C "Hello, World!" Program

In this example, you will learn to print "Hello, World!" on the screen in C programming.

To understand this example, you should have the knowledge of the following C programming topics:

- C Input Output (I/O)

Program to Display "Hello, World!"

```c
#include <stdio.h>
int main() {
   // printf() displays the string inside quotation
   printf("Hello, World!");
   return 0;
}
```

Output

```
Hello, World!
```

How "Hello, World!" program works?

- The `#include` is a preprocessor command that tells the compiler to include the contents of `stdio.h` (standard input and output) file in the program.
- The `stdio.h` file contains functions such as `scanf()` and `printf()` to take input and display output respectively.
- If you use the `printf()` function without writing `#include <stdio.h>`, the program will not compile.
- The execution of a C program starts from the `main()` function.

- `printf()` is a library function to send formatted output to the screen. In this program, `printf()` displays `Hello, World!` text on the screen.
- The `return 0;` statement is the **"Exit status"** of the program. In simple terms, the program ends with this statement.

C Program to Print an Integer (Entered by the User)

In this example, the integer entered by the user is stored in a variable and printed on the screen.

To understand this example, you should have the knowledge of the following C programming topics:

- C Variables, Constants and Literals
- C Data Types
- C Input Output (I/O)

Program to Print an Integer

```c
#include <stdio.h>
int main() {
    int number;

    printf("Enter an integer: ");

    // reads and stores input
    scanf("%d", &number);

    // displays output
    printf("You entered: %d", number);

    return 0;
}
```

Output

```
Enter an integer: 25
You entered: 25
```

In this program, an integer variable `number` is declared.

```
int number;
```

Then, the user is asked to enter an integer number. This number is stored in the `number` variable.

```
printf("Enter an integer: ");
scanf("%d", &number);
```

Finally, the value stored in `number` is displayed on the screen using `printf()`.

```
printf("You entered: %d", number);
```

C Program to Add Two Integers

In this example, the user is asked to enter two integers. Then, the sum of these two integers is calculated and displayed on the screen.

To understand this example, you should have the knowledge of the following C programming topics:

- C Data Types
- C Variables, Constants and Literals
- C Input Output (I/O)
- C Programming Operators

Program to Add Two Integers

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

    int number1, number2, sum;

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

    // calculating sum
    sum = number1 + number2;

    printf("%d + %d = %d", number1, number2, sum);
    return 0;
}
```

Output

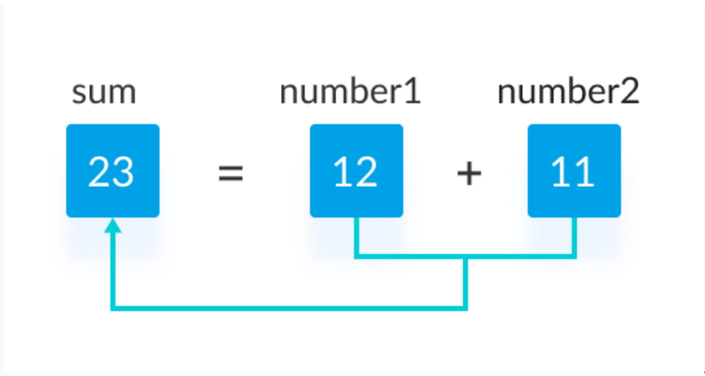
```
Enter two integers: 12
11
12 + 11 = 23
```

In this program, the user is asked to enter two integers. These two integers are stored in variables `number1` and `number2` respectively.

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

Then, these two numbers are added using the `+` operator, and the result is stored in the `sum` variable.

```c
sum = number1 + number2;
```



Add Two Numbers

Finally, the `printf()` function is used to display the sum of numbers.

```
printf("%d + %d = %d", number1, number2, sum);
```

C Program to Multiply Two Floating-Point Numbers

In this example, the product of two floating-point numbers entered by the user is calculated and printed on the screen.

To understand this example, you should have the knowledge of the following C programming topics:

- C Variables, Constants and Literals
- C Data Types
- C Input Output (I/O)
- C Programming Operators

Program to Multiply Two Numbers

```c
#include <stdio.h>
int main() {
    double a, b, product;
    printf("Enter two numbers: ");
    scanf("%lf %lf", &a, &b);

    // Calculating product
    product = a * b;

    // %.2lf displays number up to 2 decimal point
    printf("Product = %.2lf", product);

    return 0;
}
```

Output

```
Enter two numbers: 2.4
1.12
Product = 2.69
```

In this program, the user is asked to enter two numbers which are stored in variables `a` and `b` respectively.

```c
printf("Enter two numbers: ");
scanf("%lf %lf", &a, &b);
```

Then, the product of `a` and `b` is evaluated and the result is stored in `product`.

```c
product = a * b;
```

Finally, `product` is displayed on the screen using `printf()`.

```c
printf("Product = %.2lf", product);
```

Notice that, the result is rounded off to the second decimal place using `%.2lf` conversion character.

C Program to Find ASCII Value of a Character

In this example, you will learn how to find the ASCII value of a character.

To understand this example, you should have the knowledge of the following C programming topics:

- C Data Types
- C Variables, Constants and Literals
- C Input Output (I/O)

In C programming, a character variable holds ASCII value (an integer number between 0 and 127) rather than that character itself. This integer value is the ASCII code of the character.

For example, the ASCII value of `'A'` is 65.

What this means is that, if you assign `'A'` to a character variable, 65 is stored in the variable rather than `'A'` itself.

Now, let's see how we can print the ASCII value of characters in C programming.

Program to Print ASCII Value

```c
#include <stdio.h>
int main() {
    char c;
    printf("Enter a character: ");
    scanf("%c", &c);

    // %d displays the integer value of a character
    // %c displays the actual character
    printf("ASCII value of %c = %d", c, c);

    return 0;
}
```

Output

```
Enter a character: G
ASCII value of G = 71
```

In this program, the user is asked to enter a character. The character is stored in variable `c`.

When `%d` format string is used, **71** (the ASCII value of `G`) is displayed.

When `%c` format string is used, `'G'` itself is displayed.

C Program to Compute Quotient and Remainder

In this example, you will learn to find the quotient and remainder when an integer is divided by another integer.

To understand this example, you should have the knowledge of the following C programming topics:

- C Data Types
- C Variables, Constants and Literals
- C Input Output (I/O)
- C Programming Operators

Program to Compute Quotient and Remainder

```
#include <stdio.h>
int main() {
    int dividend, divisor, quotient, remainder;
    printf("Enter dividend: ");
    scanf("%d", &dividend);
    printf("Enter divisor: ");
    scanf("%d", &divisor);

    // Computes quotient
    quotient = dividend / divisor;
    // Computes remainder
    remainder = dividend % divisor;

    printf("Quotient = %d\n", quotient);
    printf("Remainder = %d", remainder);
    return 0;
}
```

Output

```
Enter dividend: 25
Enter divisor: 4
Quotient = 6
Remainder = 1
```

In this program, the user is asked to enter two integers (dividend and divisor). They are stored in variables `dividend` and `divisor` respectively.

```
printf("Enter dividend: ");
scanf("%d", &dividend);
printf("Enter divisor: ");
scanf("%d", &divisor);
```

Then the quotient is evaluated using `/` (the division operator), and stored in `quotient`.

```
quotient = dividend / divisor;
```

Similarly, the remainder is evaluated using `%` (the modulo operator) and stored in `remainder`.

```
remainder = dividend % divisor;
```

Finally, the quotient and remainder are displayed using `printf()`.

```
printf("Quotient = %d\n", quotient);
printf("Remainder = %d", remainder);
```

C Program to Compute Quotient and Remainder

In this example, you will learn to find the quotient and remainder when an integer is divided by another integer.

To understand this example, you should have the knowledge of the following C programming topics:

- C Data Types
- C Variables, Constants and Literals
- C Input Output (I/O)
- C Programming Operators

Program to Compute Quotient and Remainder

```c
#include <stdio.h>
int main() {
    int dividend, divisor, quotient, remainder;
    printf("Enter dividend: ");
    scanf("%d", &dividend);
    printf("Enter divisor: ");
    scanf("%d", &divisor);

    // Computes quotient
    quotient = dividend / divisor;

    // Computes remainder
    remainder = dividend % divisor;

    printf("Quotient = %d\n", quotient);
    printf("Remainder = %d", remainder);
    return 0;
}
```

Output

```
Enter dividend: 25
Enter divisor: 4
Quotient = 6
Remainder = 1
```

In this program, the user is asked to enter two integers (dividend and divisor). They are stored in variables `dividend` and `divisor` respectively.

```
printf("Enter dividend: ");
scanf("%d", &dividend);
printf("Enter divisor: ");
scanf("%d", &divisor);
```

Then the quotient is evaluated using `/` (the division operator), and stored in `quotient`.

```
quotient = dividend / divisor;
```

Similarly, the remainder is evaluated using `%` (the modulo operator) and stored in `remainder`.

```
remainder = dividend % divisor;
```

Finally, the quotient and remainder are displayed using `printf()`.

```
printf("Quotient = %d\n", quotient);
printf("Remainder = %d", remainder);
```

C Program to Find the Size of int, float, double and char

In this example, you will learn to evaluate the size of each variable using sizeof operator.

To understand this example, you should have the knowledge of the following C programming topics:

- C Data Types
- C Variables, Constants and Literals
- C Input Output (I/O)

The `sizeof(variable)`operator computes the size of a variable. And, to print the result returned by `sizeof`, we use either `%lu` or `%zu` format specifier.

Program to Find the Size of Variables

```
#include<stdio.h>
int main() {
    int intType;
    float floatType;
    double doubleType;
    char charType;

    // sizeof evaluates the size of a variable
    printf("Size of int: %zu bytes\n", sizeof(intType));
    printf("Size of float: %zu bytes\n", sizeof(floatType));
    printf("Size of double: %zu bytes\n", sizeof(doubleType));
    printf("Size of char: %zu byte\n", sizeof(charType));

    return 0;
}
```

Output

```
Size of int: 4 bytes
Size of float: 4 bytes
Size of double: 8 bytes
Size of char: 1 byte
```

In this program, 4 variables `intType`, `floatType`, `doubleType` and `charType` are declared.

Then, the size of each variable is computed using the `sizeof` operator.

C Program to Demonstrate the Working of Keyword long

In this example, you will learn to demonstrate the working of the long keyword.

To understand this example, you should have the knowledge of the following C programming topics:

- C Data Types
- C Variables, Constants and Literals
- C Input Output (I/O)

Program Using the long keyword

```
#include <stdio.h>
int main() {
    int a;
    long b;   // equivalent to long int b;
    long long c;  // equivalent to long long int c;
    double e;
    long double f;

    printf("Size of int = %zu bytes \n", sizeof(a));
    printf("Size of long int = %zu bytes\n", sizeof(b));
    printf("Size of long long int = %zu bytes\n", sizeof(c));
    printf("Size of double = %zu bytes\n", sizeof(e));
    printf("Size of long double = %zu bytes\n", sizeof(f));

    return 0;
}
```

Output

```
Size of int = 4 bytes
Size of long int = 8 bytes
Size of long long int = 8 bytes
Size of double = 8 bytes
Size of long double = 16 bytes
```

In this program, the `sizeof` operator is used to find the size of `int`, `long`, `long long`, `double` and `long double` variables.

As you can see, the size of `long int` and `long double` variables are larger than `int` and `double` variables, respectively.

By the way, the `sizeof` operator returns `size_t` (unsigned integral type).

The `size_t` data type is used to represent the size of an object. The format specifier used for `size_t` is `%zu`.

Note: The `long` keyword cannot be used with `float` and `char` types.

C Program to Swap Two Numbers

In this example, you will learn to swap two numbers in C programming using two different techniques.

To understand this example, you should have the knowledge of the following C programming topics:

- C Data Types
- C Programming Operators
- C Input Output (I/O)

Swap Numbers Using Temporary Variable

```
#include<stdio.h>
int main() {
  double first, second, temp;
  printf("Enter first number: ");
  scanf("%lf", &first);
  printf("Enter second number: ");
  scanf("%lf", &second);

  // value of first is assigned to temp
  temp = first;
  // value of second is assigned to first
  first = second;

  // value of temp (initial value of first) is assigned to second
  second = temp;

  // %.2lf displays number up to 2 decimal points
  printf("\nAfter swapping, first number = %.2lf\n", first);
  printf("After swapping, second number = %.2lf", second);
  return 0;
}
```

Output

```
Enter first number: 1.20
Enter second number: 2.45

After swapping, first number = 2.45
After swapping, second number = 1.20
```

In the above program, the `temp` variable is assigned the value of the `first` variable.

Then, the value of the `first` variable is assigned to the `second` variable.

Finally, the `temp` (which holds the initial value of `first`) is assigned to `second`. This completes the swapping process.

Swap Numbers Without Using Temporary Variables

```
#include <stdio.h>
int main() {
  double a, b;
  printf("Enter a: ");
  scanf("%lf", &a);
  printf("Enter b: ");
  scanf("%lf", &b);

  // swapping

  // a = (initial_a - initial_b)
  a = a - b;

  // b = (initial_a - initial_b) + initial_b = initial_a
  b = a + b;

  // a = initial_a - (initial_a - initial_b) = initial_b
  a = b - a;

  // %.2lf displays numbers up to 2 decimal places
  printf("After swapping, a = %.2lf\n", a);
  printf("After swapping, b = %.2lf", b);

  return 0;
}
```

Output

```
Enter a: 10.25
Enter b: -12.5
After swapping, a = -12.50
After swapping, b = 10.25
```

C Program to Check Whether a Number is Even or Odd

In this example, you will learn to check whether a number entered by the user is even or odd.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement

An even number is an integer that is exactly divisible by 2. For example: 0, 8, -24

An odd number is an integer that is not exactly divisible by 2. For example: 1, 7, -11, 15

Program to Check Even or Odd

```
#include <stdio.h>
int main() {
    int num;
    printf("Enter an integer: ");
    scanf("%d", &num);

    // true if num is perfectly divisible by 2
    if(num % 2 == 0)
        printf("%d is even.", num);
    else
        printf("%d is odd.", num);

    return 0;
}
```

Output

```
Enter an integer: -7
-7 is odd.
```

In the program, the integer entered by the user is stored in the variable `num`. Then, whether `num` is perfectly divisible by `2` or not is checked using the modulus `%` operator.

If the number is perfectly divisible by `2`, test expression `number%2 == 0` evaluates to `1` (true). This means the number is even.

However, if the test expression evaluates to `0` (false), the number is odd.

Program to Check Odd or Even Using the Ternary Operator

```
#include <stdio.h>
int main() {
    int num;
    printf("Enter an integer: ");
    scanf("%d", &num);

    (num % 2 == 0) ? printf("%d is even.", num) : printf("%d is odd.", num);
    return 0;
}
```

Output

```
Enter an integer: 33
33 is odd.
```

In the above program, we have used the ternary operator `?:` instead of the `if...else` statement.

C Program to Check Whether a Character is a Vowel or Consonant

In this example, you will learn to check whether an alphabet entered by the user is a vowel or a consonant.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement
- C while and do...while Loop

The five letters `A`, `E`, `I`, `O` and `U` are called vowels. All other alphabets except these 5 vowels are called consonants.
This program assumes that the user will always enter an alphabet character.

Program to Check Vowel or consonant

```
#include <stdio.h>
int main() {
    char c;
    int lowercase_vowel, uppercase_vowel;
    printf("Enter an alphabet: ");
    scanf("%c", &c);

    // evaluates to 1 if variable c is a lowercase vowel
    lowercase_vowel = (c == 'a' || c == 'e' || c == 'i' || c == 'o' || c == 'u');

    // evaluates to 1 if variable c is a uppercase vowel
    uppercase_vowel = (c == 'A' || c == 'E' || c == 'I' || c == 'O' || c == 'U');

    // evaluates to 1 (true) if c is a vowel
    if (lowercase_vowel || uppercase_vowel)
        printf("%c is a vowel.", c);
    else
        printf("%c is a consonant.", c);
    return 0;
}
```

Output

```
Enter an alphabet: G
G is a consonant.
```

The character entered by the user is stored in variable `c`.

The `lowercase_vowel` variable evaluates to 1 (true) if `c` is a lowercase vowel and 0 (false) for any other characters.

Similarly, the `uppercase_vowel` variable evaluates to 1 (true) if `c` is an uppercase vowel and 0 (false) for any other character.

If either `lowercase_vowel` or `uppercase_vowel` variable is 1 (true), the entered character is a vowel. However, if both `lowercase_vowel` and `uppercase_vowel` variables are 0, the entered character is a consonant.

Note: This program assumes that the user will enter an alphabet. If the user enters a non-alphabetic character, it displays the character is a consonant.

To fix this, we can use the isalpha() function. The `islapha()` function checks whether a character is an alphabet or not.

