

Chapter 9

ELEMENTS OF C

Q.1 Explain the importance of elements of C language?

Ans.

- A language is a source of communication between two individuals. We can express our feelings and thoughts with the help of a language. Similarly, the language through which we can communicate with a computer is called a computer language.
- The process of learning a computer language is similar to learn a human language. In English language, some alphabets are combined to make a word. Then, some words are combined to form a sentence. Finally, some sentences are collected to narrate a complete story.
- In the similar fashion, there is a set of characters (like English alphabets) in C language called Basic Character Set. These characters are used to form words and words are combined to generate instructions. Finally, instructions are written in a specific way to write a C program.

Alphabets → Words → Sentence → Story

Character set → Tokens → Commands → Program

Q.2 What is a character set? Explain the character set of C language?

Ans.

- Each programming language has its own set of characters which are used to write statements of the program.
- The C language allows a limited set of alphabets, digits and special characters. These alphabets, digits and special characters are collectively called character set of C language. A list of C character set is as follows:

Category	Description
Lowercase Letters	a, b, c, d, e, ... z.
Uppercase Letters	A, B, C, D, ... Z.
Digits	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Special Characters	+ - * / = etc.
Blank Spaces	Blank space, new line, tab

Q3. What is an Identifier? Also write down its two different types.

Ans.

Identifiers:

- Identifiers are the names used to represent variables, constants, data types, functions, and labels in the program.
- Identifiers consist of characters (alphabets, numbers, underscore). Identifiers can contain any number of characters but only the first 31 characters are significant to C compiler.
- C is a case sensitive language, therefore, in C language Uppercase and lower case letters are different.
- There are two types of identifiers in C.
 1. Standard Identifiers.
 2. User-defined Identifiers.

Standard identifiers:

- These identifiers have special meaning (defined operations) in C like reserve words.
- These can be redefined for other purposes but it is not recommended.
- If a standard identifier is redefined in a program then we are unable to use it for original purpose.
- Examples:
 - printf name of output function defined in stdio.h
 - scanf name of input function defined in stdio.h

User-defined identifiers:

- These identifiers are defined by the programmer (user).
- A user uses these identifiers for variables, constants, data types, functions, and labels in the program.
- These words are used to store or access data from various memory locations.

Q4. What are the Keywords / Reserve words in c language?

Ans.

Keywords/ Reserve words:

- These are the words, which have predefined meaning in C language.
- There are 32 keywords in C language.
- These words cannot be used or redefined for any other purpose in the C program.
- All keywords are written in lower case.
- List of C keywords:

1. auto	2. double	3. void	4. unsigned
5. long	6. switch	7. signed	8. for
9. int	10. struct	11. extern	12. typedef
13. do	14. if	15. goto	16. default
17. break	18. else	19. case	20. continue
21. static	22. while	23. union	24. return
25. volatile	26. sizeof	27. short	28. float
29. char	30. const	31. enum	32. register

Q5. What is a variable? Also write down the rules for naming a variable?

Ans.

Variables:

- A variable is a name of memory location.
- Variables are used to store values that can be changed during program execution.
- The value of variables may be numeric or alphabets.
- Variable name remains same but the value stored in variable may change during the program execution.
- When a variable is created in a computer program, some bytes in the computer memory are allocated to it. These bytes are used to store the value assigned to the variable.
- The relationship between name, content and address of a variable is shown in the following figure:

0001	
0002	
0003	
0004	
0005	
0006	500

Salary

Variable name is salary.

Address is 0006

Variable content is 500

- Variable name is the identifier that is assigned to a specific location in the computer memory.
- Variable content refer to value stored in the memory location associated with the variable, and
- Variable address refers to the address of memory assigned to the variable.

Rules for Naming Variables:

- A variable name can consists of letters, digits, and the underscore character.
- The first character of a variable name must be an alphabet.
- The underscore is also a legal first character but it is not recommended.
- The first character of a variable name cannot be a digit.
- Blank spaces are not allowed in variable names.
- Special characters e.g. &, ^, \$ etc. cannot be used in variables.
- A variable name can only be declared for only one data type in a program.
- C is case sensitive language, therefore, the names count and COUNT are two different variables
- C keywords cannot be used as variable names.
- In C, variable name can be up to 31 characters long. If a variable consists of more than 31 characters, then the compiler ignores the characters after 31st characters.
- Variable names should be in readable form e.g. pay, loan
- Programmers commonly use lower case letters for variables names and upper case for constants.

