the same for first n characters |
| [**strcmpi( )**](http://fresh2refresh.com/c/c-strings/c-strcmpi-function/) | Same as strcmp() function. But, this function negotiates case. “A”  and “a” are treated as same. |
| **strchr(s1,ch)** | Returns pointer to first occurrence ch in s1 |
| **strrchr(s1,ch )** | Returns pointer tolast occurrence ch in s1 |
| **strstr(s1,s2)** | Returns pointer to first occurrence s2 in s1 |
| **strlen( )** | function in C gives the length of the given string |
| **strdup( )** | function in C duplicates the given string |
| **strlwr( )** | function converts a given string into lowercase |
| **strupr( )** | function converts a given string into uppercase |
| **strrev( )** | function reverses a given string in C language |

**strcat ( str1, str2 )** #include <stdio.h> #include <string.h> int main( )

{

char source[ ] = " APPLE" ; char target[ ]= " LIME" ;

printf ( "\nSource string = %s", source ) ; printf ( "\nTarget string = %s", target ) ; strcat ( target, source ) ;

**printf ( "\nTarget string after strcat( ) = %s", target ) ;**

return 0;

}

|  |  |  |
| --- | --- | --- |
| **strncat ( str1, str2, n )** #include <stdio.h> #include <string.h>  int main( ) | **Source string = APPLEJUICE Target string = LIME**  **Target string after strcat( ) =**  **LIME APPL** |  |
| { char source[ ] = " APPLEJIUCE" ; char target[ ]= “LIME" ;  printf ( "\nSource string = %s", source ) ; printf ( "\nTarget string = %s", target ) ; strncat ( target, source, 4 ) ;  **printf ( "\nTarget string after strncat( ) = %s", target )**  **;**  return 0;} | | |

|  |  |  |
| --- | --- | --- |
| **strcpy(str2,str1)**  **#include <stdio.h> #include <string.h> int main( )**  **{** | **source string = one target string**  **target string after strcpy( ) = one** |  |
| **char source[ ] = "fresh2refresh" ; char target[20]= "" ;**  **printf ( "\n source string = %s", source ) ; printf ( "\n target string = %s", target ) ; strcpy ( target, source ) ;**  **printf ( "\n target string after strcpy( ) = %s", target ) ; return 0;**  **}** | | |

|  |  |  |
| --- | --- | --- |
| **strcpy(str2,str1,n)** #include <stdio.h> #include <string.h> int main( )  { | **source string = mindblowing target string =**  **target string after strncpy( ) = mindb** |  |
| char source[ ] = “mindblowing" ; char target[20]= "" ;  printf ( "\n source string = %s", source ) ; printf ( "\n target string = %s", target ) ; strncpy ( target, source, 5 ) ;  **printf ( "\ntarget string after strcpy( ) = %s", target ) ;**  return 0;} | | |

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**strlen( )**

#include <stdio.h> #include <string.h> int main( )

{

string length = 6

**strcmp(str1,str20** #include <stdio.h> #include <string.h> int main()

{

**strcmp(str1, str2)**

**= 32**

**strcmp(str1, str3)**

**= 0 (same)**

int len;

char str[20]=“APPLE" ;

**len = strlen(str) ;**

printf ( "\string length = %d \n" , len ) ; return 0;

}

char str1[] = "abcd", str2[] = "abCd", str3[] = "abcd"; int result;

**result = strcmp(str1, str2);** printf("strcmp(str1, str2) = %d\n", result); **result = strcmp(str1, str3);** printf("strcmp(str1, str3) = %d\n", result); return 0;

}

|  |  |
| --- | --- |
| **strrchr(str,ch )**  #include <stdio.h> #include <string.h> | Last occurrence of character “i” in This is a string for testing” is 26 |
| int main ()  {  char string[55] ="This is a string for testing"; char \*p;  **p = strrchr (string,'i');**  printf ("Last occurrence of character "i" in "%s is”, string, p);  return 0;  } | |

**strchr(str,ch )**

#include <stdio.h> #include <string.h> int main ()