```
#include <ctype.h>
#include <stdio.h>

int main() {
   char c;
   int lowercase_vowel, uppercase_vowel;
   printf("Enter an alphabet: ");
   scanf("%c", &c);
   // evaluates to 1 if variable c is a lowercase vowel
   lowercase_vowel = (c == 'a' || c == 'e' || c == 'i' || c == 'o' || c == 'u');

   // evaluates to 1 if variable c is a uppercase vowel
   uppercase_vowel = (c == 'A' || c == 'E' || c == 'I' || c == 'O' || c == 'U');

   // Show error message if c is not an alphabet
   if (!isalpha(c))
      printf("Error! Non-alphabetic character.");
   else if (lowercase_vowel || uppercase_vowel)
      printf("%c is a vowel.", c);
   else
      printf("%c is a consonant.", c);

   return 0;
}
```

Now, if the user enters a non-alphabetic character, you will see:

```
Enter an alphabet: 3
Error! Non-alphabetic character.
```

C Program to Find the Largest Number Among Three Numbers

In this example, you will learn to find the largest number among the three numbers entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement

Example 1: Using if Statement

```c
#include <stdio.h>

int main() {

  double n1, n2, n3;

  printf("Enter three different numbers: ");
  scanf("%lf %lf %lf", &n1, &n2, &n3);

  // if n1 is greater than both n2 and n3, n1 is the largest
  if (n1 >= n2 && n1 >= n3)
    printf("%.2f is the largest number.", n1);

  // if n2 is greater than both n1 and n3, n2 is the largest
  if (n2 >= n1 && n2 >= n3)
    printf("%.2f is the largest number.", n2);

  // if n3 is greater than both n1 and n2, n3 is the largest
  if (n3 >= n1 && n3 >= n2)
    printf("%.2f is the largest number.", n3);

  return 0;
}
```

Here, we have used 3 different `if` statements. The first one checks whether `n1` is the largest number.

The second and third `if` statements check if `n2` and `n3` are the largest, respectively.

The biggest drawback of this program is that all 3 `if` statements are executed, regardless of which number is the largest.

However, we want to execute only one `if` statement. We can do this by using an `if...else` ladder.

Example 2: Using if...else Ladder

```c
#include <stdio.h>

int main() {

  double n1, n2, n3;

  printf("Enter three numbers: ");
  scanf("%lf %lf %lf", &n1, &n2, &n3);

  // if n1 is greater than both n2 and n3, n1 is the largest
  if (n1 >= n2 && n1 >= n3)
    printf("%.2lf is the largest number.", n1);

  // if n2 is greater than both n1 and n3, n2 is the largest
  else if (n2 >= n1 && n2 >= n3)
    printf("%.2lf is the largest number.", n2);

  // if both above conditions are false, n3 is the largest
  else
    printf("%.2lf is the largest number.", n3);

  return 0;
}
```

In this program, only the `if` statement is executed when `n1` is the largest. Similarly, only the `else if` statement is executed when `n2` is the largest, and so on.

Example 3: Using Nested if...else

```c
#include <stdio.h>

int main() {

  double n1, n2, n3;

  printf("Enter three numbers: ");
  scanf("%lf %lf %lf", &n1, &n2, &n3);

  // outer if statement
  if (n1 >= n2) {

    // inner if...else
    if (n1 >= n3)
      printf("%.2lf is the largest number.", n1);
    else
      printf("%.2lf is the largest number.", n3);
  }

  // outer else statement
  else {

    // inner if...else
    if (n2 >= n3)
      printf("%.2lf is the largest number.", n2);
    else
      printf("%.2lf is the largest number.", n3);
  }

  return 0;
}
```

In this program, we have used nested `if...else` statements to find the largest number. Let's see how they work in greater detail.

1. Outer if Statement

First, notice the outer `if` statement and the inner if...else statement inside it:

```
// outer if statement
if (n1 >= n2) {
  // inner if...else
  if (n1 >= n3)
    printf("%.2lf is the largest number.", n1);
  else
    printf("%.2lf is the largest number.", n3);
}
```

Here, we are checking if `n1` is greater than or equal to `n2`. If it is, the program control goes to the inner `if...else` statement.

The inner `if` statement checks whether `n1` is also greater than or equal to `n3`.

If it is, then `n1` is either equal to both `n2` and `n3`, or it is now greater than both `n2` and `n3` i.e. `n1 >= n2 >= n3`. Hence, `n1` is the largest number.

Else, `n1` is greater than or equal to `n2` but it is less than `n3` i.e. `n3 > n1 >= n2`. Hence, `n3` is the largest number.

2. Outer else Statement

The outer `else` statement is executed when `n2 > n1`:

```
// outer else statement
else {
  // inner if...else
  if (n2 >= n3)
    printf("%.2lf is the largest number.", n2);
  else
    printf("%.2lf is the largest number.", n3);
}
```

The inner `if...else` of this part of the program uses the same logic as the one before. The only difference here is that we're checking if `n2` is greater than `n3`.

The output of all these programs above will be the same.

```
Enter three numbers: -4.5
3.9
5.6
5.60 is the largest number.
```

C Program to Find the Roots of a Quadratic Equation

In this example, you will learn to find the roots of a quadratic equation in C programming.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement

The standard form of a quadratic equation is:

```
ax² + bx + c = 0, where
a, b and c are real numbers and
a != 0
```

The term `b²; - 4ac` is known as the **discriminant** of a quadratic equation. It tells the nature of the roots.

- If the discriminant is greater than `0`, the roots are real and different.
- If the discriminant is equal to `0`, the roots are real and equal.
- If the discriminant is less than `0`, the roots are complex and different.

If the discriminant > 0,

$$\text{root1} = \frac{-b + \sqrt{(b^2 - 4ac)}}{2a}$$

$$\text{root2} = \frac{-b - \sqrt{(b^2 - 4ac)}}{2a}$$

If the discriminant = 0,

$$\text{root1} = \text{root2} = \frac{-b}{2a}$$

If the discriminant < 0,

$$\text{root1} = \frac{-b}{2a} + \frac{i\sqrt{-(b^2 - 4ac)}}{2a}$$

$$\text{root2} = \frac{-b}{2a} - \frac{i\sqrt{-(b^2 - 4ac)}}{2a}$$

Figure: Roots of a Quadratic Equation

Program to Find Roots of a Quadratic Equation

```
#include <math.h>
#include <stdio.h>
int main() {
    double a, b, c, discriminant, root1, root2, realPart, imagPart;
    printf("Enter coefficients a, b and c: ");
    scanf("%lf %lf %lf", &a, &b, &c);

    discriminant = b * b - 4 * a * c;

    // condition for real and different roots
    if (discriminant > 0) {
        root1 = (-b + sqrt(discriminant)) / (2 * a);
        root2 = (-b - sqrt(discriminant)) / (2 * a);
        printf("root1 = %.2lf and root2 = %.2lf", root1, root2);
    }
    // condition for real and equal roots
    else if (discriminant == 0) {
        root1 = root2 = -b / (2 * a);
        printf("root1 = root2 = %.2lf;", root1);
    }

    // if roots are not real
    else {
        realPart = -b / (2 * a);
        imagPart = sqrt(-discriminant) / (2 * a);
        printf("root1 = %.2lf+%.2lfi and root2 = %.2f-%.2fi", realPart, imagPart,
realPart, imagPart);
    }

    return 0;
}
```

Output

```
Enter coefficients a, b and c: 2.3
4
5.6
root1 = -0.87+1.30i and root2 = -0.87-1.30i
```

In this program, the `sqrt()` library function is used to find the square root of a number. To learn more, visit: sqrt() function.

C Program to Check Leap Year

In this example, you will learn to check whether the year entered by the user is a leap year or not.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement

A leap year is exactly divisible by 4 except for century years (years ending with 00). The century year is a leap year only if it is perfectly divisible by 400.

For example,

- 1999 is not a leap year
- 2000 is a leap year
- 2004 is a leap year

Program to Check Leap Year

```c
#include <stdio.h>
int main() {
   int year;
   printf("Enter a year: ");
   scanf("%d", &year);

   // leap year if perfectly divisible by 400
   if (year % 400 == 0) {
      printf("%d is a leap year.", year);
   }
   // not a leap year if divisible by 100
   // but not divisible by 400
   else if (year % 100 == 0) {
      printf("%d is not a leap year.", year);
   }
   // leap year if not divisible by 100
   // but divisible by 4
   else if (year % 4 == 0) {
      printf("%d is a leap year.", year);
   }
   // all other years are not leap years
   else {
      printf("%d is not a leap year.", year);
   }

   return 0;
}
```

Output 1

```
Enter a year: 1900
1900 is not a leap year.
```

Output 2

```
Enter a year: 2012
2012 is a leap year.
```

C Program to Check Whether a Number is Positive or Negative

In this example, you will learn to check whether a number (entered by the user) is negative or positive.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement

This program takes a number from the user and checks whether that number is either `positive` or `negative` or `zero`.

Check Positive or Negative Using Nested if...else

```
#include <stdio.h>

int main() {

    double num;
    printf("Enter a number: ");
    scanf("%lf", &num);
    if (num <= 0.0) {
        if (num == 0.0)
```

```c
            printf("You entered 0.");
        else
            printf("You entered a negative number.");
    }
    else
        printf("You entered a positive number.");

    return 0;
}
```

You can also solve this problem using nested if...else statement.

Check Positive or Negative Using if...else Ladder

```c
#include <stdio.h>

int main() {

    double num;
    printf("Enter a number: ");
    scanf("%lf", &num);

    if (num < 0.0)
        printf("You entered a negative number.");
    else if (num > 0.0)
        printf("You entered a positive number.");
    else
        printf("You entered 0.");

    return 0;
}
```

Output 1

```
Enter a number: 12.3
You entered a positive number.
```

Output 2

```
Enter a number: 0
You entered 0.
```

C Program to Check Whether a Character is an Alphabet or not

In this example, you will learn to check whether a character entered by the user is an alphabet or not.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement

In C programming, a character variable holds an ASCII value (an integer number between 0 and 127) rather than that character itself.

The ASCII value of the lowercase alphabet is from 97 to 122. And, the ASCII value of the uppercase alphabet is from 65 to 90.

If the ASCII value of the character entered by the user lies in the range of 97 to 122 or from 65 to 90, that number is an alphabet.

Program to Check Alphabet

```
#include <stdio.h>
int main() {
    char c;
    printf("Enter a character: ");
    scanf("%c", &c);

    if ((c >= 'a' && c <= 'z') || (c >= 'A' && c <= 'Z'))
        printf("%c is an alphabet.", c);
    else
        printf("%c is not an alphabet.", c);

    return 0;
}
```

Output

```
Enter a character: *
* is not an alphabet
```

In the program, `'a'` is used instead of `97` and `'z'` is used instead of `122`. Similarly, `'A'` is used instead of `65` and `'Z'` is used instead of `90`.

Note: It is recommended we use the isalpha() function to check whether a character is an alphabet or not.

```
if (isalpha(c))
    printf("%c is an alphabet.", c);
else
    printf("%c is not an alphabet.", c);
```

C Program to Calculate the Sum of Natural Numbers

In this example, you will learn to calculate the sum of natural numbers entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C for Loop
- C while and do...while Loop

The positive numbers **1, 2, 3...** are known as natural numbers. The sum of natural numbers up to 10 is:

```
sum = 1 + 2 + 3 + ... + 10
```

Sum of Natural Numbers Using for Loop

```c
#include <stdio.h>
int main() {
    int n, i, sum = 0;

    printf("Enter a positive integer: ");
    scanf("%d", &n);

    for (i = 1; i <= n; ++i) {
        sum += i;
    }

    printf("Sum = %d", sum);
    return 0;
}
```

The above program takes input from the user and stores it in the variable `n`. Then, `for` loop is used to calculate the sum up to `n`.

Sum of Natural Numbers Using while Loop

```c
#include <stdio.h>
int main() {
    int n, i, sum = 0;
    printf("Enter a positive integer: ");
    scanf("%d", &n);
    i = 1;

    while (i <= n) {
        sum += i;
        ++i;
    }

    printf("Sum = %d", sum);
    return 0;
}
```

Output

```
Enter a positive integer: 100
Sum = 5050
```

In both programs, the loop is iterated `n` number of times. And, in each iteration, the value of `i` is added to `sum` and `i` is incremented by `1`.

Though both programs are technically correct, it is better to use `for` loop in this case. It's because the number of iterations is known.

The above programs don't work properly if the user enters a negative integer. Here is a little modification to the above program where we keep taking input from the user until a positive integer is entered.

Read Input Until a Positive Integer is Entered

```
#include <stdio.h>
int main() {
    int n, i, sum = 0;

    do {
        printf("Enter a positive integer: ");
        scanf("%d", &n);
    } while (n <= 0);

    for (i = 1; i <= n; ++i) {
        sum += i;
    }

    printf("Sum = %d", sum);
    return 0;
}
```

Visit this page to learn how to find the sum of natural numbers using recursion.

C Program to Find Factorial of a Number

In this example, you will learn to calculate the factorial of a number entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C Data Types
- C Programming Operators
- C if...else Statement
- C for Loop

The factorial of a positive number `n` is given by:

```
factorial of n (n!) = 1 * 2 * 3 * 4....n
```

The factorial of a negative number doesn't exist. And, the factorial of 0 is 1.

Factorial of a Number

```
#include <stdio.h>
int main() {
    int n, i;
    unsigned long long fact = 1;
    printf("Enter an integer: ");
    scanf("%d", &n);

    // shows error if the user enters a negative integer
    if (n < 0)
        printf("Error! Factorial of a negative number doesn't exist.");
    else {
        for (i = 1; i <= n; ++i) {
            fact *= i;
        }
        printf("Factorial of %d = %llu", n, fact);
    }

    return 0;
}
```

Output

```
Enter an integer: 10
Factorial of 10 = 3628800
```

This program takes a positive integer from the user and computes the factorial using `for` loop.

Since the factorial of a number may be very large, the type of factorial variable is declared as `unsigned long long`.

If the user enters a negative number, the program displays a custom error message.

You can also find the factorial of a number using recursion.

C Program to Generate Multiplication Table

In this example, you will learn to generate the multiplication table of a number entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C for Loop

The program below takes an integer input from the user and generates the multiplication tables up to 10.

Multiplication Table Up to 10

```c
#include <stdio.h>
int main() {
  int n;
  printf("Enter an integer: ");
  scanf("%d", &n);

  for (int i = 1; i <= 10; ++i) {
    printf("%d * %d = %d \n", n, i, n * i);
  }
  return 0;
}
```

Output

```
Enter an integer: 9
9 * 1 = 9
9 * 2 = 18
9 * 3 = 27
9 * 4 = 36
9 * 5 = 45
9 * 6 = 54
9 * 7 = 63
9 * 8 = 72
9 * 9 = 81
9 * 10 = 90
```

Here, the user input is stored in the `int` variable `n`. Then, we use a `for` loop to print the multiplication table up to 10.

