Lecture 3
Chapter 3: Expressions & Interactivity

3.1 The cin Object
- Standard input object
- Like cout, requires iostream file → #include <iostream>
- Used to read input from keyboard
- Information retrieved from cin with >>
- Input is stored in one or more variables
- *Cin converts data to the type that matches the variable:

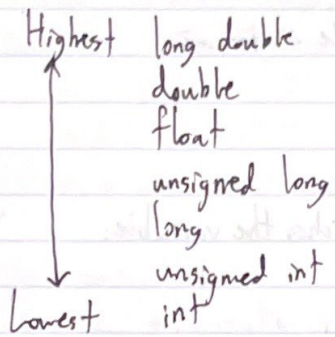
```
int height;
cout << "How tall is the room? ";
cin >> height;
```

- Is best to display a prompt (with cout) to instruct the user to enter data
- Can be used to input more than one value
  cin >> height >> width;
- Inputs must be seperated by a space in this case
- First input will be assigned to first variable (order matters)

3.2 Mathematical Expressions
PEMDAS
- Order of operations applies
  - 2+2*2-2
    (2, 1, 3)
- Multiplication requires * operator
- There is no exponentiation operator in c++, but pow(s,2) = s^2 (power function)

3.3 When you mix apples with oranges: Type Conversion
- Operations are performed between operands of the same type
- If not the same type, c++ will convert one type to the other
  - Can impact calculations

- Hierarchy of types



- Type Coercion: Automatic conversion of an operand to another data type
  - char, short, unsigned short become int
  - Lower data type is promoted to the higher one when operating on both

3.4 Overflow & Underflow
- Assigning a value to large or small for the data type
- Can cause error or incorrect results

3.5 Type Casting
- Manual data type conversion
- Useful for floating point division using ints: static_cast<data type>()

```
double m;
m= static_cast<double> (y2-y1)/(x2-x1);
```

- Useful to see int value of a char:

```
char ch='C';
cout << ch << "is" << static_cast<int> (ch);
```

3.6 Multiple Assignment & Combined Assignment

- = can be used to assign a value to multiple variables
  - `x = y = z = 5;`
- Combined assignment
  - `sum = sum + 1;` ← adds 1 to sum
  - `sum += 1;` adds 1 to sum as well

3.7 Formatting Output

- Can control how output displays for numeric, string data
  - size
  - position
  - number of digits
- Requires iomanip header file
- Stream manipulators
  - Used to control how an output field is displayed
  - Some affect just the next value displayed
    - setw(x): print in a field at least x spaces wide. Use more spaces if field isn't wide enough
  - Some affect values until changed again
    - fixed: Uses decimal notation for floating point values
    - setprecision(x): Determines number of digits after decimal
    - showpoint: Always print decimal for floating point values

3.8 Working with Characters and String Objects

`string name("nate");`

- Character case conversion
  - Requires cctype header file
  - toupper: If char is an alphabetical character, and is lower case, will make upper case
  - tolower: Take a guess
- Cin with >> operator only obtains input up to a space
- C++ function getline will retrieve the entire line, including spaces
  - `getline(cin, name);`

↘

C++ References & libraries
cplusplus.com/reference

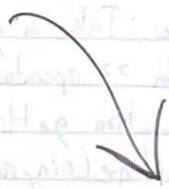
Don't mix cin>> ch and cin.get(ch)

chew chi
- Similar issue when obtaining char
  - cin >> ch ; Will skip over blanks, tabs, etc
- function cin.get(ch) will read next character entered, even whitespace
- ★ Member functions (append, length, assign) used through name.functionName(value)
  name.assign("nate");
- String length
  string state = "Texas";
  size 5 → int size = state.length();

3.9 More Mathematical Library Functions
- cmath header file
- Take double as input, return double
  - sin, cos, tan, sqrt, log, abs
- header file cstdlib
  - rand(), random number between 0 and 1

3.10 Hand Tracing a Program
- To act as if you are the computer, executing a program
  - step through & 'execute' each statement, one-by-one
- Useful to locate logic or mathmatical errors

3.11 A Case Study
- Crate inc. builds custom wooden crates
- You must write a program that calculates the:
  - Volume (ft^3)
  - Cost
  - Customer Price
  - Profit of any crate Crate inc. builds



- Program Design
  - The program must perform the following general steps:
    - Step 1: Ask user to enter crate dimensions
    - Step 2: Calculate:
      - Crate volume
      - Cost of building crate
      - Customer's charge
      - The profit made
    - Step 3: Display data calculated in step 2
- General Hierarchy Chart