In C programming language, operators have different levels of precedence, which determine the order in which the operators are evaluated in an expression.

The precedence of operators determines which operators are evaluated first, and in what order, when an expression contains multiple operators.

The table lists the operators in order of their precedence, with operators of higher precedence listed first.

| Precedence | Name | Operator | Associativity |
| :--- | :--- | :--- | :--- |
| 1 | Postfix | ()[]$->.++-$ | Left-to-right |
| 2 | Unary | $+-!\sim * \&$ sizeof | Right-to-left |
| 3 | Multiplicative | $* / \%$ | Left-to-right |
| 4 | Additive | +- | Left-to-right |
| 5 | Shift | $\ll \gg$ | Left-to-right |
| 6 | Relational | $\ll=\gg=$ | Left-to-right |
| 7 | Equality | $==!=$ | Left-to-right |
| 8 | Bitwise AND | $\&$ | Left-to-right |
| 9 | Bitwise OR | $\\|$ | Left-to-right |
| 10 | Logical AND | $\& \&$ | Left-to-right |
| 11 | Logical OR | $\\|$ | Left-to-right |
| 12 | Conditional | $?:$ | Left-to-right |
| 13 |  |  | Right-to-left |


| Precedence | Name | Operator | Associativity |
| :--- | :--- | :--- | :--- |
| 14 | Assignment | $=+=-=*=/=\%=\ll=\gg=\&=\wedge=/=$ | Right-to-left |
| 15 | Comma | , | Left-to-right |

## Arithmetic Operators:

- Addition: "+"
- Subtraction: "-"
- Multiplication: "*"
- Division: "/"
- Modulo (remainder): "\%"
- Increment: "++"
- Decrement: "-"


## Example:

```
int a = 10;
int b = 3;
int c = a + b; // c = 13
int d = a % b; // d = 1
a++; // a = 11
b--;
// b = 2
```


## Relational Operators:

- Equal to: "=="
- Not equal to: "!="
- Greater than: ">"
- Less than: "<" Greater than or equal to: ">="
- Less than or equal to: "<="

Example:

```
int a = 5;
int b = 10;
int c = (a == b); // c = 0 (false)
int d = (a != b); // d = 1 (true)
int e = (a > b); // e = 0 (false)
```


## Logical Operators:

- Logical AND: "\&\&"
- Logical OR: "||"
- Logical NOT: "!"


## Example:

```
int a = 5;
int b = 10;
int c = (a > 0) && (b < 20); // c = 1 (true)
int d = !(a == b); // d = 1 (true)
```


## Assignment Operators:

- Assignment: "="
- Addition assignment: "+="
- Subtraction assignment: "-="
- Multiplication assignment: "*="
- Division assignment: "/="
- Modulo assignment: "\%="


## Example:

```
int a = 5;
a += 3; // a = a + 3 = 8
a -= 2; // a = a - 2 = 6
a *= 4; // a = a * 4 = 24
```


## Practice Problems on Operators:

## Problem 1:

Which operator is used to access the value at a particular address in C?
a) * (Asterisk)
b) \& (Ampersand)
c) $->$ (Arrow)
d) . (Dot)

Explanation: The correct answer is a) * (Asterisk). The asterisk is the dereference operator in C, which is used to access the value at a specific memory address. For example, if you have a pointer variable ptr that points to an integer, you can access the value at that address using *ptr.

## Problem 2:

## What is the result of the expression $5+3 * 2$ in C ?

a) 16
b) 11
c) 13
d) 19

Explanation: The correct answer is b) 11 . In C, multiplication (*) has higher precedence than addition (+). Therefore, the expression is evaluated as $5+(3 * 2)$, which simplifies to $5+6$, resulting in 11.

## Problem 3:

Which operator is used to perform explicit type casting in C?
a) !
b) \&
c) \#
d) (Parentheses)

Explanation: The correct answer is d) (Parentheses). In C, you can use parentheses to
explicitly cast a value from one type to another. For example, (int) 3.14 casts the floatingpoint value 3.14 to an integer.

## Problem 4:

## What is the size of the following structure in $C$ ?

```
struct MyStruct {
    int x;
    char c;
};
```

a) 4 bytes
b) 5 bytes
c) 6 bytes
d) 8 bytes

Explanation: The correct answer is c) 6 bytes. The size of a structure in C is determined by the sum of the sizes of its individual members. In this case, int occupies 4 bytes, and char occupies 1 byte. Therefore, the total size of the structure is $4+1=5$ bytes. However, most compilers add padding between structure members for alignment purposes. In this case, the structure is likely to be padded to a multiple of the largest member's size, which is 4 bytes (for int). So, the actual size of the structure becomes $4+1+1$ (padding) $=6$ bytes.