```c
for (i = 1; i <= 10; ++i) {
  printf("%d * %d = %d \n", n, i, n * i);
}
```

The loop runs from `i = 1` to `i = 10`. In each iteration of the loop, `n * i` is printed. Here's a little modification of the above program to generate the multiplication table up to a range (where `range` is also a positive integer entered by the user).

Multiplication Table Up to a range

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

  int n, i, range;
  printf("Enter an integer: ");
  scanf("%d", &n);

  // prompt user for positive range
  do {
    printf("Enter the range (positive integer): ");
    scanf("%d", &range);
  } while (range <= 0);

  for (i = 1; i <= range; ++i) {
    printf("%d * %d = %d \n", n, i, n * i);
  }

  return 0;
}
```

Output

```
Enter an integer: 12
Enter the range (positive integer): -8
Enter the range (positive integer): 8
12 * 1 = 12
12 * 2 = 24
12 * 3 = 36
12 * 4 = 48
12 * 5 = 60
12 * 6 = 72
12 * 7 = 84
12 * 8 = 96
```

Here, we have used a `do...while` loop to prompt the user for a positive range.

```
// prompt user for positive range
do {
  printf("Enter the range (positive integer): ");
  scanf("%d", &range);
} while (range <= 0);
```

If the value of `range` is negative, the loop iterates again to ask the user to enter a positive number. Once a positive range has been entered, we print the multiplication table.

C Program to Display Fibonacci Sequence

In this example, you will learn to display the Fibonacci sequence of first n numbers (entered by the user).

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C while and do...while Loop
- C for Loop
- C break and continue

The Fibonacci sequence is a sequence where the next term is the sum of the previous two terms. The first two terms of the Fibonacci sequence are 0 followed by 1.

```
The Fibonacci sequence: 0, 1, 1, 2, 3, 5, 8, 13, 21
```

Visit this page to learn about the Fibonacci sequence.

Fibonacci Series up to n terms

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

  int i, n;

  // initialize first and second terms
  int t1 = 0, t2 = 1;

  // initialize the next term (3rd term)
  int nextTerm = t1 + t2;

  // get no. of terms from user
  printf("Enter the number of terms: ");
  scanf("%d", &n);

  // print the first two terms t1 and t2
  printf("Fibonacci Series: %d, %d, ", t1, t2);

  // print 3rd to nth terms
  for (i = 3; i <= n; ++i) {
    printf("%d, ", nextTerm);
    t1 = t2;
    t2 = nextTerm;
    nextTerm = t1 + t2;
  }

  return 0;
}
```

Output

```
Enter the number of terms: 10
Fibonacci Series: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34,
```

Let us suppose `n = 10`. First, we have printed the first two terms of the Fibonacci sequence before using a `for` loop to print the next `n` terms.

Let us see how the `for` loop works:

i	t1	t2	nextTerm
3	0	1	1
4	1	1	2
5	1	2	3
6	2	3	5
7	3	5	8
8	5	8	13
9	8	13	21
10	13	21	34

Fibonacci Sequence Up to a Certain Number

```c
#include <stdio.h>
int main() {
  int t1 = 0, t2 = 1, nextTerm = 0, n;
  printf("Enter a positive number: ");
  scanf("%d", &n);

  // displays the first two terms which is always 0 and 1
  printf("Fibonacci Series: %d, %d, ", t1, t2);
  nextTerm = t1 + t2;

  while (nextTerm <= n) {
    printf("%d, ", nextTerm);
    t1 = t2;
    t2 = nextTerm;
    nextTerm = t1 + t2;
  }

  return 0;
}
```

Output

```
Enter a positive integer: 100
Fibonacci Series: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89,
```

In this program, we have used a `while` loop to print all the Fibonacci numbers up to `n`.

If `n` is not part of the Fibonacci sequence, we print the sequence up to the number that is closest to (and lesser than) `n`.

Suppose `n = 100`. First, we print the first two terms `t1 = 0` and `t2 = 1`.

Then the `while` loop prints the rest of the sequence using the `nextTerm` variable:

t1	t2	nextTerm	nextTerm <= n
0	1	1	`true`. Print `nextTerm`.
1	1	2	`true`. Print `nextTerm`.
1	2	3	`true`. Print `nextTerm`.
...	...	...	...
34	55	89	`true`. Print `nextTerm`.
55	89	144	`false`. Terminate Loop.

C Program to Find LCM of two Numbers

In this example, you will learn to calculate the LCM (Lowest Common Multiple) of two numbers entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement
- C while and do...while Loop

The LCM of two integers `n1` and `n2` is the smallest positive integer that is perfectly divisible by both `n1` and `n2` (without a remainder). For example, the LCM of **72** and **120** is **360**.

LCM using while and if

```c
#include <stdio.h>

int main() {

    int n1, n2, max;

    printf("Enter two positive integers: ");
    scanf("%d %d", &n1, &n2);

    // maximum number between n1 and n2 is stored in max
    max = (n1 > n2) ? n1 : n2;

    while (1) {
        if ((max % n1 == 0) && (max % n2 == 0)) {
            printf("The LCM of %d and %d is %d.", n1, n2, max);
            break;
        }
        ++max;
    }
    return 0;
}
```

Output

```
Enter two positive integers: 72
120
The LCM of 72 and 120 is 360.
```

In this program, the integers entered by the user are stored in variable `n1` and `n2` respectively.

The largest number among `n1` and `n2` is stored in `max`. The LCM of two numbers cannot be less than `max`.

The test expression of `while` loop is always **true**.

In each iteration, we check whether `max` is perfectly divisible by `n1` and `n2`.

```
if ((max % n1 == 0) && (max % n2 == 0)) {
    // code
}
```

If this test condition is not true, `max` is incremented by **1** and the iteration continues until the test expression of the `if` statement is true.

LCM Calculation Using GCD

We can also find the LCM of two numbers `num1` and `num2` using their GCD:

```
LCM = (num1 * num2) / GCD
```

Learn how to find the GCD of two numbers in C programming before finding the LCM with this method.

```
#include <stdio.h>

int main() {

    int n1, n2, i, gcd, lcm;

    printf("Enter two positive integers: ");
    scanf("%d %d", &n1, &n2);

    // loop to find the GCD
    for (i = 1; i <= n1 && i <= n2; ++i) {

        // check if i is a factor of both integers
        if (n1 % i == 0 && n2 % i == 0)
            gcd = i;
    }

    lcm = (n1 * n2) / gcd;

    printf("The LCM of two numbers %d and %d is %d.", n1, n2, lcm);
    return 0;
}
```

Output

```
Enter two positive integers: 72
120
The LCM of two numbers 72 and 120 is 360.
```

C Program to Display Characters from A to Z Using Loop

In this example, you will learn to print all the letters of the English alphabet.

To understand this example, you should have the knowledge of the following C programming topics:

- C if...else Statement
- C while and do...while Loop

Program to Print English Alphabets

```c
#include <stdio.h>
int main() {
    char c;
    for (c = 'A'; c <= 'Z'; ++c)
        printf("%c ", c);
    return 0;
}
```

Output

```
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
```

In this program, the `for` loop is used to display the English alphabet in uppercase.

Here's a little modification of the above program. The program displays the English alphabet in either uppercase or lowercase depending upon the input given by the user.

Print Lowercase/Uppercase alphabets

```c
#include <stdio.h>
int main() {
    char c;
    printf("Enter u to display uppercase alphabets.\n");
    printf("Enter l to display lowercase alphabets. \n");
    scanf("%c", &c);

    if (c == 'U' || c == 'u') {
        for (c = 'A'; c <= 'Z'; ++c)
            printf("%c ", c);
    } else if (c == 'L' || c == 'l') {
        for (c = 'a'; c <= 'z'; ++c)
            printf("%c ", c);
    } else {
        printf("Error! You entered an invalid character.");
    }
    return 0;
}
```

Output

```
Enter u to display uppercase alphabets.
Enter l to display lowercase alphabets. l
a b c d e f g h i j k l m n o p q r s t u v w x y z
```

C Program to Count Number of Digits in an Integer

In this example, you will learn to count the number of digits in an integer entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C while and do...while Loop

This program takes an integer from the user and calculates the number of digits. For example: If the user enters 2319, the output of the program will be 4.

Program to Count the Number of Digits

```c
#include <stdio.h>
int main() {
  long long n;
  int count = 0;
  printf("Enter an integer: ");
  scanf("%lld", &n);

  // iterate at least once, then until n becomes 0
  // remove last digit from n in each iteration
  // increase count by 1 in each iteration
  do {
    n /= 10;
    ++count;
  } while (n != 0);

  printf("Number of digits: %d", count);
}
```

Output

```
Enter an integer: 3452
Number of digits: 4
```

The integer entered by the user is stored in variable `n`. Then the `do...while` loop is iterated until the test expression `n! = 0` is evaluated to 0 (false).

- After the first iteration, the value of `n` will be 345 and the `count` is incremented to 1.
- After the second iteration, the value of `n` will be 34 and the `count` is incremented to 2.
- After the third iteration, the value of `n` will be 3 and the `count` is incremented to 3.
- After the fourth iteration, the value of `n` will be 0 and the `count` is incremented to 4.
- Then the test expression of the loop is evaluated to false and the loop terminates.

Note: We have used a `do...while` loop to ensure that we get the correct digit count when the user enters **0**.

C Program to Reverse a Number

In this example, you will learn to reverse the number entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C while and do...while Loop

Reverse an Integer

```
#include <stdio.h>

int main() {

  int n, reverse = 0, remainder;

  printf("Enter an integer: ");
  scanf("%d", &n);

  while (n != 0) {
    remainder = n % 10;
    reverse = reverse * 10 + remainder;
    n /= 10;
  }

  printf("Reversed number = %d", reverse);

  return 0;
}
```

Output

```
Enter an integer: 2345
Reversed number = 5432
```

This program takes integer input from the user. Then the `while` loop is used until `n != 0` is false (**0**).

In each iteration of the loop, the remainder when `n` is divided by **10** is calculated and the value of `n` is reduced by 10 times.
Inside the loop, the reversed number is computed using:

```
reverse = reverse * 10 + remainder;
```

Let us see how the `while` loop works when `n = 2345`.

n	n != 0	remainder	reverse
2345	true	5	0 * 10 + 5 = 5
234	true	4	5 * 10 + 4 = 54
23	true	3	54 * 10 + 3 = 543
2	true	2	543 * 10 + 2 = 5432
0	false	-	Loop terminates.

Finally, the `reverse` variable (which contains the reversed number) is printed on the screen.

C Program to Calculate the Power of a Number

In this example, you will learn to calculate the power of a number.
To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C while and do...while Loop

The program below takes two integers from the user (a base number and an exponent) and calculates the power.

For example: In the case of 2^3

- 2 is the base number
- 3 is the exponent
- And, the power is equal to `2*2*2`

Power of a Number Using the while Loop

```c
#include <stdio.h>
int main() {
    int base, exp;
    long double result = 1.0;
    printf("Enter a base number: ");
    scanf("%d", &base);
    printf("Enter an exponent: ");
    scanf("%d", &exp);

    while (exp != 0) {
        result *= base;
        --exp;
    }
    printf("Answer = %.0Lf", result);
    return 0;
}
```

Output

```
Enter a base number: 3
Enter an exponent: 4
Answer = 81
```

We can also use the `pow()` function to calculate the power of a number.

Power Using pow() Function

```c
#include <math.h>
#include <stdio.h>

int main() {
    double base, exp, result;
    printf("Enter a base number: ");
    scanf("%lf", &base);
    printf("Enter an exponent: ");
    scanf("%lf", &exp);

    // calculates the power
    result = pow(base, exp);

    printf("%.1lf^%.1lf = %.2lf", base, exp, result);
    return 0;
}
```

Output

```
Enter a base number: 2.3
Enter an exponent: 4.5
2.3^4.5 = 42.44
```

The programs above can only calculate the power of the base number if the exponent is positive. For negative exponents, use the following mathematical logic:

$\text{base}^{(-\text{exponent})} = 1 / (\text{base}^{\text{exponent}})$

For example,

$2^{-3} = 1 / (2^{3})$

C Program to Check Whether a Number is Palindrome or Not

In this example, you will learn to check whether the number entered by the user is a palindrome or not.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement
- C while and do...while Loop

An integer is a palindrome if the reverse of that number is equal to the original number.

Program to Check Palindrome

```
#include <stdio.h>
int main() {
  int n, reversed = 0, remainder, original;
    printf("Enter an integer: ");
    scanf("%d", &n);
    original = n;

    // reversed integer is stored in reversed variable
    while (n != 0) {
        remainder = n % 10;
        reversed = reversed * 10 + remainder;
        n /= 10;
    }

    // palindrome if orignal and reversed are equal
    if (original == reversed)
        printf("%d is a palindrome.", original);
    else
        printf("%d is not a palindrome.", original);
    return 0;
}
```

Output

```
Enter an integer: 1001
1001 is a palindrome.
```

Here, the user is asked to enter an integer. The number is stored in variable `n`. We then assigned this number to another variable `orignal`. Then, the reverse of n is found and stored in `reversed`.
If `original` is equal to `reversed`, the number entered by the user is a palindrome.

C Program to Check Whether a Number is Prime or Not

In this example, you will learn to check whether an integer entered by the user is a prime number or not.

To understand this example, you should have the knowledge of the following C programming topics:

- C if...else Statement
- C for Loop
- C break and continue

A prime number is a positive integer that is divisible only by **1** and itself. For example: 2, 3, 5, 7, 11, 13, 17.

Program to Check Prime Number

```c
#include <stdio.h>

int main() {

  int n, i, flag = 0;
  printf("Enter a positive integer: ");
  scanf("%d", &n);

  // 0 and 1 are not prime numbers
  // change flag to 1 for non-prime number
  if (n == 0 || n == 1)
    flag = 1;

  for (i = 2; i <= n / 2; ++i) {

    // if n is divisible by i, then n is not prime
    // change flag to 1 for non-prime number
    if (n % i == 0) {
      flag = 1;
      break;
    }
  }

  // flag is 0 for prime numbers
  if (flag == 0)
    printf("%d is a prime number.", n);
  else
    printf("%d is not a prime number.", n);

  return 0;
}
```

Output

```
Enter a positive integer: 29
29 is a prime number.
```

In the program, a `for` loop is iterated from `i = 2` to `i < n/2`.

In each iteration, whether `n` is perfectly divisible by `i` is checked using:

```
if (n % i == 0) {
  flag = 1;
  break;
}
```

If `n` is perfectly divisible by `i`, `n` is not a prime number. In this case, `flag` is set to **1**, and the loop is terminated using the `break` statement.

Notice that we have initialized `flag` as **0** during the start of our program.

So, if `n` is a prime number after the loop, `flag` will still be **0**. However, if `n` is a non-prime number, `flag` will be **1**.

Visit this page to learn how you can print all the prime numbers between two intervals.

C Program to Display Prime Numbers Between Two Intervals

In this example, you will learn to print all prime numbers between two numbers entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C if...else Statement
- C for Loop
- C break and continue

Display Prime Numbers Between Two Intervals

```c
#include <stdio.h>

int main() {
   int low, high, i, flag;
   printf("Enter two numbers(intervals): ");
   scanf("%d %d", &low, &high);
   printf("Prime numbers between %d and %d are: ", low, high);

   // iteration until low is not equal to high
   while (low < high) {
      flag = 0;

      // ignore numbers less than 2
      if (low <= 1) {
         ++low;
         continue;
      }

      // if low is a non-prime number, flag will be 1
      for (i = 2; i <= low / 2; ++i) {

         if (low % i == 0) {
            flag = 1;
            break;
         }
      }

      if (flag == 0)
         printf("%d ", low);

