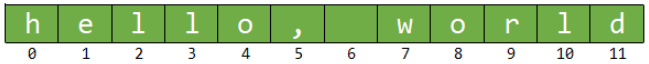
Selecting Characters

Positions in a string are subscripted (or indexed) starting at `0`. The characters in the `string` "*hello, world*" are index like this:



The numbers are alled the **index** or **subscript**; they must be positive (unlike Python where subscripts can be negative). Indexes start at `0` because it represents how many steps you need to travel from the beginning of the `string` to get to the element you are interested in. To retrieve the `'e'`, you have to travel one character from the beginning, so its subscript is `1`.

The `<string>` library has four ways to select characters from a non-empty string:

- Use the **subscript operator** like this: `cout << str[0];`
- Use the **member function** `at()` like this: `cout << str.at(0);`
- Use the members `front()` and `back()` in C++ 11+: `cout << str.front();`

If the `string` variable `str` contains `"hello, world"`, all of these expressions refer to the character `'h'` at the beginning of the `string`.

The `at()` member function makes sure the index is **in range**; the subscript operator does not. Using the subscript operator when a subscript is out of range **is undefined**. You should generally use `at()` unless you are certain that your indexes are in range.

Selecting an individual character in a `string` returns a **reference to the character** in the `string` **instead of a copy of that character**, as Java's `charAt(index)` method does. You **may assign a new value** to that reference, like this:

```
str[0] = 'H';       // or
str.at(0) = 'H';    // works as well
```

Both lines change the value from `"hello, world"` to `"Hello, world"`.