Q6. What is meant by variable declaration and initialization? Explain with the help of examples?

Ans.

Variable Declaration:

- Variable declaration tells the compiler the name and type of value stored in variable.
- C is a strongly typed language, it means before using a variable in a program, it must be declared.
- When a variable is declared, a certain number of bytes (depending upon the data type) are allocated to the variable in memory.
- It means declaration not only declares but also defines a variable.
- TC gives an error message if undeclared variable is used in the program.

Variable declaration Syntax:

```
Data_type variable name;  
int          a;
```

```
char          ch;
```

Declaration of Multiple Variables:

Data_type list of variables separated by comma;

```
float         c, d;
```

```
int           x, y, z;
```

Variable Initialization:

- Assigning a value to a variable at the time of declaration is called initialization of the variable.
- The general syntax is:

```
Type          variable      =      Value;
```

Example:

```
int k;          //declaration of k
```

```
k = 20;         //initialization of k
```

Variables can be declared and initialized in a single statement.

```
int            a = 15;
```

```
float          b = 5.23, c = 12.8;
```

```
char           ch = 'M' ;
```

Garbage Value:

- When a variable is declared, the compiler reserves the space for it. If we do not initialize it then it may contain a meaningless data is called garbage value, and with the involvement of such variable may cause unexpected results.
- To avoid this situation, all variables must be declared and initialized according to program requirement.

Assignment operator: Equal to (=) symbol is used to initialize a variable in the program.

Program:

```
#include<stdio.h>
#include<conio.h>
void main( )
{
    int x;
    printf("Value of x= %d",x);
    x=200;
    printf("Value of x= %d",x);
    getch( );
}
```

Output:

Value of x=-27896
Value of x=200

As we have displayed the value of x without initialization so output is undefined

Q7. What is a constant? Also discuss its different types.

Ans.

Constants:

- A quantity whose value cannot be changed during program execution.
- Example:

```
#define pi 3.142857
```

pi whose value remains same during program execution.

There are two types of constants:

1. Numeric constants.
2. Character constants.

Numeric Constant:

- These constants consist of numbers.
- There are two types of numeric constants.
 - i. Integers
 - ii. Float

Integer constants represent values that are counted and without decimal or fractional part. e.g. +56, -678 etc

Floating constants represents values that are measured. e.g. 4.786, 0.45 etc.

Character Constant:

- It is a single alphabet, a single digit or a single symbol enclosed within apostrophes.
- The maximum length of a character constant is 1.
- Examples are: '5', '+', 'B' etc.
- **String Constant** is a group of characters enclosed in double quotes. For example "I Love Pakistan".

Q8. What is a data type? Also write about character data types.

Ans.

Data Types:

- Data type defines maximum or minimum set of values and set of operations on those values.

Standard data type is one which is predefined in C language.

In C language the basic standard data types are int, float, char and double and long double.

User-define data type allows us to define our own data types.

Data Types for Characters.

- A keyword char is used for character data type. It is used to represent a letter, number, or a symbol.
- A character variable occupies 1 byte in memory.
- %c is used as format specifier.
- A character is enclosed in apostrophes. e.g. 'X', '5', '=', '#' etc.
- Signed and unsigned keywords can be used with char.
- Signed characters represent numbers ranging from -128 to 127.
- Unsigned characters represent numbers ranging from 0 to 255.
- Alphabets, numbers and punctuation marks are always represent with positive numbers.
- Characters can also be compared, added and subtracted.
- Characters are stored in memory in the form of ASCII codes. Therefore arithmetic operations are performed on ASCII values.

Example:

Write a program to show arithmetic operation on char type variables.

```
#include<stdio.h>
void main(void)
{
    char ch1, ch2, sum;
    ch1 = '2';           //ch1 contains ASCII code of 2 =50
    ch2 = '6';           //ch1 contains ASCII code of 6 =54
    sum = ch1 +ch2;
    printf("\n Sum = %d",sum);           //output Sum = 104
}
```

Program:

Write a program that assigns a character to char type variable and displays its ASCII value.

```
#include<stdio.h>
#include<conio.h>
void main( )
{
    char x;
    x='A',
    printf("Character value of x= %c\n",x);
    printf("ASCII value of x= %d",x);
    getch( );
}
```

}

Output:

Character Value of x=A ASCII value of x=65

Q9. Discuss different Numeric data types used in C language.

Ans.