{

first occurrence of character “i” in This is a string for testing” is 3

char string[55] ="This is a string for testing"; char \*p;

**p = strchr (string,‘i');**

printf ("First occurrence of character "i" in %s " is” %s, string, p);

return 0;

}

**strupr( )**

#include<stdio.h> #include<string.h> int main()

{

char str[ ] = "Modify This String To Upper";

**printf("%s\n",strupr(str));**

return 0;

}

**Output:**

MODIFY THIS STRING TO UPPER

|  |  |
| --- | --- |
| **strlwr( )**  #include<stdio.h> #include<string.h> |  |
| **Output:** modify this string to lower |
| {  char str[ ] = "MODIFY This String To LOwer";  **printf("%s\n",strlwr (str));**  return 0;  } | |

int main()

|  |  |  |
| --- | --- | --- |
| **strrev( )**  #include<stdio.h> #include<string.h> int main() | OUTPUT  String before strrev( ) : Hello String after strrev( ) : olleH |  |
| {  char name[30] = "Hello";  printf("String before strrev( ): %s\n",name); **printf("String after strrev( ) : %s",strrev(name));** return 0;  } | | |

|  |  |  |
| --- | --- | --- |
| **strset( )**  #include<stdio.h> #include<string.h> int main() | Original string is : Test String Test string after strset() : ########### |  |
| {  char str[20] = "Test String"; printf("Original string is : %s", str);  **printf("Test string after strset() : %s",strset(str,'#'));**  printf("After string set: %s",str); return 0;  } | | |

#### Conversion functions

|  |  |
| --- | --- |
| **Typecast Function** | **Description** |
| **atoi( )** | **Converts string to integer** |
| **atof( )** | **Converts string to float** |
| **atol( )** | **Converts string to long** |
| **itoa( )** | **Converts integer to string** |
| **ltoa( )** | **Converts long to string** |

**itoa( )-Converts integer to string**

**atoi function** #include <stdio.h> #include <stdlib.h>

int main()

{

char a[10] = "100"; int value = atoi(a);

printf("Value = %d\n", value); return 0;

}

**Output:**

Value = 100

**atof function** #include <stdio.h> #include <stdlib.h> int main()

{

char a[10] = "3.14";

float pi = atof(a); printf("Value of pi = %f\n", pi);

return 0;

}

**Output:**

Value of pi = 3.140000

#include <stdio.h>

#include <stdlib.h> #include <string.h> int main()

{

int a=54325; char buffer[20];

itoa(a,buffer,2);

**Output:**

**Binary value = 1101010000110101**

**Decimal value = 54325 Hexadecimal value = D435**

printf("Binary value = %s\n", buffer); itoa(a,buffer,10);

printf("Decimal value = %s\n", buffer); itoa(a,buffer,16);

printf("Hexadecimal value = %s\n", buffer); return 0;

**SCANSET** }

* + **This conversion facility allows the programmer to specify the set of characters that are (or are not) acceptable as part of the string.**
  + A scanset conversion consists of a list of acceptable characters enclosed within square brackets.

**Program-1**

#include<stdio.h> int main()

{

char str[50];

printf(“Enter a string in lower case:”);

**scanf(“%[a-z]”,str);**

printf(“The string was : %s\n”,str); return 0;

}

Output

1. Enter a string in lower case: hello world The string was: hello world
2. Enter a string in lower case: hello, world The string was: hello

[In the second case, the character, ‘,’ (comma) is not in the specified range.]

1. Enter a string in lower case: abcd1234 The string was : abcd

[In the third case, the digit 1234 is not in the specified range.]

**Program-2** #include<stdio.h> int main()

{

char str[50];

printf(“Enter a string in lower case:”);

**scanf(“%[^a-z]”,str);** printf(“The string was : %s\n”,str); return 0;

}

Output

Enter a string in lower case: abcd1234 The string was : 1234

**STRING ARRAY [ONE DIMENTIONAL ]**

**CHAR/STRING ARRAY DECLARATION**

String array are one-dimensional array of characters terminated by a null character '\0'.