## Problem 5:

## What does the sizeof operator return in C ?

a) The value of the operand
b) The size of the variable in bytes
c) The memory address of the operand
d) The type of the operand

Explanation: The correct answer is b) The size of the variable in bytes. The sizeof operator in C returns the size of the operand or variable in bytes. For example, sizeof(int) would return the size of an int type, usually 4 bytes on most systems.

## Problem 6:

Write a C program that takes two integer inputs from the user and swaps their values using a temporary variable.

```
#include <stdio.h>
int main() {
    int a, b, temp;
    printf("Enter the value of a: ");
    scanf("%d", &a);
    printf("Enter the value of b: ");
    scanf("%d", &b);
    printf("Before swapping: a = %d, b = %d\n", a, b);
    // Swap the values using a temporary variable
    temp = a;
    a = b;
    b = temp;
    printf("After swapping: a = %d, b = %d\n", a, b);
    return 0;
```

\}

Explanation: This program demonstrates the use of the assignment (=) operator and a temporary variable to swap the values of two variables. The user is prompted to enter the values of $a$ and $b$, which are stored in the respective variables. The values are then printed before swapping. The values of $a$ and $b$ are swapped by using a temporary variable temp. Finally, the swapped values are printed.

Output:

Enter the value of $a$ : 10
Enter the value of $b: 20$
Before swapping: $a=10, b=20$
After swapping: $a=20, b=10$

## Problem 7:

Write a C program to check whether a given number is even or odd using the modulus (\%) operator.

```
#include <stdio.h>
int main() {
    int number;
    printf("Enter a number: ");
    scanf("%d", &number);
    if (number % 2 == 0) {
        printf("%d is an even number.\n", number);
```

```
    } else {
        printf("%d is an odd number.\n", number);
}
return 0;
}
```

Explanation: This program checks whether a given number is even or odd using the modulus (\%) operator. The user is prompted to enter a number, which is stored in the number variable. The modulus operator \% returns the remainder when the number is divided by 2 . If the remainder is 0 , it means the number is divisible by 2 and hence even. Otherwise, it is odd. The program then prints the appropriate message based on the result.

Output:

Enter a number: 10
10 is an even number.

## Problem 8:

Write a C program to calculate the area of a circle using the constant value of $\mathrm{PI}(3.14159)$ and the arithmetic operators.

```
#include <stdio.h>
int main() {
    float radius, area;
    const float PI = 3.14159;
    printf("Enter the radius of the circle: ");
```

```
        scanf("%f", &radius);
        area = PI * radius * radius;
        printf("The area of the circle is: %.2f\n", area);
        return 0;
}
```

Explanation: This program calculates the area of a circle using the formula area $=\mathrm{PI} *$ radius * radius. The user is prompted to enter the radius of the circle, which is stored in the radius variable. The constant value of $\mathrm{PI}(3.14159)$ is stored in the PI variable. The area is calculated by multiplying PI with the square of the radius. The calculated area is then printed using the printf function.

Output:

Enter the radius of the circle: 5
The area of the circle is: 78.54

## Problem 9:

## What is the output of the code?

```
#include <stdio.h>
int main() {
    int a = 5;
    int b = 2;
    int c = a / b * 3;
    printf("%d\n", c);
```

```
    return 0;
}
```


## Explanation:

The output of the code will be 6 . In C, division (/) and multiplication (*) have the same precedence and associate from left to right. Therefore, the expression $a / b * 3$ is evaluated as ( $a / b$ ) * 3. The division $a / b$ is an integer division, which results in 2 . Then, $2 * 3$ is evaluated, resulting in 6.

## Problem 10:

## What is the output of the code?

```
#include <stdio.h>
int main() {
    int a = 5;
        int b = 2;
        int c = a % b + 1;
        printf("%d\n", c);
        return 0;
}
```

Explanation:
The output of the code will be 2 . In C, the modulus operator (\%) returns the remainder of the division operation. The expression a \% b calculates the remainder of $5 / 2$, which is 1 . Then, 1 +1 is evaluated, resulting in 2 .

## Problem 11:

## What is the output of the code?

```
#include <stdio.h>
int main() {
    int a = 5;
    int b = 2;
    int c = a > b ? a : b;
    printf("%d\n", c);
    return 0;
}
```

Explanation:
The output of the code will be 5 . This code uses the conditional operator (?:) to assign the greater value between $a$ and $b$ to $c$. The expression $a>b$ evaluates to true, so the value of $a$ is assigned to c. Therefore, c becomes 5 .

Problem 12:
What is the output of the code?

```
#include <stdio.h>
int main() {
    int a = 5;
    int b = 2;
```

```
    int c = a & b;
    printf("%d\n", c);
    return 0;
}
```


## Explanation:

The output of the code will be 0 . The \& operator in C is the bitwise AND operator. It performs a bitwise AND operation between the individual bits of a and b. In this case, a (binary: 101) and b (binary: 010) are bitwise ANDed, resulting in 000 (binary). Converting 000 back to decimal gives 0 , which is the value of $c$.

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