Math 5370: Transitioning to C++ for Scientific Computations

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Agenda for the week

1 CMath Library

2 Identifiers

3 Control Statements

Math functions and corresponding libraries

The standard library has the abs(int) function besides that, the cmath library has the following inbuilt functions:

- double fabs fabs(double)
- double sqrt(double)
- double pow(double, double) example pow(a,n)=a^n.
- double exp(double)
- log(double)
- int ceil(double) smallest int $\geq$ the argument.
- int floor(double) largest int $\leq$ the argument.

Naming convention for identifiers

- Must start with either an underscore '_' or an alphabet. Example: _input.
- Meaningful names should be chosen. Example: The identifier axb stores the product the a and b.
- Cannot begin with a digit but can include one in its definition. Example: input_1.
- Capitilization: Just like Linux, C++ does distinguish between different cases for the identifiers. Example: RATE, rAte, rATE are all different identifiers.
- Using *keywords as identifiers is prohibited. Example: the identifier int is a reserved word for describing a variable type.*

Types of variables

- char: stores a single symbol within single quotes ''.
- int: holds a numeric data type but only holds integers.
- double: a numeric variable stores a real number.
- string: stores a string of symbols within the double quotes "". Example: string day="Tuesday";
  The use of this variables requires the string library.
- Bool- assumes two values true or false.

classification of variables storing whole numbers

- short/short int: uses 2 bytes of memory holds a range of -2^{15} to 2^{15}.
- int: uses 4 bytes of memory holds a range of -2^{31} to 2^{31}.
- long int: has the same specs as int except for the storage space may differ based on the operating system and the architecture except on a windows os.

classification of variables storing real numbers

- float: uses 4 bytes of memory holds a range of 10^{-38} to 10^{38} with 7 digits of precision.
- double: uses 8 bytes of memory holds a range of 10^{-308} to 10^{308} with 15 digits of precision.
- long double: 10 bytes of memory used with a range of 10^{-4932} to 10^{4932} with 19 digits of precision.

Initialization and declaration of variables

Three possible ways to initialize variables a, b, axb.

- int a = 10 ;
  ('=' can be thought of as an assignment operator.)
- double b(2.25) ;
- using the assignment operator and as a result of some operation:
  Example: double axb = a*b ;

Arithmetic Operators

Besides the usual $+$, $-$, $*$, / and % (remainder operator) we have a combination of the assignment operator '='with any of the above operators:

Example	Evaluation of expression
count += 2;	count= count + 2
total-=discount	total = total - discount;
bonus*=2;	bonus = bonus*2;
time/=rush_factor	time = time/rush_factor;
change %= 100;	change =change %100
amount*=a1 + a2;	amount = amount*(a1 + a2)

Evaulation of the operators

Unary and assignment operators evaluated right to left given the same precedence other operators left to right.
Other precedence rules :

1. Evaluate any expression in ().
2. $/$
3. $*$
4. $+$
5. $-$

Control Statements

```
if (Boolean_Expression)
                    Yes_statement ;
else
                    No_statement ;
```

Boolean_Expression

C++ notation	Example	Evaluation
==	x+7 == 2*y	$x + 7 = 2y$
!=	ans != 8	ans $\neq 8$
<	discriminant < 0	discriminant <0
<=	x <= 0	$x \leq 0$
>	discriminant > 0	discriminant >0
>=	x >= 0	$x \geq 0$

Usage:

(2< x) && (y > 6) and operator,

(2< x) || (y > 6) or operator.