CS1110 Fall 2011   David Gries, Steve Marschner
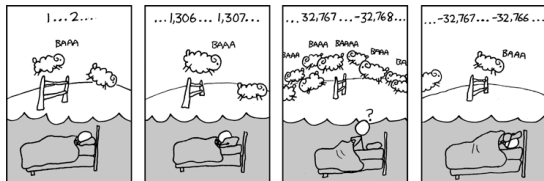
Reading for this lecture and previous lecture:
Sections 1.1, 1.2, 1.3.
Lab 1 will give you practice with concepts and details of 1.2, 1.3.

PLive: Lesson 0, Lesson page 1.3, Activity 1-4.1.

Quiz 1 in class, Tuesday 6 Sept. (more about it later)

Results of last lecture's questionnaire

Number completed: 305 (about 50 students did not)
No programming experience: 171 (56%)
< 5 months experience: 73 (24%)
>= 5 months experience: 61 (20%)

Number not in science/engineering: 44 (14%)

Number expressing concern because
of lack of experience compared to
others or the work load: 88 (29%)

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This lecture

Types
  int
  double (casting between **int** and **double**)
  boolean
  String

Variable (what it is)

Assignment statement (execution changes the value
of a variable)

Declaration of a variable

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Terminology

Programming language (Java, C, Fortran, Matlab, Python): a
  language in which people write programs, often to be executed on
  a computer.

Program: A set of instructions, written in a programming language,
  to be executed (carried out, performed) to get some task done.
  Like a recipe in a cookbook.

Machine language. The language of instructions that a computer is
  able to execute (carry out, perform).

Java Compiler. A program that translates a Java program into a
  machine language form so that it can be executed on a computer.

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**Type: A set of values together
with operations on them.**

Memorize this definition!
Write it down several times.

Type **integer**:

values: …, −3, −2, −1, 0, 1, 2, 3, 4, 5, …

operations: +, −, *, /, unary −

Type **int**: $-2^{31} .. 2^{31}-1$

values: −2147483648, −2147483647, …, −3, −2, −1,
    0, 1, 2, 3, 4, 5, …, 2147483646, 2147483647

operations: +, −, *, %, /, unary −   7%3 is remainder when
                                          dividing 7 by 3

Principal: These **int** operations must yield an **int**.

b / c rounds toward 0

Integer.MIN_VALUE   Integer.MAX_VALUE

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Type: A set of values together with operations on them.

Type **double**:
values: Numbers in scientific notation, e.g.

  22.3   −22.51 * 10^6 .00002251   22.51 * 10^{-6}

          mantissa   **exponent**

Important points:
Only approximations to real numbers; can't represent all of them.

To distinguish between **int** and **double** numbers, **double** numbers
  always have period or exponent.

Can't use notation 10^6 —exponents have to be written differently.

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Type: A set of values together with operations on them.

mantissa   exponent

Type **double**:
values: Examples: $-22.51E6$ equivalent to -22510000
or $-22.51 * 10^6$
$22.51E-6$ equivalent to $.00002251$
or $22.51 * 10^{-6}$

An approximation to the real numbers.
operations: +, −, *, /, unary −

Smallest POSITIVE value

Double.MIN_VALUE $4.9E-324$

Double.MAX_VALUE $1.7976931348623157E308$

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Casting between double and int

(**double**) 2   casts 2 to type **double**. Value is 2.0

A *widening* cast. Java does it automatically if necessary

(**int**) 2.56   casts 2.56 to type **int**. Value is 2

A *narrowing* cast. Java *never* does it automatically because it might lose information.

Other examples:

(**double**)(**int**) 2.56   Value is 2.0

(**double**) 2.56   Value is 2.56

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Type: A set of values together with operations on them.

Type **boolean**:
values: **true   false**
operations: ! (not)   && (and) || (or)

!b   read "not b"
        true if b is false and false if b is true

b && c   read "b and c"
        true if both b and c are true, false otherwise

b || c,   read "b or c",
        is true if b is true or c is true, false otherwise

i < j   i <= j   i == j   i >= j   i > j   i != j
        evaluate to true or false   ==, not = !!

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Precedence of operators (page 23)

- Unary operators: + − !
- Binary arithmetic: * / %
- Binary arithmetic: + −
- Arithmetic relations: < > <= >=
- Equality relations: == !=
- Logical and: &&
- Logical or: ||

You will practice working with expressions in Lab 01.

