

Strings

Victor Eijkhout, Susan Lindsey

Fall 2021

last formatted: September 27, 2021

Characters

1. Characters and ints

- Type *char*;
- represents '7-bit ASCII': printable and (some) unprintable characters.
- Single quotes: `char c = 'a'`

2. Char / int equivalence

Equivalent to (short) integer:

Code:

```
char ex = 'x';  
int x_num = ex, y_num = ex+1;  
char why = y_num;  
cout << "x is at position " << x_num  
    << endl;  
cout << "one further lies " << why  
    << endl;
```

Output

[string] intchar:

*x is at position 120
one further lies y*

Also: 'x'-'a' is distance a--x

Exercise 1

Write a program that accepts an integer $1 \cdots 26$ and prints the so-manieth letter of the alphabet.

Extend your program so that if the input is negative, it prints the minus-so-manieth uppercase letter of the alphabet.

Strings

3. String declaration

```
#include <string>  
using std::string;
```

```
// .. and now you can use 'string'
```

(Do not use the C legacy mechanisms.)

4. String creation

A string variable contains a string of characters.

```
string txt;
```

You can initialize the string variable or assign it dynamically:

```
string txt{"this is text"};  
string moretxt("this is also text");  
txt = "and now it is another text";
```


5. Quotes in strings

You can escape a quote, or indicate that the whole string is to be taken literally:

Code:

```
string
    one("a b c"),
    two("a \"b\" c"),
    three( R("a ""b ""c")" );
cout << one << endl;
cout << two << endl;
cout << three << endl;
```

Output

[string] quote:

```
a b c
a "b" c
"a ""b ""c
```

6. Concatenation

Strings can be *concatenated*:

Code:

```
string my_string, space{" "};  
my_string = "foo";  
my_string += space + "bar";  
cout << my_string << ": " << my_string  
      .size() << endl;
```

Output

[string] stringadd:

foo bar: 7

7. String indexing

You can query the *size*:

Code:

```
string five_text{"fiver"};  
cout << five_text.size() << endl;
```

Output

```
[string] stringsize:  
  
5
```

or use subscripts:

Code:

```
string digits{"0123456789"};  
cout << "char three: "  
      << digits[2] << endl;  
cout << "char four : "  
      << digits.at(3) << endl;
```

Output

```
[string] stringsub:  
  
char three: 2  
char four : 3
```

8. Ranging over a string

Same as ranging over vectors.

Range-based for:

Code:

```
cout << "By character: ";  
for ( char c : abc )  
    cout << c << " ";  
cout << endl;
```

Output

[string] stringrange:

By character: a b c

Ranging by index:

Code:

```
string abc = "abc";  
cout << "By character: ";  
for (int ic=0; ic<abc.size(); ic++)  
    cout << abc[ic] << " ";  
cout << endl;
```

Output

[string] stringindex:

By character: a b c

9. Range with reference

Range-based for makes a copy of the element
You can also get a reference:

Code:

```
for ( char &c : abc )  
    c += 1;  
cout << "Shifted: " << abc << endl;
```

Output

[string] stringrangeset:

Shifted: bcd

Review quiz 1

True or false?

1. '0' is a valid value for a char variable
`/poll "single-quote 0 is a valid char" "T" "F"`
2. "0" is a valid value for a char variable
`/poll "double-quote 0 is a valid char" "T" "F"`
3. "0" is a valid value for a string variable
`/poll "double-quote 0 is a valid string" "T" "F"`
4. 'a'+'b' is a valid value for a char variable
`/poll "adding single-quote chars is a valid char" "T" "F"`

Exercise 2

The oldest method of writing secret messages is the Caesar cypher. You would take an integer s and rotate every character of the text over that many positions:

$$s \equiv 3: \text{"acdZ"} \Rightarrow \text{"dfgc"}.$$

Write a program that accepts an integer and a string, and display the original string rotated over that many positions.

10. More vector methods

Other methods for the vector class apply: insert, empty, erase, push_back, et cetera.

Code:

```
string five_chars;  
cout << five_chars.size() << endl;  
for (int i=0; i<5; i++)  
    five_chars.push_back(' ');  
cout << five_chars.size() << endl;
```

Output

[string] stringpush:

0
5

Methods only for string: find and such.

http://en.cppreference.com/w/cpp/string/basic_string

Exercise 3

Write a function to print out the digits of a number: 156 should print `one five six`. You need to convert a digit to a string first; can you think of more than one way to do that?

Start by writing a program that reads a single digit and prints its name.

For the full program it is easiest to generate the digits last-to-first. Then figure out how to print them reversed.

Optional exercise 4

Write a function to convert an integer to a string: the input 215 should give two hundred fifteen, et cetera.

11. String stream

Like `cout` (including conversion from quantity to string), but to object, not to screen.

- Use the `<<` operator to build it up; then
- use the `str` method to extract the string.

```
#include <sstream>
stringstream s;
s << "text" << 1.5;
cout << s.str() << endl;
```

Exercise 5

Use integer output to print real numbers aligned on the decimal:

Code:

```
string quasifix(double);  
int main() {  
    for ( auto x : { 1.5, 12.32,  
                    123.456, 1234.5678 } )  
        cout << quasifix(x) << endl;
```

Output

[io] quasifix:

```
    1.5  
   12.32  
  123.456  
 1234.5678
```

Use four spaces for both the integer and fractional part; test only with numbers that fit this format.