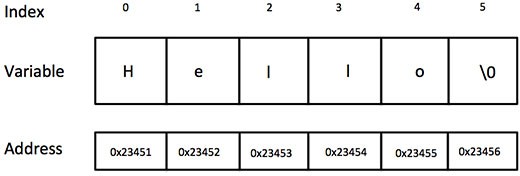
* **Character Array**

#### char arr[]={‘s’,'h’,'b',’r'}

**char arr[]={‘hello’, ‘good’ ,‘day’, ‘please’} char Str = “abcdefg”**

**char greeting[] = "Hello";**

**char greeting[6] = {'H', 'e', 'l', 'l', 'o'};**



**String Array**

* **String Array = {“abc”, ”def”, “ghi”} STRING ARRAY [TWO DIMENTIONAL ]**

**Declaration** of a two-dimensional array of strings.

A two-dimensional array of strings can be declared as follows:

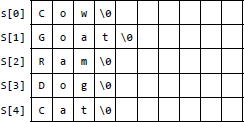
<data\_type> <string\_array\_name>[<row\_size>][<columns\_size>]; char s[5][30];

**Initialization**

Two-dimensional string arrays can be initialized as shown

char s[5][10] ={“Cow”,”Goat”,”Ram”,”Dog”,”Cat”};

which is equivalent to



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**Example program : Search a character in a string**

#include<stdio.h> int main() {

Enter a string: apple lime juice Enter the character to be searched : i Character i is present

char str[20], ch; int count = 0, i;

printf("\nEnter a string : "); scanf("%s", &str);

printf("\nEnter the character to be searched : "); scanf("%c", &ch);

for (i = 0; str[i] != '\0'; i++) { if (str[i] == ch)

count++;

}

if (count == 0)

printf("\n Character '%c'is not present", ch);

else

printf("\n Character '%c'is present", ch); return 0;

}

**binary search for strings**

#include <stdio.h> #include <string.h> void main()

**enter the number of names to be added 4**

**enter the name in ascending order**

mango jackfruit apple grapes

**enter the name to be searched**

oranges

**name not found**

{

int i,n,low,high,mid; char a[50][50],key[20];

printf("enter the number of names to be added\n"); scanf("%d",&n);

printf("enter the name in ascending order\n"); for(i=0;i<=n-1;i++)

{

scanf("%s",&a[i]);

}

printf("\n");

printf("enter the name to be searched\n"); scanf("%s",&key);

low=0; high=n-1;

while(low<=high)

{

mid=(low+high)/2;

if (strcmp(key,a[mid])==0)

{

printf("key found at the position %d\n",mid+1); exit(0);

}

else if(strcmp(key,a[mid])>0)

{

high=high; low=mid+1;

}

else

{

low=low; high=mid-1;

}

}

printf("name not found\n");

}

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#### Program to Sort String Characters in string

#include <stdio.h> #include <string.h> int main (void) {

**OUTPUT**

**String before sorting - simplyeasylearning String after sorting - aaeegiillmnnprssyy**

char string[] = "simplyeasylearning"; char temp;

int i, j;

int n = strlen(string);

printf("String before sorting - %s \n", string); for (i = 0; i < n-1; i++) {

for (j = i+1; j < n; j++) {

if (string[i] > string[j]) { temp = string[i]; string[i] = string[j]; string[j] = temp;

}

}

}

printf("String after sorting - %s \n", string); return 0;

}

**program to sort the names of students.**

#include <stdio.h> #include <string.h> int main()

{

char names[5][10], temp[10]; int i, n, j;

clrscr();

printf("\n Enter the number of students : "); scanf("%d", &n);

for(i=0;i<n;i++)

{

printf("\n Enter the name of student %d : ", i+1);

scanf(“%s”,&names[i]);

}

for(i=0;i<n;i++)

{

for(j=0;j<n–i–1;j++)

{

if(strcmp(names[j], names[j+1])>0)

{

strcpy(temp, names[j]); strcpy(names[j], names[j+1]); strcpy(names[j+1], temp);