      // to check prime for the next number
      // increase low by 1
      ++low;
   }

   return 0;
}
```

Output

```
Enter two numbers(intervals): 20
50
Prime numbers between 20 and 50 are: 23 29 31 37 41 43 47
```

In this program, the `while` loop is iterated (`high-low-1`) times.

In each iteration, whether `low` is a prime number or not is checked, and the value of `low` is incremented by `1` until `low` is equal to `high`.

Visit this page to learn more about how to check whether a number is prime or not.

If the user enters the larger number first, the above program doesn't work as intended. You can solve this issue by swapping the numbers.

Display Prime Numbers when Larger Number is Entered first

```c
#include <stdio.h>

int main() {
   int low, high, i, flag, temp;
   printf("Enter two numbers(intervals): ");
   scanf("%d %d", &low, &high);

   // swap numbers if low is greather than high
   if (low > high) {
      temp = low;
      low = high;
      high = temp;
   }

   printf("Prime numbers between %d and %d are: ", low, high);
   while (low < high) {
      flag = 0;

      // ignore numbers less than 2
      if (low <= 1) {
         ++low;
         continue;
      }
      for (i = 2; i <= low / 2; ++i) {
         if (low % i == 0) {
            flag = 1;
            break;
         }
      }
      if (flag == 0)
         printf("%d ", low);
      ++low;
   }

   return 0;
}
```

Visit this page to learn how you can display all the prime numbers between the two intervals by creating a user-defined function

C Program to Check Armstrong Number

In this example, you will learn to check whether an integer entered by the user is an Armstrong number or not.

To understand this example, you should have the knowledge of the following C programming topics:

- C if...else Statement
- C while and do...while Loop

A positive integer is called an Armstrong number (of order `n`) if

```
abcd... = aⁿ + bⁿ + cⁿ + dⁿ +
```

In the case of an Armstrong number of 3 digits, the sum of cubes of each digit is equal to the number itself. For example, 153 is an Armstrong number because

```
153 = 1*1*1 + 5*5*5 + 3*3*3
```

Check Armstrong Number of three digits

```c
#include <stdio.h>
int main() {
    int num, originalNum, remainder, result = 0;
    printf("Enter a three-digit integer: ");
    scanf("%d", &num);
    originalNum = num;

    while (originalNum != 0) {
       // remainder contains the last digit
        remainder = originalNum % 10;

       result += remainder * remainder * remainder;

       // removing last digit from the orignal number
       originalNum /= 10;
    }

    if (result == num)
        printf("%d is an Armstrong number.", num);
    else
        printf("%d is not an Armstrong number.", num);

    return 0;
}
```

Output

```
Enter a three-digit integer: 371
371 is an Armstrong number.
```

Check Armstrong Number of n digits

```c
#include <math.h>
#include <stdio.h>

int main() {
   int num, originalNum, remainder, n = 0;
   float result = 0.0;

   printf("Enter an integer: ");
   scanf("%d", &num);

   originalNum = num;

   // store the number of digits of num in n
   for (originalNum = num; originalNum != 0; ++n) {
       originalNum /= 10;
   }

   for (originalNum = num; originalNum != 0; originalNum /= 10) {
       remainder = originalNum % 10;

      // store the sum of the power of individual digits in result
      result += pow(remainder, n);
   }

   // if num is equal to result, the number is an Armstrong number
   if ((int)result == num)
    printf("%d is an Armstrong number.", num);
   else
    printf("%d is not an Armstrong number.", num);
   return 0;
}
```

Output

```
Enter an integer: 1634
1634 is an Armstrong number.
```

In this program, the number of digits of an integer is calculated first and stored in `n`. And, the `pow()` function is used to compute the power of individual digits in each iteration of the second `for` loop.

C Program to Display Armstrong Number Between Two Intervals

In this example, you will learn to find all Armstrong numbers between two integers entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C if...else Statement
- C for Loop

A positive integer is called an Armstrong number (of order `n`) if

```
abcd... = aⁿ + bⁿ + cⁿ + dⁿ +
```

In the case of an Armstrong number of 3 digits, the sum of cubes of each digit is equal to the number itself. For example, 153 is an Armstrong number because

```
153 = 1*1*1 + 5*5*5 + 3*3*3
```

In this program, we will print all the Armstrong numbers **between** two integers. This means that the two integers will not be part of the range, but only those integers that are between them.
For example, suppose we want to print all Armstrong numbers between **153** and **371**. Both of these numbers are also Armstrong numbers. Then, this program prints all Armstrong numbers that are greater than **153** and less than **371** i.e. **153** and **371** won't be printed even though they are Armstrong numbers.

Tip: Before trying this program, learn how to check whether an integer is an Armstrong number or not.

Armstrong Numbers Between Two Integers

```c
#include <math.h>
#include <stdio.h>
int main() {
  int low, high, number, originalNumber, rem, count = 0;
  double result = 0.0;
  printf("Enter two numbers(intervals): ");
  scanf("%d %d", &low, &high);
  printf("Armstrong numbers between %d and %d are: ", low, high);

  // swap numbers if high < low
  if (high < low) {
    high += low;
    low = high - low;
    high -= low;
  }

  // iterate number from (low + 1) to (high - 1)
  // In each iteration, check if number is Armstrong
  for (number = low + 1; number < high; ++number) {
    originalNumber = number;

    // number of digits calculation
    while (originalNumber != 0) {
      originalNumber /= 10;
      ++count;
    }

    originalNumber = number;

    // result contains sum of nth power of individual digits
    while (originalNumber != 0) {
      rem = originalNumber % 10;
      result += pow(rem, count);
      originalNumber /= 10;
    }
    // check if number is equal to the sum of nth power of individual digits
    if ((int)result == number) {
      printf("%d ", number);
    }

    // resetting the values
    count = 0;
    result = 0;
  }

  return 0;
}
```
Run Code

Output

```
Enter two numbers(intervals): 200
2000
Armstrong numbers between 200 and 2000 are: 370 371 407 1634
```

In the program, the outer loop is iterated from **(low+ 1)** to **(high - 1)**. In each iteration, it's checked whether `number` is an Armstrong number or not.

Inside the outer loop, the number of digits of an integer is calculated first and stored in `count`. And, the sum of the power of individual digits is stored in the `result` variable.

If `number` is equal to `result`, the number is an Armstrong number.

Notes:

- You need to swap `low` and `high` if the user input for `high` is less than that of `low`. To learn more, check our example on swapping two numbers.
- You need to reset `count` and `result` to 0 in each iteration of the outer loop.

C Program to Display Factors of a Number

In this example, you will learn to find all the factors of an integer entered by the user.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Operators
- C if...else Statement
- C for Loop

This program takes a positive integer from the user and displays all the positive factors of that number.

Factors of a Positive Integer

```c
#include <stdio.h>
int main() {
    int num, i;
    printf("Enter a positive integer: ");
    scanf("%d", &num);
    printf("Factors of %d are: ", num);
    for (i = 1; i <= num; ++i) {
        if (num % i == 0) {
            printf("%d ", i);
        }
    }
    return 0;
}
```

Output

```
Enter a positive integer: 60
Factors of 60 are: 1 2 3 4 5 6 10 12 15 20 30 60
```

In the program, a positive integer entered by the user is stored in `num`.

The `for` loop is iterated until `i is false.`

In each iteration, whether `num` is exactly divisible by `i` is checked. It is the condition for `i` to be a factor of `num`.

```
if (num % i == 0) {
            printf("%d ", i);
}
```

Then the value of `i` is incremented by 1.

C Program to Make a Simple Calculator Using switch...case

In this example, you will learn to create a simple calculator in C programming using the switch statement.

To understand this example, you should have the knowledge of the following C programming topics:

- C switch Statement
- C break and continue

This program takes an arithmetic operator `+, -, *, /` and two operands from the user. Then, it performs the calculation on the two operands depending upon the operator entered by the user.

Simple Calculator using switch Statement

```c
#include <stdio.h>

int main() {

  char op;
  double first, second;
  printf("Enter an operator (+, -, *, /): ");
  scanf("%c", &op);
  printf("Enter two operands: ");
  scanf("%lf %lf", &first, &second);

  switch (op) {
    case '+':
      printf("%.1lf + %.1lf = %.1lf", first, second, first + second);
      break;
    case '-':
      printf("%.1lf - %.1lf = %.1lf", first, second, first - second);
      break;
    case '*':
      printf("%.1lf * %.1lf = %.1lf", first, second, first * second);
      break;
    case '/':
      printf("%.1lf / %.1lf = %.1lf", first, second, first / second);
      break;
    // operator doesn't match any case constant
    default:
      printf("Error! operator is not correct");
  }

  return 0;
}
```

Output

```
Enter an operator (+, -, *,): *
Enter two operands: 1.5
4.5
1.5 * 4.5 = 6.8
```

The `*` operator entered by the user is stored in `op`. And, the two operands, `1.5` and `4.5` are stored in `first` and `second` respectively.
Since the operator `*` matches `case '*':`, the control of the program jumps to

```
printf("%.1lf * %.1lf = %.1lf", first, second, first * second);
```

This statement calculates the product and displays it on the screen.

To make our output look cleaner, we have simply limited the output to one decimal place using the code `%.1lf`.
Finally, the `break;` statement ends the `switch` statement.

C Program to Display Prime Numbers Between Intervals Using Function

In this example, you will learn to print all prime numbers between two numbers (entered by the user).

To understand this example, you should have the knowledge of the following C programming topics:

- C for Loop
- C break and continue
- C Functions
- C User-defined functions

Make sure you visit these tutorials before looking at this example:

- Check Whether a Number is Prime or Not
- Swap Two Numbers

Prime Numbers Between Two Integers

```c
#include <stdio.h>
int checkPrimeNumber(int n);
int main() {

  int n1, n2, i, flag;

  printf("Enter two positive integers: ");
  scanf("%d %d", &n1, &n2);

  // swap n1 and n2 if n1 > n2
  if (n1 > n2) {
    n1 = n1 + n2;
    n2 = n1 - n2;
    n1 = n1 - n2;
  }

  printf("Prime numbers between %d and %d are: ", n1, n2);
  for (i = n1 + 1; i < n2; ++i) {

    // flag will be equal to 1 if i is prime
    flag = checkPrimeNumber(i);

    if (flag == 1) {
      printf("%d ", i);
    }
  }

  return 0;
}

// user-defined function to check prime number
int checkPrimeNumber(int n) {
  int j, flag = 1;

  for (j = 2; j <= n / 2; ++j) {

    if (n % j == 0) {
      flag = 0;
      break;
    }
  }

  return flag;
}
```

Output

```
Enter two positive integers: 12
30
Prime numbers between 12 and 30 are: 13 17 19 23 29
```

Explanation

1. In this program, we print all the prime numbers between `n1` and `n2`. If `n1` is greater than `n2`, we swap their values:

```
if (n1 > n2) {
  n1 = n1 + n2;
  n2 = n1 - n2;
  n1 = n1 - n2;
}
```

2. Then, we run a `for` loop from `i = n1 + 1` to `i = n2 - 1`.
In each iteration of the loop, we check if `i` is a prime number using the `checkPrimeNumber()` function.
If `i` is prime, we print it.

```
for (i = n1 + 1; i < n2; ++i) {
  flag = checkPrimeNumber(i);
  if (flag == 1)
    printf("%d ", i);
  }
}
```

3. The `checkPrimeNumber()` function contains the code to check whether a number is prime or not.

```c
int checkPrimeNumber(int n) {
  int j, flag = 1;
  for (j = 2; j <= n / 2; ++j) {
    if (n % j == 0) {
      flag = 0;
      break;
    }
  }
  return flag;
}
```

C Program to Check Prime or Armstrong Number Using User-defined Function

In this example, you will learn to check whether an integer is a prime number or an Armstrong or both by creating two separate functions.

To understand this example, you should have the knowledge of the following C programming topics:

- C for Loop
- C while and do...while Loop
- C break and continue
- C Functions
- Types of User-defined Functions in C Programming

Visit these pages to learn to check whether a number is

- a prime number or not
- an Armstrong number or not

Example: Check Prime and Armstrong

```
#include <math.h>
#include <stdio.h>

int checkPrimeNumber(int n);
int checkArmstrongNumber(int n);

int main() {
   int n, flag;
   printf("Enter a positive integer: ");
   scanf("%d", &n);

   // check prime number
   flag = checkPrimeNumber(n);
   if (flag == 1)
      printf("%d is a prime number.\n", n);
   else
      printf("%d is not a prime number.\n", n);

   // check Armstrong number
   flag = checkArmstrongNumber(n);
   if (flag == 1)
      printf("%d is an Armstrong number.", n);
   else
      printf("%d is not an Armstrong number.", n);
   return 0;
}

// function to check prime number
int checkPrimeNumber(int n) {
   int i, flag = 1, squareRoot;

   // computing the square root
   squareRoot = sqrt(n);
   for (i = 2; i <= squareRoot; ++i) {
      // condition for non-prime number
      if (n % i == 0) {
         flag = 0;
         break;
      }
   }
   return flag;
}

// function to check Armstrong number
int checkArmstrongNumber(int num) {
   int originalNum, remainder, n = 0, flag;
   double result = 0.0;

   // store the number of digits of num in n
   for (originalNum = num; originalNum != 0; ++n) {
      originalNum /= 10;
   }

   for (originalNum = num; originalNum != 0; originalNum /= 10) {
      remainder = originalNum % 10;

      // store the sum of the power of individual digits in result
      result += pow(remainder, n);
   }

   // condition for Armstrong number
   if (round(result) == num)
      flag = 1;
   else
      flag = 0;
   return flag;
}
```

Output

```
Enter a positive integer: 407
407 is not a prime number.
407 is an Armstrong number.
```

In this program, two user-defined functions `checkPrimeNumber()` and `checkArmstrongNumber()` are created. The `checkPrimeNumber()` function returns:

- `1` if the number entered by the user is a prime number.
- `0` if the number entered by the user is not a prime number.

Similarly, `checkArmstrongNumber()` function returns:

- `1` if the number entered by the user is an Armstrong number.
- `0` if the number entered by the user is not an Armstrong number.

Note: In `checkPrimeNumber()` and `checkArmstrongNumber()` functions, the `flag` variables are the return value of the functions.
In `main()`, the `flag` variable stores the values returned by `checkPrimeNumber()` and `checkArmstrongNumber()`.

C Program to Check Whether a Number can be Expressed as Sum of Two Prime Numbers

In this example, you will learn to check if an integer entered by the user can be expressed as the sum of two prime numbers of all possible combinations.

To understand this example, you should have the knowledge of the following C programming topics:

- C if...else Statement
- C for Loop
- C Functions
- C User-defined functions

This program takes a positive integer from the user and checks whether that number can be expressed as the sum of two prime numbers.

If the number can be expressed as the sum of two prime numbers, the output shows the combination of the prime numbers.

To perform this task, a user-defined function is created to check prime number.

Integer as a Sum of Two Prime Numbers

```c
#include <stdio.h>
int checkPrime(int n);
int main() {
  int n, i, flag = 0;
  printf("Enter a positive integer: ");
  scanf("%d", &n);

  for (i = 2; i <= n / 2; ++i) {
    // condition for i to be a prime number
    if (checkPrime(i) == 1) {
      // condition for n-i to be a prime number
      if (checkPrime(n - i) == 1) {
        printf("%d = %d + %d\n", n, i, n - i);
        flag = 1;
      }
    }
  }

  if (flag == 0)
    printf("%d cannot be expressed as the sum of two prime numbers.", n);

  return 0;
}

// function to check prime number
int checkPrime(int n) {
  int i, isPrime = 1;

