Introduction to Programming with C++

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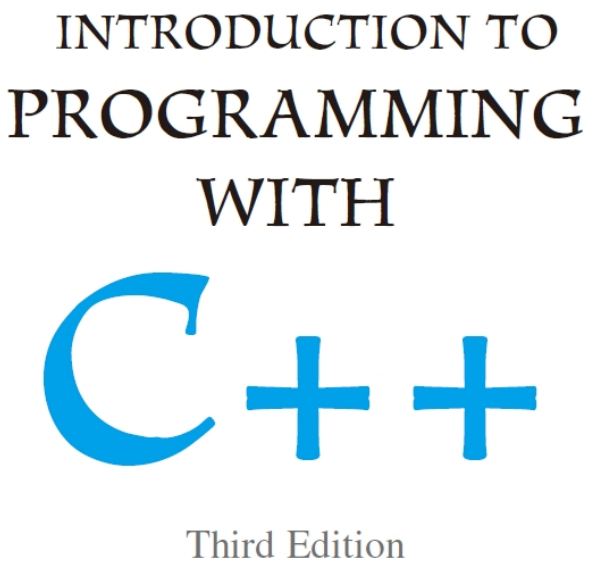

Contents are based on book by Y. Daniel Liang

Mathematical Functions

- C++ provides many useful functions in the cmath header for performing common mathematical functions.

Function	Description
`exp(x)`	Returns e raised to power of x (e^x).
`log(x)`	Returns the natural logarithm of x ($\ln(x) = \log_e(x)$).
`pow(a, b)`	Returns a raised to the power of b (a^b).
`sqrt(x)`	Returns the square root of x ($\sqrt{x}$) for $x \geq 0$.

Mathematical Functions

- Functions in the cstdlib header

Function	Description
`min(x, y)`	Returns minimum of x and y.
`max(x, y)`	Returns maxmum of x and y.
`pow(a, b)`	Returns a raised to the power of b (a^b).
`abs(x)`	Returns |x|.

Homework 4.1: Enter coordinates of three points, and compute the area of the triangle formed by these three points.

Character Data Type and Operations

- A character data type represents a single character.
- The character data type, char, is used to represent a single character.
- A character literal is enclosed in **single** quotation marks.

```
char letter = 'A';
char numChar = '4';
```

- A string literal must be enclosed in quotation marks (`" "`).
- A character literal is a single character enclosed in single quotation marks (`' '`).
- Therefore, `"A"` is a string and `'A'` is a character.

ASCII Code

- An 8-bit encoding scheme for representing all uppercase and lowercase letters, digits, punctuation marks, and control characters.

- The size of the char type is 1 byte.

Characters	ASCII Code
`'0'` to `'9'`	48 to 57
`'A'` to `'Z'`	65 to 90
`'a'` to `'z'`	97 to 122

```
char ch = 'a';
cout << ++ch;
----------------
b
```

Reading a Character from the Keyboard

```
cout << "Enter a character: ";
char ch;
cin >> ch; // Read a character
cout << "The character read is " << ch << endl;
```

In-Class Exercise: Try the above code.

- Escape Sequences

Escape Sequence	Name	ASCII Code
\t	Tab	9
\n	Linefeed	10
\\	Backslash	92
\"	Double Quote	34

```
cout << "He said \"Programming is fun\"" << endl;
cout << "\\t is a tab character" << endl;
cout << "Welcome to C++\n";
```

- See List4_2.cpp

Formatting Console Output

- You can use the stream manipulators to display formatted output on the console.
- These functions are called stream manipulators and are included in the **iomanip** header file.

Operator	Description
setprecision(n)	sets the precision of a floating-point number
fixed	displays floating-point numbers in fixed-point notation
setw(width)	specifies the width of a print field
left	justifies the output to the left
right	justifies the output to the right

```
double number = 12.34567;
cout << setprecision(3) << number << " "
     << setprecision(4) << number << " "
     << setprecision(5) << number << " "
     << setprecision(6) << number << endl;
cout << setprecision(3) << number << " ";
cout << 9.34567 << " " << 121.3457 << " " << 0.2367 << endl;
-----------------------------------------------
12.3 12.35 12.346 12.3457
12.3 9.35 121 0.237
```

Formatting Console Output

- If the width is not sufficient for an integer, the setprecision manipulator is ignored.

```
cout << setprecision(3) << 23456 << endl;
-----------------------------------------
23456
```

- Fixed Manipulator. You can use the fixed manipulator to force the number to be displayed in nonscientific notation with a fixed number of digits (default 6) after the decimal point.

```
cout << 232123434.357;
cout << fixed << 232123434.357;
cout << fixed << 23.3575655E+2;
-------------------------------------------------
2.32123e+08
232123434.357000
2335.756550
```

setw(width) Manipulator

- You can use setw(width) to specify the minimum number of columns for an output.

```
cout << setw(8) << "12345678" << setw(6) << "123456" << endl;
cout << setw(8) << "C++" << setw(6) << 101 << endl;
cout << setw(8) << "Java" << setw(6) << 101 << endl;
cout << setw(8) << "HTML" << setw(6) << 101 << endl;
```

```
-----------------------------------------------
<---8-->|<-6-->|
12345678 123456
     C++    101
    Java    101
    HTML    101
```

- If an item requires more spaces than the specified width, the width is automatically increased.

left and right Manipulators

- You can use the left manipulator to left-justify the output and use the right manipulator to right-justify the output.

```
cout << left;
cout << setw(8) << 1.23 << endl;
cout << right;
cout << setw(8) << 351.34 << endl;
```

```
-----------------------------------------------
    45678
1.23

123
___351.34
```

Homework 4.2: Programming exercise, 4.11