Data Types for Integers:

- Integers are the numbers without decimal fraction. It may be positive, negative or zero. e.g. 112, -234, 0 etc.
- An integer variable may be signed or unsigned. If not mentioned then all integers are considered as signed.
- Data Types for Integers are:
- int.
- short int.
- long int.

int:

- It takes 2 bytes in memory.
- The keyword int is used for integers.
- There are two further sub-types of int variables.
- Signed int
- Unsigned int

Signed int or short int:

- Range of int, signed int or short int variables are -2^{15} to $2^{15}-1$ or -32768 to 32767.
- int, signed int and short int can handle both positive and negative numbers.
- %d or %i are used as format specifiers.

Unsigned int or unsigned short int:

- unsigned int can not handle negative numbers.
- it can handle numbers ranging from 0 to $2^{16}-1$ or 0 to 65535
- %u is the format specifier for unsigned int.

long int:

- It is used to represent larger integers.
- It occupies 4 bytes in memory.
- It can hold numbers ranging from -2^{31} to $2^{31}-1$ (i.e. -2147483648 to 2147483647)

Unsigned long int:

- It can hold numbers ranging from 0 to $2^{32}-1$ (i.e. 0 to 4294967295).

Data Type	Bytes	Range of values
Int, signed int, short int	2	-32768 to 32767
unsigned int, unsigned short int	2	0 to 65535
Long	4	-2147483648 to 2147483647
unsigned long	4	0 to 4294967295

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Q10. Discuss different floating point or real data types used in C language.

Ans.

Data Types for Floating Point Numbers.

- These are the numbers with fractional part. e.g. 2.13, 0.54 etc.
- ANSI C specifies three floating point data types.
- float
- double
- long double
- All are different in memory requirement and range.

float:

- It may be signed or unsigned numbers.
- It is represented in decimal or exponential form.
- It occupies 4 bytes in memory.
- It can store real values up to 3.4×10^{-38} to $3.4 \times 10^{+38}$.
- Its accuracy is up to 6 decimal places.

Scientific or Exponential form of float point number:

- The storage area occupied by the number is divided into two sections.
- Mantissa: It is the value of the number.
- Exponent: it is the power to which mantissa is raised.
- In C, scientific forms of a number are
 - +mep
 - mep
 - +mEp
 - mEp
- m represents the mantissa part.
- E or e is used instead of base 10.
- p represents the exponent part.
- If the number is smaller than 1 then its exponent is negative. (i.e. 0.00524 is equal to 5.24×10^{-3})

Example: 2.45×10^5 is represented as 2.45e5 or 2.45E5.

The following table gives a real number and its equivalent scientific and exponential forms.

Floating Point Number	Scientific form	Exponential form
0.00006	6.0×10^{-5}	6.0e-5
60000000.0	6.0×10^7	6.0E7
-0.00000162	-1.62×10^{-6}	-1.620E-6
660.0	6.6×10^2	6.6E2

double:

- It is used to store larger floating point numbers.
- It takes 8 bytes in memory.
- It can handle real numbers from 1.7×10^{-308} to $1.7 \times 10^{+308}$.
- Its accuracy is up to 15 decimal places.

long double:

- A long double variable takes 10 bytes in memory.
- It can handle real numbers from 3.4×10^{-4932} to $3.4 \times 10^{+4932}$.
- Its accuracy is up to 19 decimal places.

Data Type	Bytes	Decimal Places	Range of values
Float	4	6	10^{-38} to 10^{+38}
Double	8	15	10^{-308} to 10^{+308}
long double	10	19	10^{-4932} to 10^{+4932}

Data type	Bytes	Format Specifier	Range
Signed char	1	% c	-128 to 127
Unsigned char	1	% c	0 to 255
Short signed int	2	% d, % i	-32768 to 32767
Short unsigned int	2	% u	0 to 65535
Long signed int	4	% ld	-2147483648 to 2147483647
Long unsigned int	4	% lu	0 to 4294967295
Float	4	% f	-3.4×10^{38} to 3.4×10^{38}
Double	8	% lf	-1.7×10^{308} to 1.7×10^{308}
Long double	10	% Lf	-1.7×10^{4932} to 1.7×10^{4932}

Q11. Define the Cancellation Error, Arithmetic Underflow, Arithmetic Overflow, Integer Underflow and Integer Overflow.

Ans.

Cancellation Error:

- While working with floating point numbers, some unexpected results cause problems.
- **For example** manipulation of very large and very small float numbers produced unexpected results e.g. the result of addition of 1970.0 and 0.0000001243 may produce 1970.000000 on some computers.

