# Learning Objectives: String Functions

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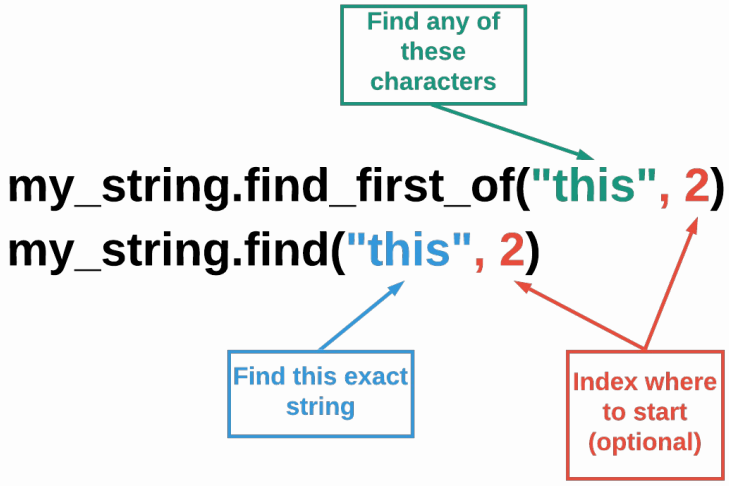
- **Identify the functions and applications of the following string functions:**
    - find_first_of() & find_last_of()
    - push_back() & insert()
    - pop_back() & erase()
    - replace()
    - append()
    - toupper() & tolower()

# Find First Of & Last Of

## The find_first_of() Function

The `find_first_of()` function works similarly to how the `find()` function does. However, the `find_first_of()` function will search for **any** matching characters specified. For example, given the string `"this is his string"`, `my_string.find_first_of("his")` will return `1` because the character `h` within `his` appears first at index number `1`. Like the `find()` function, you can optionally specify an index number to direct the system where to start searching.




.guides/img/FindFirstOf

▼ **The find_last_of() function**

You can use the `find_last_of()` function to search for a set of characters in a string that occur last. Here is an example, given the string `"this is his string"`, `my_string.find_last_of("his")` will return `15` because the `i` in `his` occurs last at index `15`. If you don't want the system to search the whole string, you can specify an index as a second parameter to direct the system where to start searching.

```
string string1 = "The brown dog jumps over the lazy fox.";
string string2 = "brown";

cout << string1.find_first_of(string2) << endl;
```

challenge

## What happens if you:

- Set `string2` to `"wornb"`?
- Change the `cout` statement to `string1.find_first_of(string2, 14)`?
- Set `string2` to `"axe"` and change the `cout` statement to `string1.find_first_of(string2, 34)`?
- Set `string2` to `"i"` and change the `cout` statement to `string1.find_first_of(string2)`?

**Remember** that `18446744073709551615` is equivalent to `-1` which also means `not found`.

# Push Back & Insert

## The push_back() Function

In a previous module, you were introduced to vectors. The `push_back()` function works the same way in strings as it does in vectors. It adds a specific **character** to the **end** of the string.

```
string my_string = "Today is Satur";
my_string.push_back('d');

cout << my_string << endl;
```

challenge

### What happens if you:

- add the code `my_string.push_back("ay");` below `my_string.push_back('d');`?
- replace `my_string.push_back("ay");` with `my_string.push_back('a');`?
- add the code `my_string.push_back('y');` below `my_string.push_back('a');`?

## The insert() Function

Unfortunately, the `push_back()` function cannot add multiple characters (string) to an existing string. However, the `insert()` function can. Unlike many functions where specifying the starting index number is optional, doing so is necessary for `insert()` to work.

Note that the index specification comes **before** the string you want the system to add. For example, `my_string.insert(0, "abc")` will add the string `abc` to the 0th index which is also the beginning of the string. To add to the end of the string, you can use `my_string.length()`. Note that you do not need to subtract `1` from `my_string.length()` because the system will add characters starting at the index **after** the last character of the string.

```
string my_string = "Today is Satur";
my_string.insert(my_string.length(), "day");

cout << my_string << endl;
```

challenge

## What happens if you:

- replace `my_string.insert(my_string.length(), "day");` with `my_string.insert(0, "day");`?
- change the code back to `my_string.insert(my_string.length(), "day");` and add `my_string.insert(9, "a good ");` below it?