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Variables. p. 26

- A variable is a name together with a value.
- A variable is a named box with a value in the box.

Memorize definition!
Write it down several times.

x 5 **int**   Here's variable **x**, with value 5.
                   It can contain an **int** value.

area 20.1 **double**   Here's variable **area**, with value 20.1.
                            It can contain a **double** value.

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Goal of next 10 minutes:
Understand assignment statement

Draw variable x on piece of paper:

x [⨯ 7]

Step 1: evaluate the expression x + 2

For x, use the value in variable x. Write the value of the expression somewhere on your piece of paper

Step 2: Store the value of the expression in x

To store the value in x, cross off the old value and write the new value in box x

Check to see whether you did the same thing as your neighbor, discuss it if you did something different.

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Goal of next 10 minutes:
Understand assignment statement

You have this:

x [⨯⨯ 22]

Execute this command:
   Step 1: evaluate the expression 3 * x + 1
   Step 2: Store its value in x

Check to see whether you did the same thing as your neighbor, discuss it if you did something different.

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Goal of next 10 minutes:
Understand assignment statement

You now have this:

x [⨯⨯ 22]

Command:
   Step 1: Evaluate the expression 3 * x + 1
   Step 2: Store its value in x

This command is called an assignment statement. It tells YOU or the computer to DO something. Performing the command is called executing the command.

To execute the command, **you** evaluated the expression (3*x+1) and stored its value in the variable x.

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Goal of next 10 minutes:
Understand assignment statement

You now have this:

x [⨯⨯ 22]

Command:
   Step 1: Evaluate the expression 3 * x + 1 and
   Step 2: Store its value in x

This assignment statement is written in Java like this:

                                    the expression
    x= 3 * x + 1;
                        the variable

When you are told to execute an assignment statement like this, first evaluate the expression and then store its value in the variable

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Goal of next 10 minutes:
Understand assignment statement

Put another variable y on your piece of paper so that it looks like this:

x [⨯⨯ 22] **int**   y [⨯ 7] **int**

Execute this assignment statement:
   y= x / y;   7

Check to see whether you did the same thing as your neighbor, discuss it if you did something different.

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Declaration of a variable. p. 26

In Java, a *declaration of a variable* gives the name of the variable and the type of value it can contain.

   int x;   Here's a declaration of x, indicating that it contain an **int** value.

   double area;   Here's a declaration of area, indicating that it can contain a **double** value.

Assignment statement. p. 27

Execution of an assignment statement stores a value in a variable.

To execute the assignment
      <var>= <expr>;
evaluate expression <expr> and store its value in variable <var>.

x= x + 1;   Evaluate expression x+1 and store its value in variable x.

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Type: A set of values together with operations on them.

Type String: values: Any sequence of characters
                     operations: + (catenation, or concatenation)

String literal: sequence of chars enclosed in double quotes:
            e.g. " abcex3$g<&"

Here is String catenation: "bc" + "fg"

> Question: what can you do to convert the value of an expr, e.g. $3.1459 + 4.1$, to a String?

+ is overloaded: Consider x + y

(1) If one operand (x or y) is a String, the other is converted to a String (if necessary) and catenation is done.

(2) Otherwise, if one operand is a **double**, the other is cast to a **double** (if necessary) and a **double** addition is done.

(3) Otherwise, both operands are **int**s and an **int** addition is done.

Quiz on Tuesday.

To find out about quizzes, visit the course webpage and click "Quizzes".

Quiz 01. In class, Tuesday, 6 Sept.

You need to know

(1) Definition of "type" (see p. 7 of text)

(2) how to execute the assignment statement
    (p. 28, box on top of page)

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Recitations (Labs) in ACCEL LAB Start Today and Tomorrow!

You can help by bringing your own laptop

A: The explanation of assignment helped! I understand how to execute an assignment statement

B: I'm still confused about the assignment statement.

C: I knew it before but you confused me

D: Boring. I knew it already

Here are the times of the recitation-labs: Attend ONE of them.
Tuesday: 12:20, 1:25, 2:30, 3:35
Wednesday: 12:20, 1:25, 2:30, 3:35

To get to the ACCEL Lab, go into the Engineering Library in Carpenter Hall, walk straight until you come to a staircase on your left, and go up the stairs.

Do not be concerned if you haven't been able to register for a recitation section. Just go to the one you want this week.

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