- This type of errors is called cancellation errors i.e. in cancellation errors a very small value disappears when it is added to or subtracted from a very large value.

Arithmetic Underflow:

- When two very small numbers are manipulated, the result may be too small to be represented accurately, so it will be represented as zero.
- This is called arithmetic underflow i.e. when the value assigned is less than the minimum allowable limit, an underflow occurs.

Arithmetic Overflow:

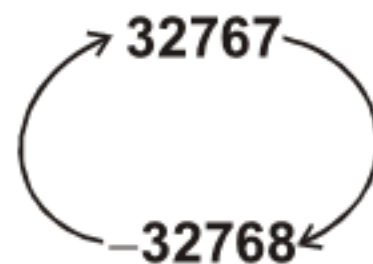
- When two very large numbers are manipulated, the result may be too large to be represented.
- This is called arithmetic overflow i.e. When the value assigned is greater than the maximum allowable limit, an overflow occurs.

Integer Underflow:

- When the value assigned to a variable is less than the minimum allowable limit of an integer i.e. -32768, an underflow occurs.
- In case of an integer underflow different compiler takes different actions.
- In most cases compiler runs the programs and it produces incorrect results.

Integer Overflow:

- When the value assigned to a variable is greater than the maximum allowable limit of an integer i.e. +32767, an integer overflow occurs.
- In case of an integer overflow different compiler takes different actions.
- In most cases compiler runs the programs and it produces incorrect results.
- In case of overflow and underflow in integer variables, the assigned value “wraps around” the maximum/minimum limits. The wrap around means that the value that comes after the maximum is the minimum value.



- For example, the maximum value that an int type variable can have is 32767. When 1 is added to a variable to already contains a value of 32767, the result is -32768. That is, the value wraps around and starts from the minimum value, i.e. -32768.

- Similarly, the value below the minimum limit is the maximum value. The minimum value that an int type variable can have is -32768 . When 1 is subtracted from the variable that already contains a value of -32768 , the result is 32767. That is the value wraps around and starts from the maximum value. i.e. 32767.

Q12. What are comments? Also discuss its different types.

Ans.

Comments:

- Comments play no role in the execution of the program. These are non-executable statements.
- The compiler does not translate these statements.
- It increases the readability of the program.
- It is used to add informative notes about the statements in a program that helps in debugging and modifying programs.
- It also explains the logic of the program.
- There are two types of comments in C.
 1. Single line comments
 2. Multi line Comments

Single line comments:

- Single line comments are inserted by typing two forward slashes before the beginning of a line.

Example: // this program Calculates temperature

Multi line Comments:

- Multi-line comments are used to provide such informative notes which extend to multi lines.
- Multi line comments are inserted by typing slash asterisk (/*) in the beginning and asterisk slash (*/) at the end of paragraph. Then the compiler ignores all lines within this block.
- By omitting ending letters */ will cause the whole program code beneath the opening letters /* for comments to be commented.

Example: /* this program calculates factorial of a number

Number is positive integer. And result is long integer. */

Q13. What is an expression? Also describe operator and operand?

Ans.

Expressions:

- An expression is a combination of Operands (constants and variables) and operators. We can write an expression as follows;

Operand1 (operator) Operand2

Or

Operator (operand)

Operator:

- It is a symbol or a sign used to perform a certain tasks on data.
- Unary operators required single data item (operand) and binary operators required two data items (Operands).
- Following types of operators are available in C.
 - o Arithmetic Operators
 - o Relational Operators.
 - o Logical Operators.
 - o Increment and decrement Operators.
 - o Assignment Operator

Operand:

- The value on which we want to perform operation is called the operand.

There are three types of Expressions

1. Arithmetic Expressions
2. Relational Expressions
3. Logical Expressions

Q14. Describe arithmetic expression? Also discuss its different modes.

Ans.

Arithmetic Expressions and Arithmetic Operators:

- Arithmetic operators are used with constants and variables forms arithmetic expressions.
- These operators (+, -, *, /, %) are used to perform arithmetic operations.

Operator	Function
+	Addition of two numbers (Binary a+b)
-	Subtraction of two Numbers (Binary a-b)
*	Multiplication of two Numbers (Binary a*b)
/	Divide two numbers (Binary a/b)

%	To get remainder after dividing numbers (Binary a%b)
+	unary + (+a)
-	unary - (-a)

- All arithmetic operators are used for all types of numeric data except remainder operator.
- Remainder operator or Modulus Operator (%) is used only with integers.
- All the arithmetic expressions are evaluated from left to right.
- The computer performs only one operation at a time.
- Unary operators have higher precedence over the binary operator.
- The priority of multiplication and division is higher than addition and subtraction, however, the priority of * and / is equal and the priority of + and - is equal.