# Pop Back & Erase

## The pop_back() Function

The `pop_back()` function removes a **single** character from the end of a string. You do not include anything within parentheses `()`.

```
string my_string = "Today is my birthday!";
my_string.pop_back();

cout << my_string << endl;
```

## The erase() Function

The `erase()` function can remove **multiple** characters from a string or the entire string itself. To remove the whole string, leave the parentheses `()` empty. Alternatively, you can specify **one** index number to remove all characters starting at that index to the end of the string. Specify **two** index numbers to start at an index and erase a *certain* number of characters at that index forward.

```
string my_string = "Today is my birthday!";
my_string.erase(my_string.length()-1);

cout << my_string << endl;
```

challenge

### What happens if you:

- Replace `my_string.erase(my_string.length()-1);` with `my_string.erase(12);`?
- Replace `my_string.erase(12);` in your current code with `my_string.erase(12, 5);`?
- Replace `my_string.erase(12, 5);` in your current code with `my_string.erase();`

▼ **Why do I see `Command was successfully executed.`?**

When Codio does not detect anything being printed to the console, you will see the message `Command was successfully executed.` displayed. The command `my_string.erase()` causes the entire string to become empty and since an empty string has no output, you will see `Command was successfully executed.` instead.

# Replace

## The replace() Function

The `replace()` function is really a combination of the `erase()` and `insert()` functions. Let's take a look at an example.

```
my_string.replace(1, 2, "3")
```

There are three parameters of interest within `replace()` above. The `1` represents the index at which we want to start erasing. The `2` tells the system how many characters to erase starting at index `1`. And the `"3"` is the string that the system will insert into the string at index `1`.

```
string string1 = "Hello world!";
string string2 = "Codio.";
string string3 = string1.replace(6, 5, string2);
// erase all characters from index 6 plus 5 chars to the right
        in string1
// then insert string2 at index 6 within string1

cout << string3 << endl;
```

challenge

## What happens if you:

- Change `string3` to `string1.replace(6, 6, string2)`?
- Change `string3` to `string1.replace(2, 3, "y")`?

# Append

## The append() function

An alternative way to **concatenate** or combine strings is to use the `append()` function. The `append()` function works in the same way as adding literal strings together using the `+` operator.

```
string a = "High";
string b = " Five";

cout << a.append(b) << endl;
```

challenge

### What happens if you:

- Change the cout statement to `a.append(b + "!")`?
- Change the cout statement to `a.append("Five" + "!")`?
- Change the cout statement to `"High" + " Five" + "!"`?
- Change the cout statement to `a + " Five" + "!"`?
- Change the cout statement back to `a.append(b)` and replace `string b = " Five";` with `int b = 5;`

important

### IMPORTANT

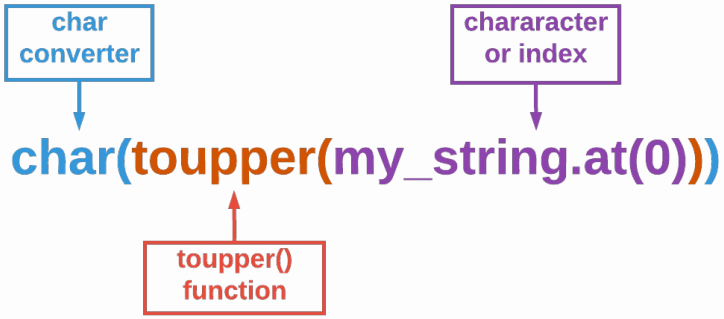
**NOTE** that the `append()` function is exclusively for strings. Thus, you cannot include other data types like `int`s when using `append()` unless they are converted to strings first. Additionally, when using the `+` operator to combine two strings together, make sure that **at least one** of the strings is a string variable. Otherwise, the system will think you are trying to manipulate a string literal, which is not allowed.

# Uppercase & Lowercase

## The toupper() Function

The `toupper()` function returns the uppercase form of a specified character. Insert the character you wish to convert as a parameter.

**Note** that by default, `toupper()` returns the **ASCII** representation of the uppercase letter. Thus, you'll need `char` to convert the ASCII code into alphabetical.




.guides/img/StringToUpper

```
string my_string = "the big brown dog";

cout << char(toupper(my_string.at(0))) << endl;
```

challenge

### What happens if you:

- Change the cout statement to `char(toupper(my_string.at(my_string.length()-1)))`?
- Change the cout statement to `char(toupper('t'))`?
- Change the cout statement to `char(toupper(my_string))`?

## The tolower() Function

The `tolower()` function returns the lowercase form of a specified character. It has all of the technicalities that the `toupper()` function has.

```
string my_string = "THE BIG BROWN DOG";

cout << char(tolower(my_string.at(1))) << endl;
```

challenge

## What happens if you:

- Change the cout statement to `char(tolower(my_string.at(my_string.length()-1)))`?
- Change the cout statement to `char(tolower('B'))`?
- Change the cout statement to `char(tolower('%'))`?