}

}

}

printf("\n Names of the students in alphabetical order are : "); for(i=0;i<n;i++)

{ printf(“%s \n”,names[i]);

}

return 0;

}

**Output**

Enter the number of students : 3 Enter the name of student 1 : Goransh Enter the name of student 2 : Aditya Enter the name of student 3 : Sarthak

Names of the students in alphabetical order are : Aditya

Goransh Sarthak

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**Eg Program to count vowels, consonants etc.**

#include <stdio.h> int main()

{

char line[150];

int i, vowels, consonants, digits, spaces; vowels = consonants = digits = spaces = 0; printf("Enter a line of string: "); scanf("%[^\n]", line);

for(i=0; line[i]!='\0'; ++i)

{

if(line[i]=='a' || line[i]=='e' || line[i]=='i' || line[i]=='o' || line[i]=='u' || line[i]=='A' || line[i]=='E' || line[i]=='I' || line[i]=='O' || line[i]=='U')

{

++vowels;

}

else if((line[i]>='a'&& line[i]<='z') || (line[i]>='A'&& line[i]<='Z'))

{

++consonants;

}

else if(line[i]>='0' && line[i]<='9')

{

++digits;

}

else if (line[i]==' ')

{

++spaces;

}

}

printf("Vowels: %d",vowels); printf("\nConsonants: %d",consonants); printf("\nDigits: %d",digits); printf("\nWhite spaces: %d", spaces); return 0;

}

**Output**

Enter a line of string: adfslkj34 34lkj343 34lk Vowels: 1

Consonants: 11

Digits: 9

White spaces: 2

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**Length of String Without Using strcat( )**

#include <stdio.h> int main()

{

char s[1000], i;

printf("Enter a string: "); scanf("%s", s);

for(i = 0; s[i] != '\0'; ++i);

printf("Length of string: %d", i); return 0;

}

**Output**

Enter a string: apple Length of string: 5

**copy Two Strings Without Using strcpy( )**

#include <stdio.h> int main()

{

char s1[100], s2[100], i; printf("Enter string s1: "); scanf("%s",s1);

for(i = 0; s1[i] != '\0'; ++i)

{

s2[i] = s1[i];

}

s2[i] = '\0';

printf("String s2: %s", s2); return 0;

}

**Output**

Enter String s1: apple String s2: apple

**program to convert the lower case characters of a string into upper case without using string functions**

**EC8393**

**#include <stdio.h> int main()**

**Output**

Enter the string : Hello

The string converted into upper case is : HELLO

**{**

**char str[100], upper\_str[100]; int i=0;**

**clrscr();**

**printf("\n Enter the string :"); gets(str);**

**while(str[i] != '\0')**

**{**

**if(str[i]>='a' && str[i]<='z') upper\_str[i] = str[i] – 32; else**

**upper\_str[i] = str[i]; i++;**

**}**

**upper\_str[i] = '\0';**

**printf("\n The string converted into upper case is : "); puts(upper\_str);**

**return 0;**

**}**

**program to compare two strings without using string function**

#include <stdio.h> #include <string.h> int main()

{

char str1[50], str2[50];

int i=0, len1=0, len2=0, same=0; clrscr();

printf("\n Enter the first string : "); gets(str1);

printf("\n Enter the second string : "); gets(str2);

len1 = strlen(str1); len2 = strlen(str2); if(len1 == len2)

{

while(i<len1)

{

if(str1[i] == str2[i]) i++;

else break;

}

if(i==len1)

{

same=1;

printf("\n The two strings are equal");

}

}

if(len1!=len2)

printf("\n The two strings are not equal"); if(same == 0)

{

if(str1[i]>str2[i])

printf("\n String 1 is greater than string 2"); else if(str1[i]<str2[i])

printf("\n String 2 is greater than string 1");

}

return 0;

}

**Write a program to reverse a given string without using string function**

#include <stdio.h>

**EC8393**

#include <conio.h> #include <string.h> int main()