There are three modes of arithmetic expressions.

- Integer Arithmetic
- Real Arithmetic
- Mixed arithmetic

Integer arithmetic Mode:

- When an arithmetic operation is performed on integer values it always yields an integer result.
- It does not produce real results.

Example:

	A+B	A-B	A*B	A/B
A=22, B=4	26	18	88	5

Real arithmetic Mode:

- When an arithmetic operation is performed on floating point numbers, it always yields a floating point result.

Example:

	A+B	A-B	A*B	A/B
A=22.0, B=4.0	26.000000	18.000000	88.000000	5.500000

Mixed arithmetic Mode:

- When an arithmetic operation is performed on integers and floating point numbers (anyone is real number), it always yields a floating point result.

Example:

	A+B	A-B	A*B	A/B
A=22, B=4.0	26.000000	18.000000	88.000000	5.500000

Program:

Write a program in C language to show different arithmetic operations on data.

```
#include<stdio.h>
#include<conio.h>
void main( )
{
int x,y,add,sub,mul,div,mod;
x=20;
y=4;
add=x+y;
sub=x-y;
mul=x*y;
div=x/y;
mod=x%y;
printf("Addition is %d\n",add);
printf("Subtraction is %d\n",sub);
printf("Multiplication is %d\n",mul);
printf("Division is %d\n",div);
printf("Modulus is %d\n",mod);
getch( );
}
```

Output:

Addition is 24

Subtraction is 16

Multiplication is 80

Division is 5

Modulus is 0.

Q15. What are relational expressions?

Ans.

Relational Expression and Relational Operators:

- Relational operators with constants and variables form relational expressions.
- There are six binary relational operators (<, >, <=, >=, ==, !=) used to compare two values.
- These always evaluates to true or false.
- A true state is represented by a non zero value (1) and a false state is represented by a zero value (0).
- All the relational expressions are evaluated from left to right.
- Relational operators are at the same level of hierarchy i.e. no relational operator has the preference over the other.

Operator	Meaning	Expression
<	Less than	$a < b$
<=	Less than or equal to	$a \leq b$
>	Greater then	$a > b$
>=	greater than or equal to	$a \geq b$
==	equal to	$a == b$
!=	not equal to	$a != b$

Example:

	A<B	A<=B	A>B	A>=B	A==B	A!=B
A=10, B=20	1	1	0	0	0	1
A=10, B=10	0	1	0	1	1	0
A=20, B=10	0	0	1	1	0	1

Q16. What are Logical Expressions? Also discuss its different operators.

Ans.

Logical Expressions and Logical Operators:

- These operators are used to combine more than one relational expression i.e. relational expressions with logical operators form logical expressions.
- And (&&), or (||) and not (!) are three logical operators.
- Logical operators also produce true or false results.
- Not (!) is a unary operator but && and || are binary operators.
- If more than one logical operator is used in an expression then the expression will be evaluated from left to right in the following sequence.

Not (!)

And (&&)

Or (||)

And Operator (&&)

- It is used to combine two or more relational expressions.
- It produces true if all the relational expressions (conditions) are true and it produces false result if any one of the conditions or all the conditions are false.

A(Exp-1)	B(Exp-2)	A && B
1	1	1
1	0	0
0	1	0
0	0	0

Example: X=10, Y=20, Z=30

A=X>Y	B=X>Z	A&&B
0	0	0
A=X<Y	B=X>Z	A&&B
1	0	0
A=X>Y	B=X<Z	A&&B
0	1	0
A=X<Y	B=X<Z	A&&B
1	1	1

Or Operator (||):

- It is also used to combine two or more relational expressions.
- It produces false if all the conditions (relational expressions) are false and it produces true result if any one of the conditions or all the conditions are true.

A(Exp-1)	B(Exp-2)	A B
1	1	1
1	0	1
0	1	1
0	0	0

Example: X=10, Y=20, Z=30

A=X>Y	B=X>Z	A B
0	0	0
A=X<Y	B=X>Z	A B
1	0	1
A=X>Y	B=X<Z	A B
0	1	1
A=X<Y	B=X<Z	A B
1	1	1

Not or Negation Operator (!):

- It negates the value of an expression.
- If an expression evaluates to true (non-zero value) then it converts true into false (zero value) and if an expression yields false then its negation yields true.

