- A bigger room has been requested.
- The instructor has no control over enrollments. Please go to the departmental office (LAS 1003) if you have any questions.
- If you can only enroll after the first test, then the weight of that test will be distributed over the other tests.
- Slides and sample code can be found at www.eecs.yorku.ca/course/1020.

Compile the app: javac AgeOfJava.java



CSE 4302: Compilers and Interpreters

eclipse automatically compiles the app.

Run the app: java AgeOfJava



In eclipse, you press the button with the green circle and the white arrow.

- Solve the problem.
- Write the app (using an editor such as eclipse).
- Sompile the app (done automatically in eclipse).
- Q Run the app (pressing a button in eclipse).

How to represent and manipulate data?

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A data type consists of

- a name,
- a set of values, and
- a set of operations.

- name: int
- values: 0, 1, -1, 2, -2, ...
- operations: +, -, *, /, ...

3) 3

Question: How many bytes are used to represent a value of type int?

Answer:

Answer: 4

Answer: 4

Question: A byte consists of how many bits? Answer:

Answer: 4

Question: A byte consists of how many bits? Answer: 8

Answer: 4

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Question: How many bits are used to represent a value of type int? Answer:

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Question: How many bits are used to represent a value of type int? Answer: $4 \times 8 = 32$

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Question: How many bits are used to represent a value of type int? Answer: $4 \times 8 = 32$

Question: How many different values has a bit? Answer:

Answer: 4

Question: A byte consists of how many bits? Answer: 8

Question: How many bits are used to represent a value of type int? Answer: $4 \times 8 = 32$

Question: How many different values has a bit? Answer: 2

Answer: 4

Question: A byte consists of how many bits? Answer: 8

Question: How many bits are used to represent a value of type int? Answer: $4 \times 8 = 32$

Question: How many different values has a bit? Answer: 2

Question: How many values of type int are there? Answer:

Answer: 4

Question: A byte consists of how many bits? Answer: 8

Question: How many bits are used to represent a value of type int? Answer: $4 \times 8 = 32$

Question: How many different values has a bit? Answer: 2

Question: How many values of type int are there? Answer: 2^{32}

- name: int
- values: [-2147483648, 2147483647]
- operations: +, -, *, /, ...

Note that $2147483648 = 2^{31}$.

The operations are typed. For example,

```
\cdot - \cdot : (int \times int) \rightarrow int
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specifies that the operation - takes two values of type int and returns a value of type $\operatorname{int}.$

What happens when you subtract one from -2147483648?

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- name: int
- values: [-2147483648, 2147483647]

. . .

• operations:

$$\begin{array}{l} \cdot + \cdot : (\operatorname{int} \times \operatorname{int}) \to \operatorname{int} \\ \cdot - \cdot : (\operatorname{int} \times \operatorname{int}) \to \operatorname{int} \\ \cdot \ast \cdot : (\operatorname{int} \times \operatorname{int}) \to \operatorname{int} \\ \cdot / \cdot : (\operatorname{int} \times \operatorname{int}) \to \operatorname{int} \end{array}$$

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Write an app that prints the age of Java as a real number.

- name: double
- values: 3.14, -7.3, ...

. . .

- operations:
- $\begin{array}{l} \cdot + \cdot : (\text{double} \times \text{double}) \to \text{double} \\ \cdot \cdot : (\text{double} \times \text{double}) \to \text{double} \\ \cdot * \cdot : (\text{double} \times \text{double}) \to \text{double} \\ \cdot / \cdot : (\text{double} \times \text{double}) \to \text{double} \end{array}$

To convert an int to a double we use the operation

 $(\text{double}) \cdot : \text{int} \rightarrow \text{double}$

This operation, known as casting, takes a value of type int and returns a corresponding value of type double.

A value of type double is represented by 8 bytes. Question: How many bits is that? Answer: A value of type double is represented by 8 bytes. Question: How many bits is that? Answer: $8 \times 8 = 64$

Question: How many bits is that? Answer: $8 \times 8 = 64$

Question: How many values of type double are there? Answer:

Question: How many bits is that? Answer: $8 \times 8 = 64$

Question: How many values of type double are there? Answer: 2^{64}

Question: How many bits is that? Answer: $8 \times 8 = 64$

Question: How many values of type double are there? Answer: 2^{64}

Question: How many real number are there? Answer:

Question: How many bits is that? Answer: $8 \times 8 = 64$

Question: How many values of type double are there? Answer: 2^{64}

Question: How many real number are there? Answer: infinitely many

Question: How many bits is that? Answer: $8 \times 8 = 64$

Question: How many values of type double are there? Answer: 2^{64}

Question: How many real number are there? Answer: infinitely many

Conclusion: most real numbers cannot be represented exactly

We distinguish between these two cases:

(double) : int \rightarrow double

is an example of promotion. In general, promotions only lead to small round off errors or are precise.

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(int) : double \rightarrow int

is an example of demotion. In general, demotions loose information.

The compiler performs promotions automatically when needed.

Question

From the expression

(double) year +

(double) (currentDay - birthDay) / (double) daysPerYear

which casts can be removed?

Write an app that prints the age of Java as a real number with two digits precision.

Write an app that prints the age of Java as a real number preceded by

The age of Java is

- name: String
- values: "zero or more characters"

. . .

- operations:
- $\cdot + \cdot : (\mathrm{String} \times \mathrm{String}) \to \mathrm{String}$

Write an app that prints the age of Java as a real number preceded by

The "age" of Java is

Write an app that prints the age of Java as a real number preceded by

The age of Java is

in Chinese.

A Unicode is represented as

\u????

where is each ? is one of the following:

0, 1, ..., 9, A, B, ..., F

For example, the Unicode for $\not<$ is \u226E. Question: How many Unicodes are there? Answer:

A Unicode is represented as

\u????

where is each ? is one of the following:

0, 1, ..., 9, A, B, ..., F

For example, the Unicode for $\not<$ is \u226E.

Question: How many Unicodes are there? Answer: $16^4 = (2^4)^4 = 2^{16}$ Write an app that prints the age of Java as a real number preceded by

The age of Java is

which not only gives the correct result today, but also tomorrow, the day after tomorrow, etc.

- Study the remainder of Chapter 1 of the textbook.
- Activate your EECS account: www.eecs.yorku.ca/activ8.
- Attend the lab on Friday to do
 - the guided tour,
 - Lab 1 from the textbook, and
 - <u>Check01C</u> from the textbook.
- Submit Check01C (in the textbook and on Moodle) before Sunday to obtain feedback.