  // 0 and 1 are not prime numbers
  if (n == 0 || n == 1) {
    isPrime = 0;
  }
  else {
    for(i = 2; i <= n/2; ++i) {
      if(n % i == 0) {
        isPrime = 0;
        break;
      }
    }
  }

  return isPrime;
}
```

Output

```
Enter a positive integer: 34
34 = 3 + 31
34 = 5 + 29
34 = 11 + 23
34 = 17 + 17
```

In this program, we use the `checkPrime()` function to check whether a number is prime or not.

In `main()`, we take a number from the user and store it in the variable `n`.

We also initialize the `int` variable `flag` to `0`. We use this variable to determine whether the input number can be expressed as the sum of two prime numbers.

We then iterate a loop from `i = 2` to `i = n/2`. In each iteration, we check whether `i` is a prime number or not.

If `i` is a prime, we check whether `n - i` is prime or not.

If `n - i` is also a prime, then we know that `n` can be expressed as the sum of two prime numbers `i` and `n - i`.

So, we print the result on the screen and change the value of `flag` to `1`.

Otherwise, `flag` remains `0`.

This process continues until the loop ends.

If `flag` is still `0`, then we know that `n` can't be expressed as the sum of two primes, and we print that message on the screen.

C Program to Find the Sum of Natural Numbers using Recursion

In this example, you will learn to find the sum of natural numbers using a recursive function.

To understand this example, you should have the knowledge of the following C programming topics:

- C User-defined functions
- C Recursion

The positive numbers 1, 2, 3... are known as natural numbers. The program below takes a positive integer from the user and calculates the sum up to the given number.

Visit this page to find the sum of natural numbers using a loop.

Sum of Natural Numbers Using Recursion

```
#include <stdio.h>

int addNumbers(int n);

int main() {

  int num;
  printf("Enter a positive integer: ");
  scanf("%d", &num);
  printf("Sum = %d", addNumbers(num));
  return 0;
}

int addNumbers(int n) {
  if (n != 0)
    return n + addNumbers(n - 1);
  else
    return n;
}
```

Output

```
Enter a positive integer: 20
Sum = 210
```

Suppose the user entered **20**.

Initially, `addNumbers()` is called from `main()` with **20** passed as an argument.

The number **20** is added to the result of `addNumbers(19)`.

In the next function call from `addNumbers()` to `addNumbers()`, **19** is passed which is added to the result of `addNumbers(18)`. This process continues until `n` is equal to **0**.

When `n` is equal to **0**, there is no recursive call. This returns the sum of integers ultimately to the `main()` function.

C Program to Find Factorial of a Number Using Recursion

In this example, you will learn to find the factorial of a non-negative integer entered by the user using recursion.

To understand this example, you should have the knowledge of the following C programming topics:

- C Functions
- C User-defined functions
- C Recursion

The factorial of a positive number `n` is given by:

```
factorial of n (n!) = 1 * 2 * 3 * 4 *...  * n
```

The factorial of a negative number doesn't exist. And the factorial of `0` is `1`.
You will learn to find the factorial of a number using recursion in this example.
Visit this page to learn how you can find the factorial of a number using a loop.

Factorial of a Number Using Recursion

```c
#include<stdio.h>
long int multiplyNumbers(int n);
int main() {
    int n;
    printf("Enter a positive integer: ");
    scanf("%d",&n);
    printf("Factorial of %d = %ld", n, multiplyNumbers(n));
    return 0;
}

long int multiplyNumbers(int n) {
    if (n>=1)
        return n*multiplyNumbers(n-1);
    else
        return 1;
}
```

Output

```
Enter a positive integer: 6
Factorial of 6 = 720
```

Suppose the user entered 6.

Initially, `multiplyNumbers()` is called from `main()` with 6 passed as an argument.
Then, 5 is passed to `multiplyNumbers()` from the same function (recursive call). In each recursive call, the value of argument `n` is decreased by 1.
When the value of `n` is less than 1, there is no recursive call and the factorial is returned ultimately to the `main()` function.

C Program to Find G.C.D Using Recursion

In this example, you will learn to find the GCD (Greatest Common Divisor) of two positive integers entered by the user using recursion.

To understand this example, you should have the knowledge of the following C programming topics:

- C Functions
- C User-defined functions
- C Recursion

This program takes two positive integers as input from the user and calculates GCD using recursion.

Visit this page to learn how you can calculate the GCD using loops.

GCD of Two Numbers using Recursion

```c
#include <stdio.h>
int hcf(int n1, int n2);
int main() {
    int n1, n2;
    printf("Enter two positive integers: ");
    scanf("%d %d", &n1, &n2);
    printf("G.C.D of %d and %d is %d.", n1, n2, hcf(n1, n2));
    return 0;
}

int hcf(int n1, int n2) {
    if (n2 != 0)
        return hcf(n2, n1 % n2);
    else
        return n1;
}
```

Output

```
Enter two positive integers: 366
60
G.C.D of 366 and 60 is 6.
```

In this program, recursive calls are made until the value of `n2` is equal to 0.

C Program to Convert Binary Number to Decimal and vice-versa

In this example, you will learn to convert binary numbers to decimal and vice-versa manually by creating a user-defined function.

To understand this example, you should have the knowledge of the following C programming topics:

- C Functions
- C User-defined functions

Example 1: C Program to Convert Binary Number to Decimal

```
// convert binary to decimal

#include <stdio.h>
#include <math.h>

// function prototype
int convert(long long);

int main() {
  long long n;
  printf("Enter a binary number: ");
  scanf("%lld", &n);
  printf("%lld in binary = %d in decimal", n, convert(n));
  return 0;
}
```

```
// function definition
int convert(long long n) {
  int dec = 0, i = 0, rem;

  while (n!=0) {
    rem = n % 10;
    n /= 10;
    dec += rem * pow(2, i);
    ++i;
  }

  return dec;
}
```

Output

```
Enter a binary number: 1101
1101 in binary = 13 in decimal
```

In the program, we have included the header file `math.h` to perform mathematical operations in the program.

We ask the user to enter a binary number and pass it to the `convert()` function to convert it decimal.

Suppose `n = 1101`. Let's see how the `while` loop in the `convert()` function works.

n != 0	rem = n % 10	n /= 10	i	dec += rem * pow(2, i)
1101 != 0	1101 % 10 = 1	1101 / 10 = 110	0	0 + 1 * pow (2, 0) = 1
110 != 0	110 % 10 = 0	110 / 10 = 11	1	1 + 0 * pow (2, 1) = 1
10 != 0	11 % 10 = 1	11 /10 = 1	2	1 + 1 * pow (2, 2) = 5
1 != 0	1 % 10 = 1	1 / 10 = 0	3	5 + 1 * pow (2, 3) = 13

So, `1101` in binary is `13` in decimal.

Now, let's see how we can change the decimal number into a binary number.

Example 2: C Program to convert decimal number to binary

```c
// convert decimal to binary

#include <stdio.h>
#include <math.h>

long long convert(int);

int main() {
  int n, bin;
  printf("Enter a decimal number: ");
  scanf("%d", &n);
  bin = convert(n);
  printf("%d in decimal =  %lld in binary", n, bin);
  return 0;
}

long long convert(int n) {
  long long bin = 0;
  int rem, i = 1;

  while (n!=0) {
    rem = n % 2;
    n /= 2;
    bin += rem * i;
    i *= 10;
  }

  return bin;
}
```

Output

```
Enter a decimal number: 13
13 in decimal = 1101 in binary
```

Suppose `n = 13`. Let's see how the `while` loop in the `convert()` function works.

n != 0	rem = n % 2	n /= 2	i	bin += rem * i	i * = 10
13 != 0	13 % 2 = 1	13 / 2 = 6	1	0 + 1 * 1 = 1	1 * 10 = 10
6 != 0	6 % 2 = 0	6 / 2 = 3	10	1 + 0 * 10 = 1	10 * 10 = 100
3 != 0	3 % 2 = 1	3 / 2 = 1	100	1 + 1 * 100 = 101	100 * 10 = 1000
1 != 0	1 % 2 = 1	1 / 2 = 0	1000	101 + 1 * 1000 = 1101	1000 * 10 = 10000
0 != 0	-	-		-	Loop terminates

Thus, `13` in decimal is `1101` in binary.

C Program to Convert Octal Number to Decimal and vice-versa

In this example, you will learn to convert octal numbers to decimal and vice-versa manually by creating a user-defined function.

To understand this example, you should have the knowledge of the following C programming topics:

- C Functions
- C User-defined functions

Example 1: Program to Convert Decimal to Octal

```c
#include <stdio.h>
#include <math.h>

// function prototype
int convertDecimalToOctal(int decimalNumber);

int main() {

    int decimalNumber;

    printf("Enter a decimal number: ");
    scanf("%d", &decimalNumber);

    printf("%d in decimal = %d in octal", decimalNumber,
convertDecimalToOctal(decimalNumber));

    return 0;
}

// function to convert decimalNumber to octal
int convertDecimalToOctal(int decimalNumber) {
    int octalNumber = 0, i = 1;

    while (decimalNumber != 0) {
        octalNumber += (decimalNumber % 8) * i;
        decimalNumber /= 8;
        i *= 10;
    }

    return octalNumber;
}
```

Output

```
Enter a decimal number: 78
78 in decimal = 116 in octal
```

Example 2: Program to Convert Octal to Decimal

```c
#include <stdio.h>
#include <math.h>

// function prototype
long long convertOctalToDecimal(int octalNumber);

int main() {

    int octalNumber;

    printf("Enter an octal number: ");
    scanf("%d", &octalNumber);

    printf("%d in octal = %lld in decimal", octalNumber,
convertOctalToDecimal(octalNumber));

    return 0;
}

// function to convert octalNumber to decimal
long long convertOctalToDecimal(int octalNumber) {
    int decimalNumber = 0, i = 0;

    while(octalNumber != 0) {
        decimalNumber += (octalNumber%10) * pow(8,i);
        ++i;
        octalNumber/=10;
    }

    i = 1;

    return decimalNumber;
}
```

Output

```
Enter an octal number: 116
116 in octal = 78 in decimal
```

Note: This program doesn't work if we input non-octal numbers i.e., numbers that contain 8 or 9. For example, 187, 96, 985, etc., are not octal numbers.

Example 3: Check for Octal Number and Convert it to Decimal

```c
#include <stdio.h>
#include <math.h>

// function prototypes
int checkOctal(int);
long long convertOctalToDecimal(int);

int main() {

    int octalNumber;
    int condition;

    // repeat loop as long as user
    // gives a non-octal number
    do {
        printf("Enter an octal number: ");
        scanf("%d", &octalNumber);

        // check if number is octal
        condition = checkOctal(octalNumber);

        if (!condition) {
            printf("%d is not an octal number!\n", octalNumber);
        }
    } while (condition == 0);

    printf("%d in octal = %lld in decimal", octalNumber,
convertOctalToDecimal(octalNumber));

    return 0;
}

// function to check octal number
int checkOctal(int octalNumber) {
    int remainder;
    // check each digit of input number
    while(octalNumber != 0) {
        remainder = octalNumber % 10;

        // return 0 if a digit is 8 or 9
        if (remainder >= 8) {
            return 0;
        }

        octalNumber/= 10;
    }

    // return 1 if number is octal
    return 1;
}

// function to convert octalNumber to decimal
long long convertOctalToDecimal(int octalNumber) {
    int decimalNumber = 0, i = 0;

    while(octalNumber != 0) {
        decimalNumber += (octalNumber%10) * pow(8,i);
        ++i;
        octalNumber/=10;
    }

    i = 1;

    return decimalNumber;
}
```

```
Enter an octal number: 96
96 is not an octal number!
Enter an octal number: 25
25 in octal = 21 in decimal
```

C Program to Convert Binary Number to Octal and vice-versa

In this example, you will learn to convert binary numbers to octal and vice versa manually by creating a user-defined function.

To understand this example, you should have the knowledge of the following C programming topics:

- C Functions
- C User-defined functions

Program to Convert Binary to Octal

In this program, we will first convert a binary number to decimal. Then, the decimal number is converted to octal.

```
#include <math.h>
#include <stdio.h>
int convert(long long bin);
int main() {
    long long bin;
    printf("Enter a binary number: ");
    scanf("%lld", &bin);
    printf("%lld in binary = %d in octal", bin, convert(bin));
    return 0;
}

int convert(long long bin) {
    int oct = 0, dec = 0, i = 0;

    // converting binary to decimal
    while (bin != 0) {
        dec += (bin % 10) * pow(2, i);
        ++i;
        bin /= 10;
    }
    i = 1;

    // converting to decimal to octal
    while (dec != 0) {
        oct += (dec % 8) * i;
        dec /= 8;
        i *= 10;
    }
    return oct;
}
```

Output

```
Enter a binary number: 101001
101001 in binary = 51 in octal
```

Program to Convert Octal to Binary

In this program, an octal number is converted to decimal at first. Then, the decimal number is converted to binary number.

```
#include <math.h>
#include <stdio.h>
long long convert(int oct);
int main() {
    int oct;
    printf("Enter an octal number: ");
    scanf("%d", &oct);
    printf("%d in octal = %lld in binary", oct, convert(oct));
    return 0;
}

long long convert(int oct) {
    int dec = 0, i = 0;
    long long bin = 0;

    // converting octal to decimal
    while (oct != 0) {
        dec += (oct % 10) * pow(8, i);
        ++i;
        oct /= 10;
    }
    i = 1;

   // converting decimal to binary
    while (dec != 0) {
        bin += (dec % 2) * i;
        dec /= 2;
        i *= 10;
    }
    return bin;
}
```

Output

```
Enter an octal number: 67
67 in octal = 110111 in binary
```

C Program to Reverse a Sentence Using Recursion

In this example, you will learn to take a sentence from the user and reverse it using recursion.

To understand this example, you should have the knowledge of the following C programming topics:

- C Functions
- C User-defined functions
- C Recursion

Reverse a sentence using recursion

```
#include <stdio.h>
void reverseSentence();
int main() {
    printf("Enter a sentence: ");
    reverseSentence();
    return 0;
}
```

```
void reverseSentence() {
    char c;
    scanf("%c", &c);
    if (c != '\n') {
        reverseSentence();
        printf("%c", c);
    }
}
```

Output

```
Enter a sentence: margorp emosewa
awesome program
```

This program first prints `Enter a sentence:` . Then, the `reverseSentence()` function is called.

This function stores the first letter entered by the user in `c`. If the variable is any character other than `\n` (newline), `reverseSentence()` is called again.

This process goes on until the user hits enter.

When the user hits enter, the `reverseSentence()` function starts printing characters from last.

C program to calculate the power using recursion

In this example, you will learn to calculate the power of a number using recursion.

To understand this example, you should have the knowledge of the following C programming topics:

- C Functions
- C User-defined functions
- C Recursion

Program to calculate power using recursion.

```c
#include <stdio.h>
int power(int n1, int n2);
int main() {
    int base, a, result;
    printf("Enter base number: ");
    scanf("%d", &base);
    printf("Enter power number(positive integer): ");
    scanf("%d", &a);
    result = power(base, a);
    printf("%d^%d = %d", base, a, result);
    return 0;
}

int power(int base, int a) {
    if (a != 0)
        return (base * power(base, a - 1));
    else
        return 1;
}
```

Output

```
Enter base number: 3
Enter power number(positive integer): 4
3^4 = 81
```

You can also compute the power of a number using a loop.

If you need to calculate the power of a number raised to a decimal value, you can use the pow() library function.

C Program to Calculate Average Using Arrays

In this example, you will learn to calculate the average of n number of elements entered by the user using arrays.

To understand this example, you should have the knowledge of the following C programming topics:

- C while and do...while Loop
- C for Loop
- C Arrays

Store Numbers and Calculate Average Using Arrays

```c
#include <stdio.h>
int main() {
    int n, i;
    float num[100], sum = 0.0, avg;

    printf("Enter the numbers of elements: ");
    scanf("%d", &n);

    while (n > 100 || n < 1) {
        printf("Error! number should in range of (1 to 100).\n");
        printf("Enter the number again: ");
        scanf("%d", &n);
    }

    for (i = 0; i < n; ++i) {
        printf("%d. Enter number: ", i + 1);
        scanf("%f", &num[i]);
        sum += num[i];
    }
    avg = sum / n;
    printf("Average = %.2f", avg);
    return 0;
}
```

Output

```
Enter the numbers of elements: 6
1. Enter number: 45.3
2. Enter number: 67.5
3. Enter number: -45.6
4. Enter number: 20.34
5. Enter number: 33
6. Enter number: 45.6
Average = 27.69
```

Here, the user is first asked to enter the number of elements. This number is assigned to `n`.

If the user entered integer is greater less than 1 or greater than 100, the user is asked to enter the number again. This is done using a `while` loop.

Then, we have iterated a `for` loop from `i = 0` to `i . In each iteration of the loop, the user is asked to enter numbers to calculate the average. These numbers are stored in the num[] array.`

```
scanf("%f", &num[i]);
```

And, the sum of each entered element is computed.

