Today’s big ideas

• (See some Java syntax and vocabulary)

• In Java, variables need *types*

• Java programs need to be *compiled* before they can run
CS 2230

CS II: Data structures

Meeting 2: intro to Java

Brandon Myers

University of Iowa
An example from calculus

area under the curve = \( \int_{x_0}^{x_4} f(x) \)

how do we calculate this expression numerically?
An example from calculus

area under the curve = \[ \int_{x_0}^{x_4} f(x) \approx \sum_{i=1}^{4} f(x_i) \times \Delta x \]
Let’s write it in Java for \( f(x) = x^2 \)

let’s assume
\( x_0=1, x_4=10, \text{ and } \Delta x = 0.1 \)

\[
\sum_{i=1}^{4} x_i^2 \cdot \Delta x
\]

Python

```python
def square(a):
    return a*a

x0 = 1
x4 = 10
Dx = 0.1

sum = 0
x = x0 + Dx;
while x <= x4:
    sum += square(x)*Dx
    x += Dx;

print sum
```
Let’s write it in Java for $f(x) = x^2$

let’s assume $x_0 = 1, x_4 = 10, \text{and } \Delta x = 0.1$

$$\sum_{i=1}^{4} x_i^2 \times \Delta x$$

Java

```java
public class Integration {
    public static void main(String[] args) {
        int x0 = 1;
        int x4 = 10;
        float Dx = 0.1f;

        float sum = 0;
        float x = x0 + Dx;
        while (x <= x4) {
            sum += square(x)*Dx;
            x += Dx;
        }

        System.out.println(sum);
    }

    public static float square(float a) {
        return a*a;
    }
}
```

Python

```python
def square(a):
    return a*a

x0 = 1
x4 = 10
Dx = 0.1

sum = 0
x = x0 + Dx;
while x <= x4:
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public class Integration {
    public static void main(String[] args) {
        int x0 = 1;
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        float sum = 0;
        float x = x0 + Dx;
        while (x <= x4) {
            sum += square(x)*Dx;
            x += Dx;
        }

        System.out.println(sum);
    }

    public static float square(float a) {
        return a*a;
    }
}
Peer instruction

Which statement in the program is incorrect?

```java
public class PeerInstruction1 {
    public static void main(String[] args) {
        float a = 10;
        int b;
        float c = 3.14f;
        int d = 10.1;
    }
}
```
NetBeans is helpful

```java
public class PeerInstruction1 {
    public static void main(String[] args) {
        float a = 10;
        int b;
        float c = 3.14f;
        int d = 10.1;
    }
}
```

If I ignore the red squiggle and try to “run” my code anyway:

Another important difference with Java

There is an “extra” step to running a Java program
1. **compile** the java file
2. then, Run it

What is compiling for?

- checks for common bugs (the red squiggles in NetBeans)
  - syntax errors
  - other kinds of errors, too!

- compiling also does other things like making sure the program will run fast...

  ```java
  int x = a+a+a+a+a+b+b+b+b; ➔ int x = 5*a+4*b;
  ```
Why do we have to write a type for every variable in Java?
Why do we have to write a type for every variable in Java?

```python
def first_letter(s):
    if len(s) > 0:
        return s[0]
    else:
        return ""

# your test cases – everything is ok!
print first_letter("cs2230")
print first_letter("hello world")
print first_letter(""")

# the user's input
print first_letter(4)
```

Traceback (most recent call last):  File "types.py", line 16, in <module>     print first_letter(4)   # breaks!  File "types.py", line 4, in first_letter   if len(s) > 0:  TypeError: object of type 'int' has no len()
Before we run the Java program, we compile it. And the compiler says:

Types.java:7: error: incompatible types: int cannot be converted to String
first_letter(4);
What is the result of trying to compile and run this program?

a) runs fine
b) error while compiling (“compile time error”)
c) error while running (“runtime error”)

```java
public class Mystery {
    public static void main(String[] args) {
        int f = 22;
        int g = 1000;
        f = g + f;
    }

    public static int stuff(int x) {
        return -x
    }
}
```
Today’s big ideas

• (See some Java syntax and vocabulary)

• In Java, variables need **types**

• Java programs need to be **compiled** before they can run

• Next time:
  • Object oriented programming (i.e., why do I have to write “class” and “public” and “static” everywhere???)
What to do now

• HW 1 and Quiz 1
• Start going to discussion if you haven’t been already
• go on ICON and take the syllabus survey if you want to vote on policies, if you haven’t already
• Check ICON and reply to the discussion question