

# **Computer Programming**

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Session: Assignment Statement and Arithmetic Expressions





- Structure of a simple C++ program
- Variables and type declarations
- Naming conventions

### **Overview of This Lecture**



- Assignment statement
- Arithmetic expressions

## **Assignment Statement**



General form

destination = expression;

- Compute the value of expression and store in destination
- Destination
  - Variable, for now
  - Has a declared type
  - More advanced things later...
- = in C++ assignment statement
  - **NOT SAME AS equality** in maths
    - C = C + 1 meaningful in C++, not in maths
    - A + B = C meaningful in maths, not in C++



## **Assignment Statement**



#### • Expression

- Refers to values of variables
- Refers to operators
- Evaluates to a value
- A value must have a type How much memory to store? How to interpret stored bits?
- So an expression has a type
- Normally, destination and expression types match
  C is int, A + B is int





- Usual way we write expressions in algebra
  - a, b, c : variables

Integer remainder: 5 % 3 = 2

- + , , \* , / , % : operators
- a + b, a b, b \* c, a/c, a%b : Arithmetic expressions
- What is the data type of a + b?
  - How many bytes to store in memory?
  - How are the stored bits interpretted?
  - Depends on data types of a and b
     a and b both int implies a + b, a b, a \* b, a/b, a%b are all int

## Type of An Arithmetic Expression



### • Rule of thumb:

Expression type at least as "expressive" as operand types, but no more

### float a and int b

- float "more expressive" than int
- a + b, a b, a \* b, a/b are all float, 2 \* b is int, 2.0 \* b is float
- double a, float b and int c
  - double "more expressive" than float
  - float "more expressive" than int
  - a + (b \* c) has type double

## Type and Value of Arithmetic Expression



Type of a/b: int Value of a/b: 0 (integer part of 1/2)

Type of a/b: float Value of a/b: 0.5 (float can represent fractions)

### **Operator Precedence**



- What is a + b \* c + d?
  - a + (b\*c) + d or (a + b) \* (c + d) or ((a + b) \* c) + d?
  - Depends on operator precedence
     In C++, \* has higher precedence than +: a + (b \* c) + d
- What is a + b c + d?
  - (a + b) (c + d) or (a + (b c)) + d?
  - In C++, + and have same precedence ( (a + b) c) + d
  - For now, left-to-right evaluation for same precedence operators Left-associative (exceptions later in course ...)
- \*, / and % have same precedence, and are left-associative:
   ((a % b) / c)\* d
   Different from usual algebra?
- Best practice: Use ( ... ) to specify unambiguously



- Can be used to override default operator precedences
  - Compare ((a + b) \* c + d) with a + (b \* c) + d
- Can be used to form complex expressions

• 1 + (1 / (2 + (3 / (4 + x)))) represents 1 + 
$$1$$
  
2 +  $3$   
4 + x

- Evaluate from innermost parenthesized expression outwards
- Not to be confused with { ... } or [ ... ]
  - a + {b \* c} will give a compilation error !!!





- Assignment statement in C++
- Arithmetic expressions
  - Types
  - Values
  - Use of parentheses