```
sum += num[i];
```

Once the `for` loop is completed, the average is calculated and printed on the screen.

C Program to Find Largest Element in an Array

In this example, you will learn to display the largest element entered by the user in an array.

To understand this example, you should have the knowledge of the following C programming topics:

- C for Loop
- C Arrays

Example: Largest Element in an array

```c
#include <stdio.h>
int main() {
  int n;
  double arr[100];
  printf("Enter the number of elements (1 to 100): ");
  scanf("%d", &n);

  for (int i = 0; i < n; ++i) {
    printf("Enter number%d: ", i + 1);
    scanf("%lf", &arr[i]);
  }

  // storing the largest number to arr[0]
  for (int i = 1; i < n; ++i) {
    if (arr[0] < arr[i]) {
      arr[0] = arr[i];
    }
  }

  printf("Largest element = %.2lf", arr[0]);

  return 0;
}
```

Output

```
Enter the number of elements (1 to 100): 5
Enter number1: 34.5
Enter number2: 2.4
Enter number3: -35.5
Enter number4: 38.7
Enter number5: 24.5
Largest element = 38.70
```

This program takes `n` number of elements from the user and stores it in the `arr` array.
To find the largest element,

- the first two elements of array are checked and the largest of these two elements are placed in `arr[0]`
- the first and third elements are checked and largest of these two elements is placed in `arr[0]`.
- this process continues until the first and last elements are checked
- the largest number will be stored in the `arr[0]` position

```
// storing the largest number at arr[0]
for (int i = 1; i < n; ++i) {
  if (arr[0] < arr[i]) {
    arr[0] = arr[i];
  }
}
```

C Program to Calculate Standard Deviation

In this example, you will learn to calculate the standard deviation of 10 numbers stored in an array.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- Pass arrays to a function in C

This program calculates the standard deviation of an individual series using arrays. Visit this page to learn about Standard Deviation.
To calculate the standard deviation, we have created a function named `calculateSD()`.

Example: Population Standard Deviation

```c
// SD of a population
#include <math.h>
#include <stdio.h>
float calculateSD(float data[]);
int main() {
    int i;
    float data[10];
    printf("Enter 10 elements: ");
    for (i = 0; i < 10; ++i)
        scanf("%f", &data[i]);
    printf("\nStandard Deviation = %.6f", calculateSD(data));
    return 0;
}

float calculateSD(float data[]) {
    float sum = 0.0, mean, SD = 0.0;
    int i;
    for (i = 0; i < 10; ++i) {
        sum += data[i];
    }
    mean = sum / 10;
    for (i = 0; i < 10; ++i) {
        SD += pow(data[i] - mean, 2);
    }
    return sqrt(SD / 10);
}
```

Output

```
Enter 10 elements: 1
2
3
4
5
6
7
8
9
10

Standard Deviation = 2.872281
```

Here, the array containing 10 elements is passed to the `calculateSD()` function. The function calculates the standard deviation using **mean** and returns it.

Note: The program calculates the standard deviation of a **population**. If you need to find the standard deviation of a **sample**, the formula is slightly different.

C Program to Add Two Matrices Using Multi-dimensional Arrays

In this example, you will learn to add two matrices in C programming using two-dimensional arrays.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Multidimensional Arrays

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

  printf("\nEnter elements of 1st 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]);
    }

  printf("Enter elements of 2nd matrix:\n");
  for (i = 0; i < r; ++i)
    for (j = 0; j < c; ++j) {
      printf("Enter element b%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];
    }

  // printing the result
  printf("\nSum of two matrices: \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;
}
```

Output

```
Enter the number of rows (between 1 and 100): 2
Enter the 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 b11: -4
Enter element b12: 5
Enter element b13: 3
Enter element b21: 5
Enter element b22: 6
Enter element b23: 3

Sum of two matrices:
-2   8   7

10   8   6
```

In this program, the user is asked to enter the number of rows `r` and columns `c`. Then, the user is asked to enter the elements of the two matrices (of order `rxc`).
We then added corresponding elements of two matrices and saved it in another matrix (two-dimensional array). Finally, the result is printed on the screen.

C Program to Multiply Two Matrices Using Multi-dimensional Arrays

In this example, you will learn to multiply two matrices and display it using user-defined functions.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Multidimensional Arrays

This program asks the user to enter the size (rows and columns) of two matrices.

To multiply two matrices, **the number of columns of the first matrix should be equal to the number of rows of the second matrix**.
The program below asks for the number of rows and columns of two matrices until the above condition is satisfied.

Then, the multiplication of two matrices is performed, and the result is displayed on the screen.

To perform this, we have created three functions:

- `getMatrixElements()` - to take matrix elements input from the user.
- `multiplyMatrices()` - to multiply two matrices.
- `display()` - to display the resultant matrix after multiplication.

Multiply Matrices by Passing it to a Function.

```c
#include <stdio.h>

// function to get matrix elements entered by the user
void getMatrixElements(int matrix[][10], int row, int column) {

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

   for (int i = 0; i < row; ++i) {
      for (int j = 0; j < column; ++j) {
         printf("Enter a%d%d: ", i + 1, j + 1);
         scanf("%d", &matrix[i][j]);
      }
   }
}

// function to multiply two matrices
void multiplyMatrices(int first[][10],
                      int second[][10],
                      int result[][10],
                      int r1, int c1, int r2, int c2) {

   // Initializing elements of matrix mult to 0.
   for (int i = 0; i < r1; ++i) {
      for (int j = 0; j < c2; ++j) {
         result[i][j] = 0;
      }
   }

   // Multiplying first and second matrices and storing it in result
   for (int i = 0; i < r1; ++i) {
      for (int j = 0; j < c2; ++j) {
         for (int k = 0; k < c1; ++k) {
            result[i][j] += first[i][k] * second[k][j];
         }
      }
   }
}

// function to display the matrix
void display(int result[][10], int row, int column) {

   printf("\nOutput Matrix:\n");
   for (int i = 0; i < row; ++i) {
      for (int j = 0; j < column; ++j) {
         printf("%d  ", result[i][j]);
         if (j == column - 1)
            printf("\n");
      }
   }
}

int main() {
   int first[10][10], second[10][10], result[10][10], r1, c1, r2, c2;
   printf("Enter rows and column for the first matrix: ");
   scanf("%d %d", &r1, &c1);
   printf("Enter rows and column for the second matrix: ");
   scanf("%d %d", &r2, &c2);

   // Taking input until
   // 1st matrix columns is not equal to 2nd matrix row
   while (c1 != r2) {
      printf("Error! Enter rows and columns again.\n");
      printf("Enter rows and columns for the first matrix: ");
      scanf("%d%d", &r1, &c1);
      printf("Enter rows and columns for the second matrix: ");
      scanf("%d%d", &r2, &c2);
   }

   // get elements of the first matrix
   getMatrixElements(first, r1, c1);

   // get elements of the second matrix
   getMatrixElements(second, r2, c2);

   // multiply two matrices.
   multiplyMatrices(first, second, result, r1, c1, r2, c2);
```

```
    // display the result
    display(result, r1, c2);
    return 0;
}
```

Output

```
Enter rows and column for the first matrix: 2
3
Enter rows and column for the second matrix: 3
2

Enter elements:
Enter a11: 2
Enter a12: -3
Enter a13: 4
Enter a21: 53
Enter a22: 3
Enter a23: 5

Enter elements:
Enter a11: 3
Enter a12: 3
Enter a21: 5
Enter a22: 0
Enter a31: -3
Enter a32: 4

Output Matrix:
-21  22
159  179
```

C Program to Find Transpose of a Matrix

In this example, you will learn to find the transpose of a matrix in C programming.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Multidimensional Arrays

The transpose of a matrix is a new matrix that is obtained by exchanging the rows and columns.

In this program, the user is asked to enter the number of rows `r` and columns `c`. Their values should be less than 10 in this program.
Then, the user is asked to enter the elements of the matrix (of order `r*c`).
The program below then computes the transpose of the matrix and prints it on the screen.

Program to Find the Transpose of a Matrix

```
#include <stdio.h>
int main() {
  int a[10][10], transpose[10][10], r, c;
  printf("Enter rows and columns: ");
  scanf("%d %d", &r, &c);

  // asssigning elements to the matrix
  printf("\nEnter matrix elements:\n");
  for (int i = 0; i < r; ++i)
  for (int j = 0; j < c; ++j) {
    printf("Enter element a%d%d: ", i + 1, j + 1);
    scanf("%d", &a[i][j]);
  }

  // printing the matrix a[][]
  printf("\nEntered matrix: \n");
  for (int i = 0; i < r; ++i)
  for (int j = 0; j < c; ++j) {
    printf("%d  ", a[i][j]);
    if (j == c - 1)
    printf("\n");
  }

  // computing the transpose
  for (int i = 0; i < r; ++i)
  for (int j = 0; j < c; ++j) {
    transpose[j][i] = a[i][j];
  }

  // printing the transpose
  printf("\nTranspose of the matrix:\n");
  for (int i = 0; i < c; ++i)
  for (int j = 0; j < r; ++j) {
    printf("%d  ", transpose[i][j]);
    if (j == r - 1)
    printf("\n");
  }
  return 0;
}
```

Output

```
Enter rows and columns: 2
3

Enter matrix elements:
Enter element a11: 1
Enter element a12: 4
Enter element a13: 0
Enter element a21: -5
Enter element a22: 2
Enter element a23: 7



Entered matrix:
1  4  0
-5  2  7
```

```
Transpose of the matrix:
1  -5
4  2
0  7
```

C Program to Multiply two Matrices by Passing Matrix to a Function

In this example, you'll learn to multiply two matrices and display it using user defined function.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Multidimensional Arrays
- Pass arrays to a function in C

This program asks the user to enter the size of the matrix (rows and column).

Then, it asks the user to enter the elements of those matrices and finally adds and displays the result.

To perform this task three functions are made:

1. To takes matrix elements from user `enterData()`
2. To multiply two matrix `multiplyMatrices()`
3. To display the resultant matrix after multiplication `display()`

Example: Multiply Matrices by Passing it to a Function

```
#include <stdio.h>

void enterData(int firstMatrix[][10], int secondMatrix[][10], int rowFirst, int 
columnFirst, int rowSecond, int columnSecond);
void multiplyMatrices(int firstMatrix[][10], int secondMatrix[][10], int 
multResult[][10], int rowFirst, int columnFirst, int rowSecond, int columnSecond);
void display(int mult[][10], int rowFirst, int columnSecond);

int main()
{
	int firstMatrix[10][10], secondMatrix[10][10], mult[10][10], rowFirst, 
columnFirst, rowSecond, columnSecond, i, j, k;

	printf("Enter rows and column for first matrix: ");
	scanf("%d %d", &rowFirst, &columnFirst);

	printf("Enter rows and column for second matrix: ");
	scanf("%d %d", &rowSecond, &columnSecond);

	// If colum of first matrix in not equal to row of second matrix, asking user to 
enter the size of matrix again.
	while (columnFirst != rowSecond)
	{
		printf("Error! column of first matrix not equal to row of second.\n");
		printf("Enter rows and column for first matrix: ");
		scanf("%d%d", &rowFirst, &columnFirst);
		printf("Enter rows and column for second matrix: ");
		scanf("%d%d", &rowSecond, &columnSecond);
	}

	// Function to take matrices data
        enterData(firstMatrix, secondMatrix, rowFirst, columnFirst, rowSecond, 
columnSecond);

        // Function to multiply two matrices.
        multiplyMatrices(firstMatrix, secondMatrix, mult, rowFirst, columnFirst, 
rowSecond, columnSecond);

        // Function to display resultant matrix after multiplication.
        display(mult, rowFirst, columnSecond);
```

```c
        return 0;
}

void enterData(int firstMatrix[][10], int secondMatrix[][10], int rowFirst, int 
columnFirst, int rowSecond, int columnSecond)
{
        int i, j;
        printf("\nEnter elements of matrix 1:\n");
        for(i = 0; i < rowFirst; ++i)
        {
                for(j = 0; j < columnFirst; ++j)
                {
                        printf("Enter elements a%d%d: ", i + 1, j + 1);
                        scanf("%d", &firstMatrix[i][j]);
                }
        }

        printf("\nEnter elements of matrix 2:\n");
        for(i = 0; i < rowSecond; ++i)
        {
                for(j = 0; j < columnSecond; ++j)
                {
                        printf("Enter elements b%d%d: ", i + 1, j + 1);
                        scanf("%d", &secondMatrix[i][j]);
                }
        }
}

void multiplyMatrices(int firstMatrix[][10], int secondMatrix[][10], int mult[][10], int 
rowFirst, int columnFirst, int rowSecond, int columnSecond)
{
        int i, j, k;

        // Initializing elements of matrix mult to 0.
        for(i = 0; i < rowFirst; ++i)
        {
                for(j = 0; j < columnSecond; ++j)
                {
                        mult[i][j] = 0;
                }
        }
        // Multiplying matrix firstMatrix and secondMatrix and storing in array mult.
        for(i = 0; i < rowFirst; ++i)
        {
                for(j = 0; j < columnSecond; ++j)
                {
                        for(k=0; k<columnFirst; ++k)
                        {
                                mult[i][j] += firstMatrix[i][k] * secondMatrix[k][j];
                        }
                }
        }
}

void display(int mult[][10], int rowFirst, int columnSecond)
{
        int i, j;
        printf("\nOutput Matrix:\n");
        for(i = 0; i < rowFirst; ++i)
        {
                for(j = 0; j < columnSecond; ++j)
                {
                        printf("%d  ", mult[i][j]);
                        if(j == columnSecond - 1)
                                printf("\n\n");
                }
        }
}
```

Output

```
Enter rows and column for first matrix: 3
2
Enter rows and column for second matrix: 3
2
Error! column of first matrix not equal to row of second.

Enter rows and column for first matrix: 2
3
Enter rows and column for second matrix: 3
2

Enter elements of matrix 1:
Enter elements a11: 3
Enter elements a12: -2
Enter elements a13: 5
Enter elements a21: 3
Enter elements a22: 0
Enter elements a23: 4

Enter elements of matrix 2:
Enter elements b11: 2
Enter elements b12: 3
Enter elements b21: -9
Enter elements b22: 0
Enter elements b31: 0
Enter elements b32: 4

Output Matrix:
24  29

6  25
```

C Program to Access Array Elements Using Pointer

In this example, you will learn to access elements of an array using a pointer.

To understand this example, you should have the knowledge of the following C programming topics:

- C for Loop
- C Arrays
- C Pointers
- Relationship Between Arrays and Pointers

Access Array Elements Using Pointers

```c
#include <stdio.h>
int main() {
    int data[5];

    printf("Enter elements: ");
    for (int i = 0; i < 5; ++i)
        scanf("%d", data + i);

    printf("You entered: \n");
    for (int i = 0; i < 5; ++i)
        printf("%d\n", *(data + i));
    return 0;
}
```

Output

```
Enter elements: 1
2
3
5
4
You entered:
1
2
3
5
4
```

In this program, the elements are stored in the integer array `data[]`.
Then, the elements of the array are accessed using the pointer notation. By the way,

- `data[0]` is equivalent to `*data` and `&data[0]` is equivalent to `data`
- `data[1]` is equivalent to `*(data + 1)` and `&data[1]` is equivalent to `data + 1`
- `data[2]` is equivalent to `*(data + 2)` and `&data[2]` is equivalent to `data + 2`
- `...`
- `data[i]` is equivalent to `*(data + i)` and `&data[i]` is equivalent to `data + i`

C Program Swap Numbers in Cyclic Order Using Call by Reference

In this example, the three numbers entered by the user are swapped in cyclic order using call by reference.

