

CS1428 Review

Chapters 1-5

CS 2308
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Structure of a C++ Program

- Hello world:

```
//This program outputs a message to the screen
#include <iostream>
using namespace std;

int main() {
    cout << "Hello world!" << endl;
}
```

- In general:

```
//This is a comment
#include <includefile> ...
using namespace std;

int main() {
    statements ...
}
```

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Variables, Data Types

- **Variable:** portion of memory that stores a value
- Identifier: name of a program element
- Fundamental data types

char	float	bool
short	double	char
int	long double	
long		

- **Variable Declaration** statement

```
datatype identifier;
```

```
float hours;
```

- **Variable Initialization** statement:

```
datatype identifier = constant;
```

```
int count = 0;
```

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Constants

- **Literals** (specific value of a given type)

```
1
75
-2
```

```
12.45
-3.8
6.25e-5
```

```
true
false
```

```
'A'
'2'
```

- **Named Constants:**
variable whose value cannot be changed

```
const datatype identifier = constant;
```

```
const double TAX_RATE = 0.0675;
```

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Assignment statement, expressions

- To change the value of a variable:

```
variable = expression;
```

```
count = 10;
```

- The lefthand side must be a variable
- The righthand side is an expression of the right type
- What is an expression?
 - an expression has a type and evaluates to a value
 - literal
 - named constant
 - variable
 - arithmetic expression
 - etc.

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Arithmetic and Relational Operations

- arithmetic operators:

+ addition
 - subtraction
 * multiplication
 / division
 % modulo

```
x + 10
7 % 2
8 + 5 * 10
```

Watchout: Integer division!!

- relational operators (result is bool):

== Equal to
 != Not equal to
 > Greater than
 < Less than
 >= Greater than or equal to
 <= Less than or equal to

```
7 < 25
89 == x
x % 2 != 0
8 + 5 * 10 <= 100 * n
```

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Logical Operations, precedence

- logical operators (values and results are bool):

! not
 && and
 || or

```
x < 10 && x > 0
y == 10 || y == 20
!(a == b)
```

- operator precedence (which happens first?):

!
 +- (unary)
 * / %
 +- (binary)
 <><=>=
 == !=
 &&
 ||

```
!(y == 10) || y == 20 && x > 3 * z
```

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More assignment statements

- Compound assignment

+=	x += e;	x = x + e;
-=	x -= e;	x = x - e;
*=	x *= e;	x = x * e;
/=	x /= e;	x = x / e;

- increment, decrement

++	x++; ++x;	x = x + 1;
--	x--; --x;	x = x - 1;

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Basic Input/Output

- Output (cout and <<)

```
cout << expression;  
cout << expr1 << expr2;
```

```
cout << "hello";  
cout << "Count is: " << count << endl;
```

- Input (cin and >>)

```
cin >> variable;  
cin >> var1 >> var2;
```

right hand side must be a variable!

```
cin >> x;  
cout << "Enter the height and width: ";  
cin >> height >> width;
```

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Control structures: if else

- if and else

```
if (expression)  
    statement1  
else  
    statement2
```

statement may be a compound statement (a block: {statements})

- if expression is true, statement 1 is executed
- if expression is false, statement2 is executed

- the else is optional:

```
if (expression)  
    statement
```

- nested if else

```
if (expression1)  
    statement1  
else if (expression2)  
    statement2  
else if (expression3)  
    statement3  
else  
    statement4
```

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Control structures: loops

- while

```
while (expression)  
    statement
```

statement may be a compound statement (a block: {statements})

- * if expression is true, statement is executed, repeat

- for:

```
for (expr1; expr2; expr3)  
    statement
```

- * equivalent to:

```
expr1;  
while (expr2) {  
    statement  
    expr3;  
}
```

- do while:

```
do  
    statement  
while (expression)
```

statement is executed, if expression is true then repeat

Control structures: switch

- switch stmt:

```
switch (expression) {  
    case constant: statements  
    ...  
    case constant: statements  
    default: statements  
}
```

- execution starts at the case labeled with the value of the expression.
- if no match, start at default
- use break to exit switch (usually at end of statements)

- example:

```
switch (ch) {  
    case 'a':  
        case 'A': cout << "Option A";  
                break;  
    case 'b':  
        case 'B': cout << "Option B";  
                break;  
    default: cout << "Invalid choice";  
}
```

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File Input/Output

- `#include <fstream>`
- Output (ofstream)

```
ofstream fout;
fout.open("filename.txt");
fout << "hello";
fout << "Count is: " << count << endl;
fout.close();
```

- Input (ifstream)

```
ifstream fin;
fin.open("data.txt");
if (!fin) { Check for file open errors
    cout << "error opening file" << endl;
    return (0);
}
int x;
fin >> x; right hand side must be a variable!
cout << "x is " << x << endl;
fin.close();
```

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File Input: read to end of file

pp 279-281 in Gaddis, 7th ed.

- `>>` returns true when a value is successfully read, false otherwise.

```
ifstream fin;
fin.open("data.txt");
int x;
while (fin >> x) {
    cout << "next number is " << x << endl;
}
fin.close();
```

NOTE:
DO NOT USE: `fin.eof()`

- How the while loop works:

- executes `fin >> x`
- If a value can be read in, it's assigned to `x`, and it returns true.
- If a value cannot be read in (ie nothing else in file), nothing happens except that it returns false. ¹⁴

Type conversions

- Implicit

- assignment:

```
int x;
double d = 3.1415;
x = d;
cout << x << endl;
```

the type of expression on the right will be converted to type of variable on left, possibly losing information.

- binary operations:

```
int x = 10;
double d = 2.3;
cout << x + d << endl;
```

the operand with the lower ranking type is converted to the type of the other.

- Explicit

```
int x, y;
...
float avg = static_cast<float>(x)/y;
```

or

```
float avg = x/(float)y; //c-style notation
```

Order of types:

```
long double
double
float
unsigned long
long
unsigned int
int 15
```