A	!(A)
1	0
0	1

Example: X=10, Y=20

A=X>Y	!(A)
0	1
A=X<Y	!(A)
1	0

Q17. What is Increment and decrement operator? Explain with the help of examples.

Ans.

Increment Operator (++):

- ++ is used as increment operator.

- It is used to increase the value of the variable by one.
- It can be used before or after the variable name e.g. `x++` or `++x`.
- It can not be used with constants and expressions. Only the variables can be incremented.
- It is unary operator.
- There are two types of increment operator
 1. Postfix increment operator
 2. Prefix increment operator.

Postfix increment operator:

- When `++` follows its operand (variable), it is called postfix increment operator.
- In postfix increment, `++` increases the value of variable after the execution of the statement i.e. it first uses the current value of the variable in the statement and after the completion of the statement it increases the value by one.

Example:

```
A = 100;
B = A++;           //    A=101, B=100
B = A++;           //    is equivalent to B = A; and A = A + 1;
```

Prefix increment operator:

- When `++` precedes its operand (variable), it is called prefix increment operator.
- In prefix increment, `++` increases the value of the variable before the execution of the statement i.e. it first increases the current value of the variable by one and then new value is used in the statement.

Example:

```
A = 100;
B = ++A;           //    A=101, B=101
B = ++A;           //    is equivalent to      A = A + 1; AND B = A;
```

Decrement Operator (--):

- `--` is used as decrement operator.
- It is used to decrease the value of the variable by one.
- It can be used before or after the variable name e.g. `x--` or `--x`.
- It can not be used with constants and expressions. Only the variables can be decremented.
- It is unary operator.
- There are two types of decrement operator
 1. Postfix decrement operator
 2. Prefix decrement operator.

Postfix decrement operator:

- When -- is follows its operand (variable), it is called postfix decrement operator.
- In postfix decrement, -- decreases the value of variable after the execution of the statement i.e. it first uses the current value of the variable in the statement and after the completion of the statement it decreases the value by one.

Example:

```
A = 100;
B = A--;           //      A=99, B=100
B = A--;           //      is equivalent to B = A; and A = A - 1;
```

Prefix decrement operator:

- When -- is precedes its operand (variable), it is called prefix decrement operator.
- In prefix decrement, -- decreases the value of the variable before the execution of the statement i.e. it first decreases the current value of the variable by one and then new value is used in the statement.

Example:

```
A = 100;
B = --A;           //      A=99, B=99
B = --A;           //      is equivalent to A = A - 1; AND B = A;
```

Program:

Write a program in C language to show the difference of prefix increment and postfix increment.

```
#include<stdio.h>
#include<conio.h>
void main( )
{
    int x, y;
    y=50;
    x=++y;
    clrscr( );
    printf("Prefix Increment\n");
    printf("Value of x = %d\n",x);
    printf("Value of y = %d\n",y);
    y=50;
    x=y++;
    printf("Postfix Increment\n");
    printf("Value of x = %d\n",x);
```

```
printf("Value of y = %d\n",y);
getch( );
}
```

Output:

Prefix Increment

Value of x = 51

Value of y = 51

Postfix Increment

Value of x = 50

Value of y = 51

Q18. What is assignment statement and assignment operator?**Ans.****Assignment Statement and Assignment Operator (=):**

- Assignment statement is used to assign a value or a computational result to a variable.
- The symbol equal (=) represents assignment operator.
- There are two types of assignment statement.
 1. Simple Assignment Statement
 2. Compound Assignment Statement

Simple Assignment statement:

- The value is written on the right side of the operator and the variable is left side of the operator in the assignment statement.
 - Writing variable to right and value to left causes a syntax error.
 - General form of assignment statement
 - Variable = expression
- Expression can be a variable, constant, arithmetic, relational or logical expression e.g.

```
A = 10;
```

```
D = B*B - 4*A*C;
```

Compound Assignment statement:

- It is used to assign one value to more than one variables.
- General form of compound Statement
- Var-1=var-2=var-3=-----=var-n=value

Example:

```
int x, y, z;
```

```
x = y = z = 10; //The value 10 is stored in variables x, y and z
```

Compound Assignment Expression And Compound Assignment Operators:

- It is used to add, subtract, multiply or divide the value to or from a variable.
- There are four compound assignment operators (+=, -=, *=, /=) that can increment or decrement the value of the variables by other than one.
- General form of writing compound assignment expressions is
Variable operator = value