To understand this example, you should have the knowledge of the following C programming topics:

- C Pointers
- C Pass Addresses and Pointers

Program to Swap Elements Using Call by Reference

```c
#include <stdio.h>
void cyclicSwap(int *a, int *b, int *c);
int main() {
    int a, b, c;

    printf("Enter a, b and c respectively: ");
    scanf("%d %d %d", &a, &b, &c);

    printf("Value before swapping:\n");
    printf("a = %d \nb = %d \nc = %d\n", a, b, c);

    cyclicSwap(&a, &b, &c);

    printf("Value after swapping:\n");
    printf("a = %d \nb = %d \nc = %d", a, b, c);

    return 0;
}

void cyclicSwap(int *n1, int *n2, int *n3) {
    int temp;
    // swapping in cyclic order
    temp = *n2;
    *n2 = *n1;
    *n1 = *n3;
    *n3 = temp;
}
```

Output

```
Enter a, b and c respectively: 1
2
3
Value before swapping:
a = 1
b = 2
c = 3
Value after swapping:
a = 3
b = 1
c = 2
```

Here, the three numbers entered by the user are stored in variables `a`, `b` and `c` respectively. The addresses of these numbers are passed to the `cyclicSwap()` function.

```
cyclicSwap(&a, &b, &c);
```

In the function definition of `cyclicSwap()`, we have assigned these addresses to pointers.

```
cyclicSwap(int *n1, int *n2, int *n3) {
    ...
}
```

When `n1`, `n2` and `n3` inside `cyclicSwap()` are changed, the values of `a`, `b` and `c` inside `main()` are also changed.

Note: The `cyclicSwap()` function is not returning anything.

C Program to Find Largest Number Using Dynamic Memory Allocation

In this example, you will learn to find the largest number entered by the user in a dynamically allocated memory.

To understand this example, you should have the knowledge of the following C programming topics:

- C Pointers
- C Dynamic Memory Allocation
- C for Loop

Example: Find the Largest Element

```c
#include <stdio.h>
#include <stdlib.h>

int main() {

  int n;
  double *data;
  printf("Enter the total number of elements: ");
  scanf("%d", &n);

  // Allocating memory for n elements
  data = (double *)calloc(n, sizeof(double));
  if (data == NULL) {
    printf("Error!!! memory not allocated.");
    exit(0);
  }

  // Storing numbers entered by the user.
  for (int i = 0; i < n; ++i) {
    printf("Enter number%d: ", i + 1);
    scanf("%lf", data + i);
  }
  // Finding the largest number
  for (int i = 1; i < n; ++i) {
    if (*data < *(data + i)) {
      *data = *(data + i);
    }
  }
  printf("Largest number = %.2lf", *data);

  free(data);

  return 0;
}
```

Output

```
Enter the total number of elements: 5
Enter number1: 3.4
Enter number2: 2.4
Enter number3: -5
Enter number4: 24.2
Enter number5: 6.7
Largest number = 24.20
```

Explanation

In the program, we have asked the user to enter the total number of elements which is stored in the variable `n`. Then, we have allocated memory for `n` number of `double` values.

```
// Allocating memory for n double values
data = (double *)calloc(n, sizeof(double));
```

Then, we used a `for` loop to take `n` number of data from the user.

```
// Storing elements
for (int i = 0; i < n; ++i) {
  printf("Enter Number%d: ", i + 1);
  scanf("%lf", data + i);
}
```

Finally, we used another `for` loop to compute the largest number.

```
// Computing the largest number
for (int i = 1; i < n; ++i) {
  if (*data < *(data + i))
    *data = *(data + i);
  }
}
```

Note: Instead of `calloc()`, it's also possible to solve this problem using the malloc() function.

C Program to Find the Frequency of Characters in a String

In this example, you will learn to find the frequency of a character in a string.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Programming Strings

Find the Frequency of a Character

```
#include <stdio.h>
int main() {
    char str[1000], ch;
    int count = 0;

    printf("Enter a string: ");
    fgets(str, sizeof(str), stdin);

    printf("Enter a character to find its frequency: ");
    scanf("%c", &ch);

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

    printf("Frequency of %c = %d", ch, count);
    return 0;
}
```

Output

```
Enter a string: This website is awesome.
Enter a character to find its frequency: e
Frequency of e = 4
```

In this program, the string entered by the user is stored in `str`.

Then, the user is asked to enter the character whose frequency is to be found. This is stored in variable `ch`.

Then, a `for` loop is used to iterate over characters of the string. In each iteration, if the character in the string is equal to the `ch`, `count` is increased by 1.

Finally, the frequency stored in the `count` variable is printed.

Note: This program is case-sensitive i.e. it treats uppercase and lowercase versions of the same alphabet as different characters.

C Program to Count the Number of Vowels, Consonants and so on

In this example, the number of vowels, consonants, digits, and white-spaces in a string entered by the user is counted.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Programming Strings

Program to count vowels, consonants, etc.

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

  char line[150];
  int vowels, consonant, digit, space;

  // initialize all variables to 0
  vowels = consonant = digit = space = 0;

  // get full line of string input
  printf("Enter a line of string: ");
  fgets(line, sizeof(line), stdin);

  // loop through each character of the string
  for (int i = 0; line[i] != '\0'; ++i) {

    // convert character to lowercase
    line[i] = tolower(line[i]);

    // check if the character is a vowel
    if (line[i] == 'a' || line[i] == 'e' || line[i] == 'i' ||
        line[i] == 'o' || line[i] == 'u') {

      // increment value of vowels by 1
      ++vowels;
    }

    // if it is not a vowel and if it is an alphabet, it is a consonant
    else if ((line[i] >= 'a' && line[i] <= 'z')) {
      ++consonant;
    }

    // check if the character is a digit
    else if (line[i] >= '0' && line[i] <= '9') {
      ++digit;
    }

    // check if the character is an empty space
    else if (line[i] == ' ') {
      ++space;
    }
  }

  printf("Vowels: %d", vowels);
  printf("\nConsonants: %d", consonant);
  printf("\nDigits: %d", digit);
  printf("\nWhite spaces: %d", space);

  return 0;
}
```

Output

```
Enter a line of string: C++ 20 is the latest version of C++ yet.
Vowels: 9
Consonants: 16
Digits: 2
White spaces: 8
```

Here, the string entered by the user is stored in the `line` variable.

Initially, the variables `vowel`, `consonant`, `digit`, and `space` are initialized to **0**.

Then, a `for` loop is used to iterate over the characters of the string. In each iteration, we:

- convert the character to lowercase using the `tolower()` function
- check whether the character is a vowel, a consonant, a digit, or an empty space. Suppose the character is a consonant. Then, the `consonant` variable is increased by **1**.

When the loop ends, the number of vowels, consonants, digits, and white spaces are stored in variables `vowel`, `consonant`, `digit`, and `space` respectively.

Note: We have used the tolower() function to simplify our program. To use this function, we need to import the ctype.h header file.

C Program to Remove all Characters in a String Except Alphabets

In this example, you will learn to remove all the characters from a string entered by the user except the alphabets.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Programming Strings
- C for Loop
- C while and do...while Loop

Remove Characters in String Except Alphabets

```
#include <stdio.h>
int main() {
   char line[150];

   printf("Enter a string: ");
   fgets(line, sizeof(line), stdin); // take input


   for (int i = 0, j; line[i] != '\0'; ++i) {

      // enter the loop if the character is not an alphabet
      // and not the null character
      while (!(line[i] >= 'a' && line[i] <= 'z') && !(line[i] >= 'A' && line[i] <= 'Z')
&& !(line[i] == '\0')) {
         for (j = i; line[j] != '\0'; ++j) {

            // if jth element of line is not an alphabet,
            // assign the value of (j+1)th element to the jth element
            line[j] = line[j + 1];
         }
         line[j] = '\0';
      }
   }
   printf("Output String: ");
   puts(line);
   return 0;
}
```

Output

```
Enter a string: p2'r-o@gram84iz./
Output String: programiz
```

This program takes a string input from the user and stores in the `line` variable. Then, a `for` loop is used to iterate over characters of the string.

If the character in a string is not an alphabet, it is removed from the string and the position of the remaining characters are shifted to the left by 1 position.

C Program to Find the Length of a String

In this example, you will learn to find the length of a string manually without using the strlen() function.

To understand this example, you should have the knowledge of the following C programming topics:

- C Programming Strings
- String Manipulations In C Programming Using Library Functions
- C for Loop

As you know, the best way to find the length of a string is by using the `strlen()` function. However, in this example, we will find the length of a string manually.

Calculate Length of String without Using strlen() Function

```c
#include <stdio.h>
int main() {
    char s[] = "Programming is fun";
    int i;

    for (i = 0; s[i] != '\0'; ++i);

    printf("Length of the string: %d", i);
    return 0;
}
```

Output

```
Length of the string: 18
```

Here, using a `for` loop, we have iterated over characters of the string from `i = 0` to until `'\0'` (null character) is encountered. In each iteration, the value of `i` is increased by 1.

When the loop ends, the length of the string will be stored in the `i` variable.

Note: Here, the array `s[]` has 19 elements. The last element `s[18]` is the null character `'\0'`. But our loop does not count this character as it terminates upon encountering it.

C Program to Concatenate Two Strings

In this example, you will learn to concatenate two strings manually without using the strcat() function.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Programming Strings
- C for Loop

As you know, the best way to concatenate two strings in C programming is by using the strcat() function. However, in this example, we will concatenate two strings manually.

Concatenate Two Strings Without Using strcat()

```
#include <stdio.h>
int main() {
  char s1[100] = "programming ", s2[] = "is awesome";
  int length, j;

  // store length of s1 in the length variable
  length = 0;
  while (s1[length] != '\0') {
    ++length;
  }

  // concatenate s2 to s1
  for (j = 0; s2[j] != '\0'; ++j, ++length) {
    s1[length] = s2[j];
  }

  // terminating the s1 string
  s1[length] = '\0';
  printf("After concatenation: ");
  puts(s1);

  return 0;
}
```

Output

```
After concatenation: programming is awesome
```

Here, two strings `s1` and `s2` and concatenated and the result is stored in `s1`. It's important to note that the length of `s1` should be sufficient to hold the string after concatenation. If not, you may get unexpected output.

C Program to Copy String Without Using strcpy()

In this example, you will learn to copy strings without using the strcpy() function.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C Programming Strings
- C for Loop

As you know, the best way to copy a string is by using the `strcpy()` function. However, in this example, we will copy a string manually without using the `strcpy()` function.

Copy String Without Using strcpy()

```c
#include <stdio.h>
int main() {
    char s1[100], s2[100], i;
    printf("Enter string s1: ");
    fgets(s1, sizeof(s1), stdin);

    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: Hey fellow programmer.
String s2: Hey fellow programmer.
```

The above program copies the content of string `s1` to string `s2` manually.

C Program to Sort Elements in Lexicographical Order (Dictionary Order)

In this example, you will learn to sort 5 strings entered by the user in the lexicographical order (dictionary order).

To understand this example, you should have the knowledge of the following C programming topics:

- C Multidimensional Arrays
- C Programming Strings
- String Manipulations In C Programming Using Library Functions

Sort strings in the dictionary order

```c
#include <stdio.h>
#include <string.h>

int main() {
   char str[5][50], temp[50];
   printf("Enter 5 words: ");

   // Getting strings input
   for (int i = 0; i < 5; ++i) {
      fgets(str[i], sizeof(str[i]), stdin);
   }

   // storing strings in the lexicographical order
   for (int i = 0; i < 5; ++i) {
      for (int j = i + 1; j < 5; ++j) {

         // swapping strings if they are not in the lexicographical order
         if (strcmp(str[i], str[j]) > 0) {
            strcpy(temp, str[i]);
            strcpy(str[i], str[j]);
            strcpy(str[j], temp);
         }
      }
   }

   printf("\nIn the lexicographical order: \n");
   for (int i = 0; i < 5; ++i) {
      fputs(str[i], stdout);
   }
   return 0;
}
```

Output

```
Enter 5 words: R programming
JavaScript
Java
C programming
C++ programming

In the lexicographical order:
C programming
C++ programming
Java
JavaScript
R programming
```

To solve this program, a two-dimensional string named `str` is created. The string can hold a maximum of `5` strings and each string can have a maximum of `50` characters (including the `null` character).
In the program, we have used two library functions:

- strcmp() - to compare strings
- strcpy() - to copy strings

These functions are used to compare strings and sort them in the correct order.

C Program to Store Information of a Student Using Structure

In this example, you will learn to store the information of a student in a structure and display them on the screen.

To understand this example, you should have the knowledge of the following C programming topics:

- C struct

Store Information and Display it Using Structure

```c
#include <stdio.h>
struct student {
    char name[50];
    int roll;
    float marks;
} s;

int main() {
    printf("Enter information:\n");
    printf("Enter name: ");
    fgets(s.name, sizeof(s.name), stdin);

    printf("Enter roll number: ");
    scanf("%d", &s.roll);
    printf("Enter marks: ");
    scanf("%f", &s.marks);

    printf("Displaying Information:\n");
    printf("Name: ");
    printf("%s", s.name);
    printf("Roll number: %d\n", s.roll);
    printf("Marks: %.1f\n", s.marks);

    return 0;
}
```

Output

```
Enter information:
Enter name: Jack
Enter roll number: 23
Enter marks: 34.5
Displaying Information:
Name: Jack
Roll number: 23
Marks: 34.5
```

In this program, a structure `student` is created. The structure has three members: `name` (string), `roll` (integer) and `marks` (float).

Then, a structure variable `s` is created to store information and display it on the screen.

C Program to Add Two Distances (in inch-feet system) using Structures

In this example, you will learn to take two distances (in the inch-feet system), add them and display the result on the screen.

To understand this example, you should have the knowledge of the following C programming topics:

- C struct

If you do not know, 12 inches is 1 foot.

Program to add two distances in the inch-feet system

```
#include <stdio.h>

struct Distance {
   int feet;
   float inch;
} d1, d2, result;

int main() {
   // take first distance input
   printf("Enter 1st distance\n");
   printf("Enter feet: ");
   scanf("%d", &d1.feet);
   printf("Enter inch: ");
   scanf("%f", &d1.inch);

   // take second distance input
   printf("\nEnter 2nd distance\n");
   printf("Enter feet: ");
   scanf("%d", &d2.feet);
```

```c
   printf("Enter inch: ");
   scanf("%f", &d2.inch);

   // adding distances
   result.feet = d1.feet + d2.feet;
   result.inch = d1.inch + d2.inch;

   // convert inches to feet if greater than 12
   while (result.inch >= 12.0) {
      result.inch = result.inch - 12.0;
      ++result.feet;
   }
   printf("\nSum of distances = %d\'-%.1f\"", result.feet, result.inch);
   return 0;
}
```

Output

```
Enter 1st distance
Enter feet: 23
Enter inch: 8.6

Enter 2nd distance
Enter feet: 34
Enter inch: 2.4

Sum of distances = 57'-11.0"
```

In this program, a structure `Distance` is defined. The structure has two members:

- **feet** - an integer
- **inch** - a float

Two variables `d1` and `d2` of type `struct Distance` are created. These variables store distances in the feet and inches.

Then, the sum of these two distances are computed and stored in the `result` variable. Finally, `result` is printed on the screen.

C Program to Add Two Complex Numbers by Passing Structure to a Function

In this example, you will learn to take two complex numbers as structures and add them by creating a user-defined function.

To understand this example, you should have the knowledge of the following C programming topics:

- C struct
- C Structure and Function

Add Two Complex Numbers