**Output**

Enter the string: Hi there

The reversed string is: ereht iH

{

char str[100], reverse\_str[100], temp; int i=0, j=0;

clrscr();

printf("\n Enter the string : "); gets(str);

j = strlen(str)–1; while(i < j)

{

temp = str[j]; str[j] = str[i]; str[i] = temp; i++;

j––;

}

printf("\n The reversed string is : "); puts(str);

getch(); return 0;

}

**C program to change case from upper to lower and lower to upper** without using string function

**#include <stdio.h> int main ()**

o/p

Input a string file ABC

the string is FILEabc

**{**

**int i = 0;**

**char ch, s[1000];**

**printf("Input a string\n"); gets(s);**

**while (s[i] != '\0') { ch = s[i];**

**if (ch >= 'A' && ch <= 'Z') // convrt to lower case s[i] = s[i] + 32;**

**else if (ch >= 'a' && ch <= 'z') //convert to upper case s[i] = s[i] - 32;**

**i++;**

**}**

**Printf(“\n the string is:”) printf("%s\n", s); return 0;**

**}**

#### C Program to Count Number of Words in a given Text or Sentence

**#include <stdio.h> #include <string.h> void main()**

**o/p**

**enter the string**

**hello how are you friends**

**number of words in given string are: 5**

**{**

**char s[200]**;

**int count** = **0**, **i**;

**printf("enter the string\n")**; **scanf("%[^\n]s"**, **s)**;

**for (i** = **0**;**s[i]** != **'\0'**;**i**++**)**

**{ if (s[i]** == **' ') count**++; **}**

**printf("number of words in given string are: %d\n"**, **count** + **1)**; return 0;

**}**

**Palindrome program in C language using built in functions**

**EC8393**

**#include <stdio.h> #include <string.h> int main()**

o/p

Enter a string to check if it is a palindrome wow

Entered string is a palindrome

**{**

**char a[100], b[100];**

**printf("Enter a string to check if it is a palindrome\n"); gets(a);**

**strcpy(b,a); strrev(b);**

**if (strcmp(a,b) == 0)**

**printf("Entered string is a palindrome.\n"); else**

**printf("Entered string isn't a palindrome.\n"); return 0;**

**}**

**Palindrome program in C language without using built in functions**

#include **<stdio.h>** #include **<string.h> int** main**(){**

o/p

Enter a string:wow

wow is not a palindrome

**char** string1**[20]; int** i**,** length**;**

**int** flag **= 0;**

printf**("Enter a string:");**

scanf**("%s",** string1**);** length **=** strlen**(**string1**); for(**i**=0;**i **<** length **;**i**++){**

**if(**string1**[**i**] !=** string1**[**length**-**i**-1]){** flag **= 1;**

**break;**

**} }**

**if (**flag**) {**

printf**("%s is not a palindrome",** string1**);**

**}**

**else {**

printf**("%s is a palindrome",** string1**);**

**}**

**return 0;**

**}**

**C program to find the frequency of characters in a string**

**#include <stdio.h> #include <string.h> int main()**

Enter a string maple tree

a occurs 1 times in the string e occurs 3 times in the string l occurs 1 times in the string m occurs 1 times in the string p occurs 1 times in the string r occurs 1 times in the string t occurs 1 times in the string

**{**

**char string[100];**

**int c = 0, count[26] = {0}, x; printf("Enter a string\n"); gets(string);**

**while (string[c] != '\0') {**

***/\*\* Considering characters from 'a' to 'z' only and ignoring others. \*/***

**if (string[c] >= 'a' && string[c] <= 'z') { x = string[c] - 'a';**

**count[x]++;**

**}**

**c++;**

**}**

**for (c = 0; c < 26; c++)**

**printf("%c occurs %d times in the string.\n", c + 'a', count[c]); return 0; }**

**EC8393**

**C program to swap two strings**

#include <stdio.h> #include <string.h> int main()