Example:

```
int J = 10, I=20;
```

```
J += 5;    // value of j is increase by 5 and J=15    or    J=J+5
```

```
I *= 5;    // value of i is multiplied by 5 and stored in I (I=100) //or equivalent to  
I = I*5
```

Program:

Write a program in C language to show the working of compound assignment statement.

```
#include<stdio.h>
#include<conio.h>
void main( )
{
    int a, s, m, d, r;
    a = s = m = d = r = 200;
    a+=5;
    s-=5;
    m*=5;
    d/=5;
    r%=5;
    clrscr( );
    printf("%d\n",a);
    printf("%d\n",s);
    printf("%d\n",m);
    printf("%d\n",d);
    printf("%d\n",r);
}
```

Output:

```
205
95
1000
40
0
```

Q19. What is operator precedence? List the operators used in C language according to their precedence level.

Ans.

Operator Precedence:

- The order in which different types of operators are evaluated is called as operator precedence. It is also known as hierarchy of operators.
- All operators in C language have their own precedence level.
- In any expression, the operators with higher precedence level are evaluated before the operators with lower precedence level.
- When an expression is a combination of arithmetic, relational and logical expression then the expression is evaluated in the following sequence.
 - o Arithmetic
 - o Relational
 - o Logical
 - o The expression in parenthesis is evaluated first. In case of nested parenthesis, the part of expression in the inner most parenthesis is evaluated first.
 - o Next, multiplication and division (* /) operators are evaluated.
 - o Then, plus and minus (+ -) operators are evaluated.
 - o Relational operators, Logical AND, OR and finally assignment operator are respectively evaluated.

Operator	Precedence
! Logical not	Highest
() parenthesis	
*, /, %	
+, -	
>, >=, <, <=	
==, !=	
&& (and)	
 (or)	Lowest
=	

The table shows the level of precedence for different operators. Logical not (!) and parenthesis has the highest precedence.

For example, consider the expression: $25 * (6 + (50 - 48) / 2) + 15$

- First of all, the expression in the inner most parenthesis (50 - 48) is evaluated.
- Then, the result of this expression is divided by 2. It gives value 1.
- In third step, 1 is added to 6. The entire expression in parenthesis gives value 7.
- Now, 7 is multiplied to 25. Finally, 175 is added with 15 and 190 becomes the answer.

Q.20 What is an operator's associativity? Explain with example.

Ans.

- The order in which the operators of same precedence are evaluated is called operator associativity. It tells the compiler that if some operators of same precedence level are there then how the expression is evaluated (from left – to – right or right – to – left).

Operator	Associativity
() ++ (postfix) -- (postfix)	Left – to – right
+ (unary) – (unary) ++ (prefix) --(prefix)	Left – to – right
* / %	Left – to – right
+ –	Left – to – right
= += -= *= /=	Right – to – left

