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```
double divide_by_zero = 7 / 0;
```

The above code causes an exception as it is not possible to divide a number by **0**.

The process of handling these types of errors in C++ is known as exception handling.

In C++, we handle exceptions with the help of the `try` and `catch` blocks, along with the `throw` keyword.

- `try` - code that may raise an exception
- `throw` - throws an exception when an error is detected
- `catch` - code that handles the exception thrown by the `throw` keyword

Note: The `throw` statement is not compulsory, especially if we use standard C++ exceptions.

Syntax for Exception Handling in C++

The basic syntax for exception handling in C++ is given below:



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The `catch` block cannot be used without the `try` block.

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```
try {  
  
    // throw an exception if denominator is 0  
    if (denominator == 0)  
        throw 0;  
  
    // not executed if denominator is 0  
    divide = numerator / denominator;  
    cout << numerator << " / " << denominator << " = " << divide << endl;  
}  
  
catch (int num_exception) {  
    cout << "Error: Cannot divide by " << num_exception << endl;
```

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Output 1

```
Enter numerator: 72  
Enter denominator: 0  
Error: Cannot divide by 0
```

Output 2

```
Enter numerator: 72  
Enter denominator: 3  
72 / 3 = 24
```



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denominator == 0

```
try {  
    if (denominator == 0)  
        throw 0;  
    // code  
}  
catch (int num_exception) {  
    // code  
}  
return 0;
```

denominator != 0

```
try {  
    if (denominator == 0)  
        throw 0;  
    // code  
}  
catch (int num_exception) {  
    // code  
}  
return 0;
```

Working of try, throw, and catch statements in C++

Notice that we have thrown the `int` literal `0` with the code `throw 0;`.

We can throw any literal or variable or class, depending on the situation and depending on what we want to execute inside the `catch` block.

The `catch` parameter `int num_exception` takes the value passed by the `throw` statement i.e. the literal `0`.

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can occur due to the code in our `try` statement.

This is so that we can use the appropriate `catch` parameters. Otherwise, the `try...catch` statements might not work properly.

If we do not know the types of exceptions that can occur in our `try` block, then we can use the ellipsis symbol `...` as our `catch` parameter.

```
try {  
    // code  
}  
catch (...) {  
    // code  
}
```

C++ Multiple catch Statements

In C++, we can use multiple `catch` statements for different kinds of exceptions that can result from a single block of code.

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of `catch (...) {}` is executed.

Notes:

- `catch (...) {}` should always be the final block in our `try...catch` statement. This is because this block catches all possible exceptions and acts as the default `catch` block.
- It is not compulsory to include the default `catch` block in our code.

Example 2: C++ Multiple catch Statements

This program divides two numbers and stores the result in an array element. There are two possible exceptions that can occur in this program:

- If the array is out of bounds i.e. if the index of the array is greater than the size of the array
- If a number is divided by 0

These exceptions are caught in multiple `catch` statements.

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```
cout << "Enter numerator: ";
cin >> numerator;

cout << "Enter denominator: ";
cin >> denominator;

// throw exception if denominator is 0
if (denominator == 0)
    throw 0;
```

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Output 1

```
Enter array index: 5
Error: Array out of bounds!
```

Here, the array `arr` only has **4** elements. So, `index` cannot be greater than **3**.

In this case, `index` is **5**. So we throw a string literal `"Error: Array out of bounds!"`. This exception is caught by the first `catch` block.

Notice the `catch` parameter `const char* msg`. This indicates that the `catch` statement takes a `string` literal as an argument.

Output 2



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Here, the program runs without any problem as no exception occurs.

C++ Standard Exception

C++ has provided us with a number of standard exceptions that we can use in our exception handling. Some of them are shown in the table below.

Exception	Description
<code>std::exception</code>	The parent class of all C++ exceptions.
<code>std::bad_alloc</code>	Thrown when a dynamic memory allocation fails.
<code>std::bad_cast</code>	Thrown by C++ when an attempt is made to perform a <code>dynamic_cast</code> to an invalid type.
<code>std::bad_exception</code>	Typically thrown when an exception is thrown and it cannot be rethrown.

There are many other standard exceptions in C++.

These exceptions are defined in the `exception` header file.

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