```c
#include <stdio.h>
typedef struct complex {
    float real;
    float imag;
} complex;

complex add(complex n1, complex n2);

int main() {
    complex n1, n2, result;

    printf("For 1st complex number \n");
    printf("Enter the real and imaginary parts: ");
    scanf("%f %f", &n1.real, &n1.imag);
    printf("\nFor 2nd complex number \n");
    printf("Enter the real and imaginary parts: ");
    scanf("%f %f", &n2.real, &n2.imag);

    result = add(n1, n2);

    printf("Sum = %.1f + %.1fi", result.real, result.imag);
    return 0;
}
```

```
complex add(complex n1, complex n2) {
    complex temp;
    temp.real = n1.real + n2.real;
    temp.imag = n1.imag + n2.imag;
    return (temp);
}
```

Output

```
For 1st complex number
Enter the real and imaginary parts: 2.1
-2.3

For 2nd complex number
Enter the real and imaginary parts: 5.6
23.2
Sum = 7.7 + 20.9i
```

In this program, a structure named`complex` is declared. It has two members: `real` and `imag`. We then created two variables `n1` and `n2` from this structure.

These two structure variables are passed to the `add()` function. The function computes the sum and returns the structure containing the sum.

Finally, the sum of complex numbers is printed from the `main()` function.

C Program to Calculate Difference Between Two Time Periods

In this example, you will learn to calculate the difference between two time periods using a user-defined function.

To understand this example, you should have the knowledge of the following C programming topics:

- C User-defined functions
- C struct
- C Structure and Function
- C structs and Pointers

Calculate Difference Between Two Time Periods

```
#include <stdio.h>
struct TIME {
   int seconds;
   int minutes;
   int hours;
};

void differenceBetweenTimePeriod(struct TIME t1,
                                 struct TIME t2,
                                 struct TIME *diff);

int main() {
   struct TIME startTime, stopTime, diff;

   printf("Enter the start time. \n");
   printf("Enter hours, minutes and seconds: ");
   scanf("%d %d %d", &startTime.hours,
         &startTime.minutes,
         &startTime.seconds);

   printf("Enter the stop time. \n");
   printf("Enter hours, minutes and seconds: ");
   scanf("%d %d %d", &stopTime.hours,
         &stopTime.minutes,
         &stopTime.seconds);

   // Difference between start and stop time
   differenceBetweenTimePeriod(startTime, stopTime, &diff);
   printf("\nTime Difference: %d:%d:%d - ", startTime.hours,
          startTime.minutes,
          startTime.seconds);
   printf("%d:%d:%d ", stopTime.hours,
          stopTime.minutes,
          stopTime.seconds);
   printf("= %d:%d:%d\n", diff.hours,
          diff.minutes,
          diff.seconds);
   return 0;
}

// Computes difference between time periods
void differenceBetweenTimePeriod(struct TIME start,
                                 struct TIME stop,
                                 struct TIME *diff) {
   while (stop.seconds > start.seconds) {
      --start.minutes;
      start.seconds += 60;
   }
   diff->seconds = start.seconds - stop.seconds;
   while (stop.minutes > start.minutes) {
      --start.hours;
      start.minutes += 60;
   }
   diff->minutes = start.minutes - stop.minutes;
   diff->hours = start.hours - stop.hours;
}
```

Output

```
Enter the start time.
Enter hours, minutes and seconds: 13
34
55
Enter the stop time.
Enter hours, minutes and seconds: 8
12
15

Time Difference: 13:34:55 - 8:12:15 = 5:22:40
```

In this program, the user is asked to enter two time periods and these two periods are stored in structure variables `startTime` and `stopTime` respectively. Then, the function `differenceBetweenTimePeriod()` calculates the difference between the time periods. The result is displayed from the `main()` function without returning it (using **call by reference** technique).

C Program to Store Information of Students Using Structure

In this example, you will learn to store the information of 5 students by using an array of structures.

To understand this example, you should have the knowledge of the following C programming topics:

- C Arrays
- C struct

Store Information in Structure and Display it

```c
#include <stdio.h>
struct student {
    char firstName[50];
    int roll;
    float marks;
} s[5];

int main() {
    int i;
    printf("Enter information of students:\n");

    // storing information
    for (i = 0; i < 5; ++i) {
        s[i].roll = i + 1;
        printf("\nFor roll number%d,\n", s[i].roll);
        printf("Enter first name: ");
        scanf("%s", s[i].firstName);
        printf("Enter marks: ");
        scanf("%f", &s[i].marks);
    }
    printf("Displaying Information:\n\n");

    // displaying information
    for (i = 0; i < 5; ++i) {
        printf("\nRoll number: %d\n", i + 1);
        printf("First name: ");
        puts(s[i].firstName);
        printf("Marks: %.1f", s[i].marks);
        printf("\n");
    }
    return 0;
}
```

Output

```
Enter information of students:

For roll number1,
Enter name: Tom
Enter marks: 98

For roll number2,
Enter name: Jerry
Enter marks: 89
.
.
.
Displaying Information:

Roll number: 1
Name: Tom
Marks: 98
.
.
.
```

In this program, a structure `student` is created. The structure has three members: `name` (string), `roll` (integer) and `marks` (float).
Then, we created an array of structures `s` having 5 elements to store information of 5 students.
Using a `for` loop, the program takes the information of 5 students from the user and stores it in the array of structure. Then using another `for` loop, the information entered by the user is displayed on the screen.

C Program to Store Data in Structures Dynamically

In this example, you will learn to store the information entered by the user using dynamic memory allocation.

To understand this example, you should have the knowledge of the following C programming topics:

- C Pointers
- C Dynamic Memory Allocation
- C struct

This program asks the user to store the value of `noOfRecords` and allocates the memory for the `noOfRecords` structure variables dynamically using the `malloc()` function.

Demonstrate the Dynamic Memory Allocation for Structure

```
#include <stdio.h>
#include <stdlib.h>
struct course {
  int marks;
  char subject[30];
};

int main() {
  struct course *ptr;
  int noOfRecords;
  printf("Enter the number of records: ");
  scanf("%d", &noOfRecords);

  // Memory allocation for noOfRecords structures
  ptr = (struct course *)malloc(noOfRecords * sizeof(struct course));
  for (int i = 0; i < noOfRecords; ++i) {
    printf("Enter subject and marks:\n");
    scanf("%s %d", (ptr + i)->subject, &(ptr + i)->marks);
  }

  printf("Displaying Information:\n");
  for (int i = 0; i < noOfRecords; ++i) {
    printf("%s\t%d\n", (ptr + i)->subject, (ptr + i)->marks);
  }

  free(ptr);

  return 0;
}
```

Output

```
Enter the number of records: 2
Enter subject and marks:
Science 82
Enter subject and marks:
DSA 73

Displaying Information:
Science     82
DSA     73
```

C Program to Write a Sentence to a File

In this example, you will learn to write a sentence in a file using fprintf() statement.

To understand this example, you should have the knowledge of the following C programming topics:

- C File Handling
- C Standard Library Functions

This program stores a sentence entered by the user in a file.

```c
#include <stdio.h>
#include <stdlib.h>

int main() {
    char sentence[1000];

    // creating file pointer to work with files
    FILE *fptr;

    // opening file in writing mode
    fptr = fopen("program.txt", "w");

    // exiting program
    if (fptr == NULL) {
        printf("Error!");
        exit(1);
    }
    printf("Enter a sentence:\n");
    fgets(sentence, sizeof(sentence), stdin);
    fprintf(fptr, "%s", sentence);
    fclose(fptr);
    return 0;
}
```

Output

```
Enter a sentence: C Programming is fun

Here, a file named program.txt is created. The file will contain C programming is fun
text.
```

In the program, the sentence entered by the user is stored in the `sentence` variable.

Then, a file named **program.txt** is opened in writing mode. If the file does not exist, it will be created.

Finally, the string entered by the user will be written to this file using the `fprintf()` function and the file is closed.

C Program to Read the First Line From a File

In this example, you will learn to print the first line from a file in C programming.

To understand this example, you should have the knowledge of the following C programming topics:

- C File Handling
- C Programming Strings

Program to read the first line from a file.

```c
#include <stdio.h>
#include <stdlib.h> // For exit() function
int main() {
    char c[1000];
    FILE *fptr;
    if ((fptr = fopen("program.txt", "r")) == NULL) {
        printf("Error! File cannot be opened.");
        // Program exits if the file pointer returns NULL.
        exit(1);
    }

    // reads text until newline is encountered
    fscanf(fptr, "%[^\n]", c);
    printf("Data from the file:\n%s", c);
    fclose(fptr);

    return 0;
}
```

If the file is found, the program saves the content of the file to a string `c` until `'\n'` newline is encountered.

Suppose the `program.txt` file contains the following text in the current directory.

```
C programming is awesome.
I love C programming.
How are you doing?
```

The output of the program will be:

```
Data from the file:
C programming is awesome.
```

If the file `program.txt` is not found, the program prints the error message.

C Program to Display its own Source Code as Output

In this example, you'll learn to display source of the program using __FILE__ macro.

To understand this example, you should have the knowledge of the following C programming topics:

- C Preprocessor and Macros
- C File Handling

Though this problem seems complex, the concept behind this program is straightforward; display the content from the same file you are writing the source code.

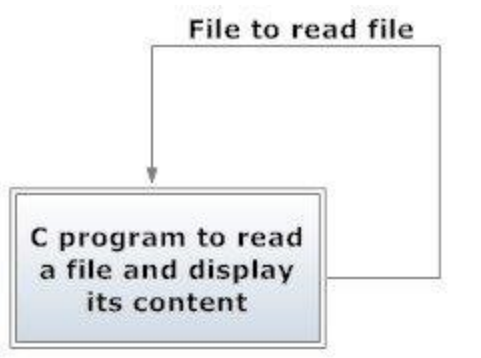


Figure: Technique to display its own source code

In C programming, there is a predefined macro named `__FILE__` that gives the name of the current input file.

```
#include <stdio.h>

int main() {

   // location the current input file.

   printf("%s",__FILE__);

}
```

C program to display its own source code

```
#include <stdio.h>
int main() {
    FILE *fp;
    int c;

    // open the current input file
    fp = fopen(__FILE__,"r");

    do {
         c = getc(fp);   // read character
         putchar(c);     // display character
    }
    while(c != EOF);  // loop until the end of file is reached

    fclose(fp);
    return 0;
}
```

C Program to Print Pyramids and Patterns

In this example, you will learn to print half pyramids, inverted pyramids, full pyramids, inverted full pyramids, Pascal's triangle, and Floyd's triangle in C Programming.

To understand this example, you should have the knowledge of the following C programming topics:

- C if...else Statement
- C for Loop
- C while and do...while Loop
- C break and continue

Here is a list of programs you will find in this page.

C Examples

Half pyramid of *

Half pyramid of numbers

Half pyramid of alphabets

Inverted half pyramid of *

Inverted half pyramid of numbers

Full pyramid of *

C Examples

Full pyramid of numbers

Inverted full pyramid of *

Pascal's triangle

Floyd's triangle

Example 1: Half Pyramid of *

```
*
* *
* * *
* * * *
* * * * *
```

C Program

```c
#include <stdio.h>
int main() {
   int i, j, rows;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = 1; i <= rows; ++i) {
      for (j = 1; j <= i; ++j) {
         printf("* ");
      }
      printf("\n");
   }
   return 0;
}
```

Example 2: Half Pyramid of Numbers

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```

C Program

```
#include <stdio.h>
int main() {
   int i, j, rows;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = 1; i <= rows; ++i) {
      for (j = 1; j <= i; ++j) {
         printf("%d ", j);
      }
      printf("\n");
   }
   return 0;
}
```

Example 3: Half Pyramid of Alphabets

```
A
B B
C C C
D D D D
E E E E E
```

C Program

```
#include <stdio.h>
int main() {
   int i, j;
   char input, alphabet = 'A';
   printf("Enter an uppercase character you want to print in the last row: ");
   scanf("%c", &input);
   for (i = 1; i <= (input - 'A' + 1); ++i) {
      for (j = 1; j <= i; ++j) {
         printf("%c ", alphabet);
      }
      ++alphabet;
      printf("\n");
   }
   return 0;
}
```

Example 4: Inverted half pyramid of *

```
* * * * *
* * * *
* * *
* *
*
```

C Program

```
#include <stdio.h>
int main() {
   int i, j, rows;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = rows; i >= 1; --i) {
      for (j = 1; j <= i; ++j) {
         printf("* ");
      }
      printf("\n");
   }
   return 0;
}
```

Example 5: Inverted half pyramid of numbers

```
1 2 3 4 5
1 2 3 4
1 2 3
1 2
1
```

C Program

```c
#include <stdio.h>
int main() {
   int i, j, rows;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = rows; i >= 1; --i) {
      for (j = 1; j <= i; ++j) {
         printf("%d ", j);
      }
      printf("\n");
   }
   return 0;
}
```

Example 6: Full Pyramid of *

```
        *
      * * *
    * * * * *
  * * * * * * *
* * * * * * * * *
```

C Program

```c
#include <stdio.h>
int main() {
   int i, space, rows, k = 0;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = 1; i <= rows; ++i, k = 0) {
      for (space = 1; space <= rows - i; ++space) {
         printf("  ");
      }
      while (k != 2 * i - 1) {
         printf("* ");
         ++k;
      }
      printf("\n");
   }
   return 0;
}
```

Example 7: Full Pyramid of Numbers

```
        1
      2 3 2
    3 4 5 4 3
  4 5 6 7 6 5 4
5 6 7 8 9 8 7 6 5
```

C Program

```c
#include <stdio.h>
int main() {
   int i, space, rows, k = 0, count = 0, count1 = 0;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = 1; i <= rows; ++i) {
      for (space = 1; space <= rows - i; ++space) {
         printf("  ");
         ++count;
      }
      while (k != 2 * i - 1) {
         if (count <= rows - 1) {
            printf("%d ", i + k);
            ++count;
         } else {
            ++count1;
            printf("%d ", (i + k - 2 * count1));
         }
         ++k;
      }
      count1 = count = k = 0;
      printf("\n");
   }
   return 0;
}
```

Example 8: Inverted full pyramid of *

```
* * * * * * * * *
  * * * * * * *
    * * * * *
      * * *
        *
```

C Program

```
#include <stdio.h>
int main() {
   int rows, i, j, space;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = rows; i >= 1; --i) {
      for (space = 0; space < rows - i; ++space)
         printf("  ");
      for (j = i; j <= 2 * i - 1; ++j)
         printf("* ");
      for (j = 0; j < i - 1; ++j)
         printf("* ");
      printf("\n");
   }
   return 0;
}
```

Example 9: Pascal's Triangle

```
           1
         1   1
       1   2   1
     1   3   3    1
   1  4    6   4   1
 1  5   10   10  5   1
```

C Program

```
#include <stdio.h>
int main() {
   int rows, coef = 1, space, i, j;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = 0; i < rows; i++) {
      for (space = 1; space <= rows - i; space++)
         printf("  ");
      for (j = 0; j <= i; j++) {
         if (j == 0 || i == 0)
            coef = 1;
         else
            coef = coef * (i - j + 1) / j;
         printf("%4d", coef);
      }
      printf("\n");
   }
   return 0;
}
```

Example 10: Floyd's Triangle.

```
1
2 3
4 5 6
7 8 9 10
```

C Program

```
#include <stdio.h>
int main() {
   int rows, i, j, number = 1;
   printf("Enter the number of rows: ");
   scanf("%d", &rows);
   for (i = 1; i <= rows; i++) {
      for (j = 1; j <= i; ++j) {
         printf("%d ", number);
         ++number;
      }
      printf("\n");
   }
   return 0;
}
```