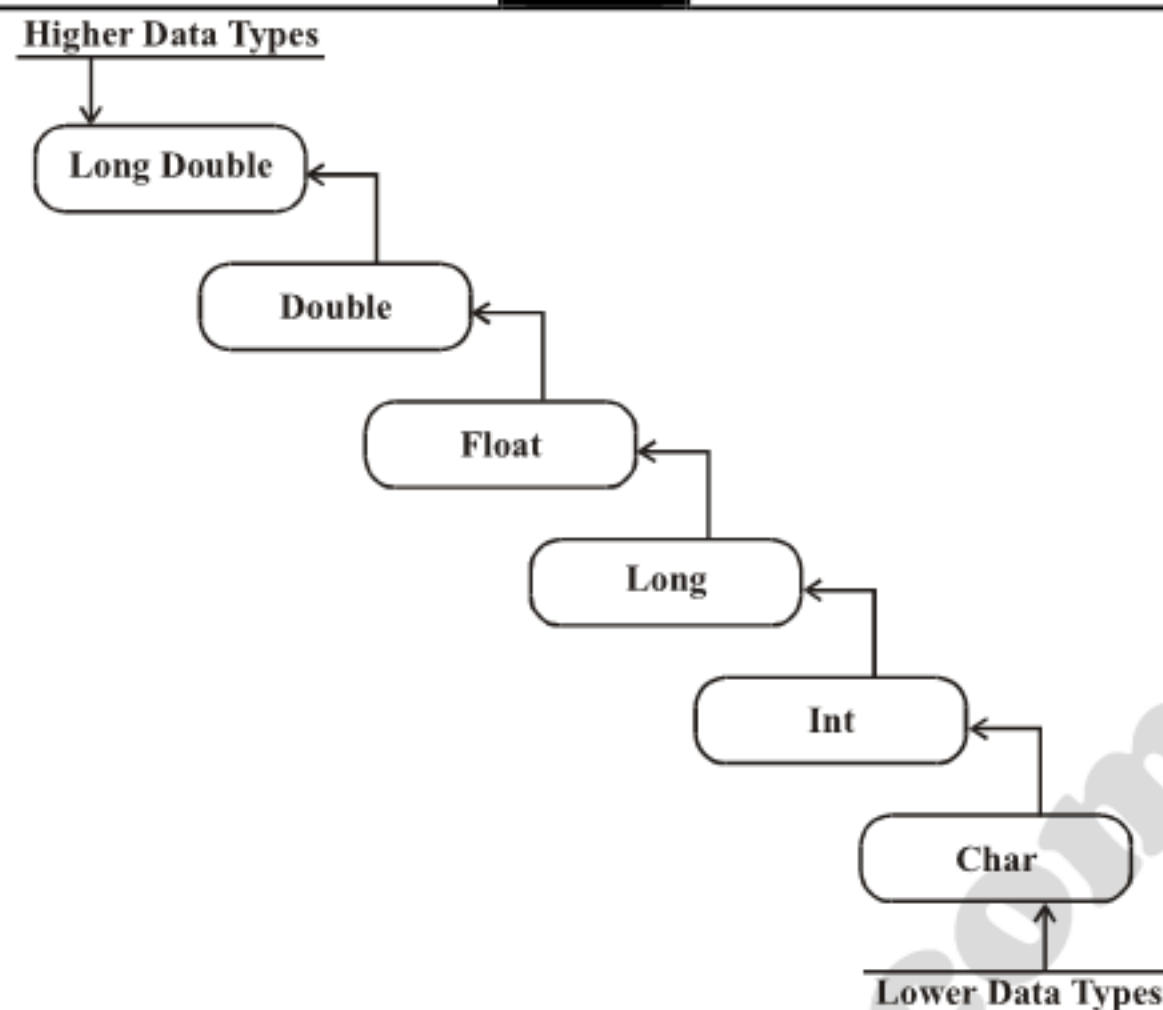
- For example, consider the expression: $5 + 6 - 9 - 2 + 7$. In this expression, plus and minus operators have the same precedence level. Here, operators associativity rule (described in row no. 4 of the above table) is used to evaluate this expression. It is evaluated as follows:

- o $5 + 6 - 9 - 2 + 7$
- o $11 - 9 - 2 + 7$
- o $2 - 2 + 7$
- o $0 + 7$
- o 7

Q.21 What is meant by type casting? Explain in detail.

Ans. Type Casting:

- The conversion of the data type of a value into another data type during the program execution is called type casting. Type casting can be performed in two standard ways:
- Implicit Casting
- Explicit Casting
- **Implicit Casting:**
 - o Implicit casting is automatically performed by the C compiler. The operands in arithmetic operation must be of similar data types. In case, the data types of operands are different, the values with lower data type are converted into higher data type.
 - o It is important to describe here that data types in C language are categorized from lower to higher order. This categorization is based on the number of bytes that a data type takes in memory. Different data types are arranged into the following sequence.
 - o If nested parenthesis are used, then the part of expression in the inner most parenthesis is evaluated first.



- o For example, suppose a is an integer type variable and b is a long type variable and we want to evaluate the expression $a + b$. In this expression, data type of variable a is lower than b. Therefore, the value of variable a will be converted into long. The data type of a is not changed i.e., it remains int. Only the value is converted into another data types in order to evaluate the expression.
- **Explicit Casting:**
 - o Explicit casting is performed by the programmer. In explicit casting, the type cast operator is used i.e., convert one numeric data type into another numeric data type. The syntax for this conversion is as shown below:

(type) expression;
 - o **Type:** It specifies the data type to which the value of the expression is to be converted.
 - o **Expression:** It includes a constant, variable, or expression whose data type is to be converted.
 - o For example, consider the expression $a \% b$;. Suppose, both variables are of float data type. The expression will generate a runtime error because the modulus operator cannot work with float variables. It can only work with integers. So, the value of both variables will be converted into int data type.
 $(int) a \% (int) b ;$

- o The above statement will convert the value of variable a and value of variable b into int data type. Then, it can be successfully evaluated. Here, it is important to explain that the values of both variables are temporarily converted while the actual data type remains float.

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