{

char first[100], second[100], temp[100];

printf("Enter first string**\n**"); gets(first);

printf("Enter second string**\n**"); gets(second);

printf("**\n**Before Swapping**\n**"); printf("First string: %s**\n**", first); printf("Second string: %s**\n\n**", second);

strcpy(temp, first); strcpy(first, second); strcpy(second, temp);

printf("After Swapping**\n**"); printf("First string: %s**\n**", first); printf("Second string: %s**\n**", second);

return 0;

}

**Write a program to extract a substring from the middle of a given string.**

#include <stdio.h> #include <conio.h> int main()

{

char str[100], substr[100]; int i=0, j=0, n, m;

clrscr();

printf("\n Enter the main string : "); gets(str);

printf("\n Enter the position from which to start the substring: "); scanf("%d", &m);

printf("\n Enter the length of the substring: "); scanf("%d", &n);

i=m;

while(str[i] != '\0' && n>0)

substr[j] = str[i]; i++;

j++; n––;

}

substr[j] = '\0';

printf("\n The substring is : "); puts(substr);

getch(); return 0;

}

**Output**

Enter the main string : Hi there

Enter the position from which to start the substring: 1 Enter the length of the substring: 4

The substring is : i th

**EC8393**

**Write a program to insert a string in the main text.**

#include <stdio.h> int main()

{

char text[100], str[20], ins\_text[100]; int i=0, j=0, k=0,pos;

clrscr();

printf("\n Enter the main text : "); gets(text);

printf("\n Enter the string to be inserted : "); gets(str);

printf("\n Enter the position at which the string has to be inserted: "); scanf("%d", &pos);

while(text[i]! = '\0')

{

**Output**

Enter the main text : newsman

Enter the string to be inserted : paper

Enter the position at which the string has to be inserted: 4

The new string is: newspaperman

if(i==pos)

{

while(str[k] != '\0')

{

ins\_text[j] = str[k]; j++;

k++;

}

}

else

{

ins\_text[j] = text[i]; j++;

} i++;

}

ins\_text[j] = '\0';

printf("\n The new string is : "); puts(ins\_text);

getch(); return0;

}

**Write a program to delete a substring from a text.**

#include <stdio.h> int main()

{

**Output**

Enter the main text : Hello, how are you? Enter the string to be deleted : , how are you?

The new string is : Hello

char text[200], str[20], new\_text[200];

int i=0, j=0, found=0, k, n=0, copy\_loop=0; clrscr();

printf("\n Enter the main text : "); gets(text);

printf("\n Enter the string to be deleted : "); gets(str);

while(text[i]!='\0')

{

j=0, found=0, k=i; while(text[k]==str[j] && str[j]!='\0')

{ k++; j++;

}

if(str[j]=='\0') copy\_loop=k;

new\_text[n] = text[copy\_loop]; i++;

copy\_loop++; n++;

}

new\_str[n]='\0';

printf("\n The new string is : "); puts(new\_str);

return 0;

**EC8393**

}

**Write a program to replace a pattern with another pattern in the text.**

#include <stdio.h> #include <conio.h> main()

{

char str[200], pat[20], new\_str[200], rep\_pat[100]; int i=0, j=0, k, n=0, copy\_loop=0, rep\_index=0; clrscr();

printf("\n Enter the string : "); gets(str);

printf("\n Enter the pattern to be replaced: "); gets(pat);

printf("\n Enter the replacing pattern: "); gets(rep\_pat);

while(str[i]!='\0')

{

j=0,k=i;

while(str[k]==pat[j] && pat[j]!='\0')

{ k++; j++;

}

if(pat[j]=='\0')

{

copy\_loop=k; while(rep\_pat[rep\_index] !='\0')

{

new\_str[n] = rep\_pat[rep\_index]; rep\_index++;

n++;

}

}

new\_str[n] = str[copy\_loop]; i++;

copy\_loop++; n++;

}

new\_str[n]='\0';

printf("\n The new string is : "); puts(new\_str);

getch(); return 0;

}

**Output**

Enter the string : How ARE you?

Enter the pattern to be replaced : ARE Enter the replacing pattern : are

The new string is : How are you?