CRA Conference at Snowbird 2006

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Programming is a Mode of Thought

- It isn’t Computer Science but a key component and a gateway to CS as well as Computational X
- Teaching students of all persuasions and interests how to be competent in programming is a “good thing”
- No claim that my “hard core” approach is the only approach or the best one – it works

CS15: Introduction to Object Oriented Programming

- The first of a two-course introductory sequence;
  - a smaller rival course teaches Scheme, ML and Java, more likely to be taken by those with some experience
- Assumes no prior background in CS
  - Welcomes, if not caters to, newbies
- Now about 100 students enrolled yearly
  - 30% female.
  - Fewer than 50% will be CS majors; many will take additional courses
- Attempts to teach OOP and software design through intense, immersive experience
  - Students work steadily
- A strong focus on interaction via GUIs
  - Great for OOP; keeps students more interested
- Followed by Algorithms and Data Structures (in Java)

CS15's Approach to Teaching

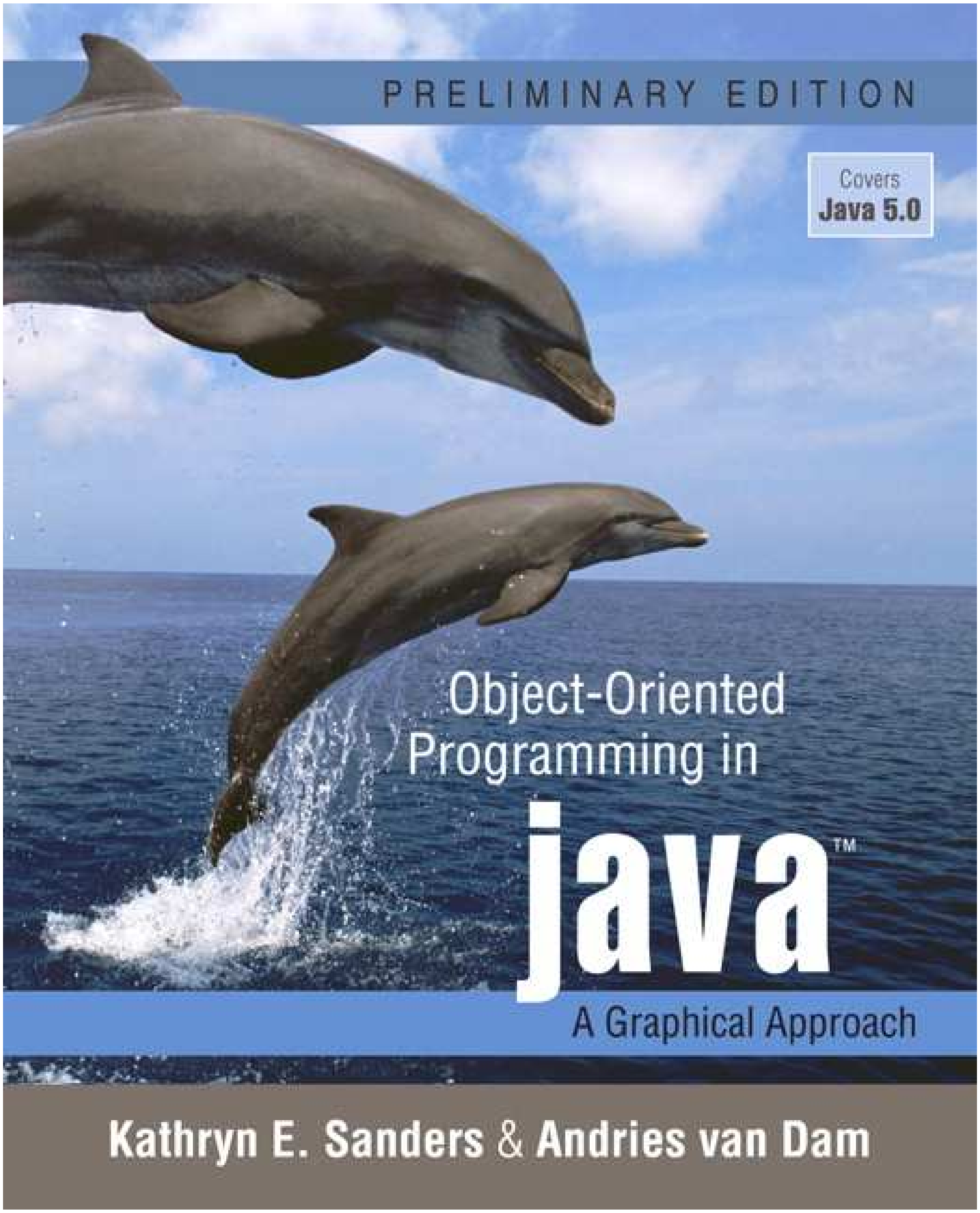
- Teach objects first
  - Avoid inducing a hybrid procedural/OOP style of coding
  - All of OOP before many standard programming concepts
    - e.g. polymorphism before flow-of-control

- Learn by doing – lectures nearly irrelevant

- 8 substantial programs, no exams, quizzes
  - Including Tetris and a large final project
  - Final projects reach several thousand lines
  - All programs have written design elements which must be handed in before the final program is due

- CS15 makes heavy use of pre-written libraries
  - So called "magic" is inevitable
  - Better to learn how to use them
  - Students do learn lower level concepts in the third course taken by CS concentrators at Brown

CS15's textbook


PRELIMINARY EDITION
Covers Java 5.0
Object-Oriented Programming in
java™
A Graphical Approach
Kathryn E. Sanders & Andries van Dam

Methodology

- Detailed slide sets for every lecture
  - use PowerPoint© animations to illustrate concepts visually
  - Posted on the course website
  - Lectures are recorded with both video of the slides and audio of the lecture to further encourage review

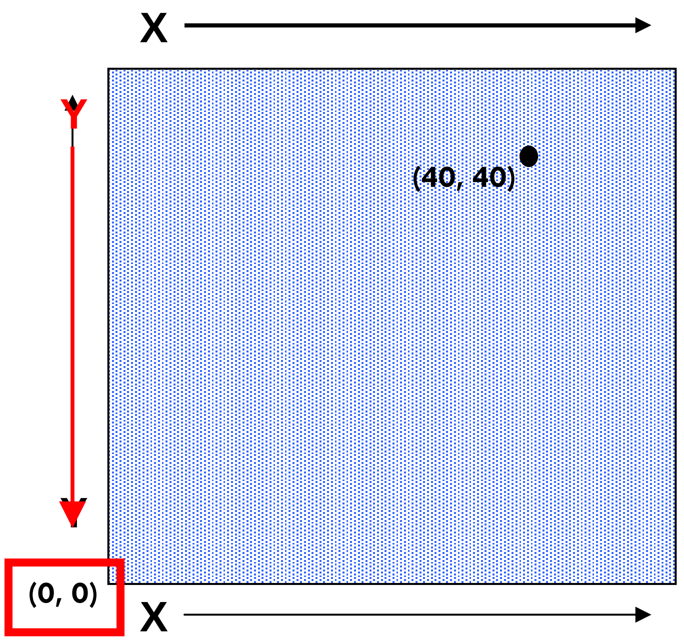
- Java demos to immediately demonstrate uses for concepts

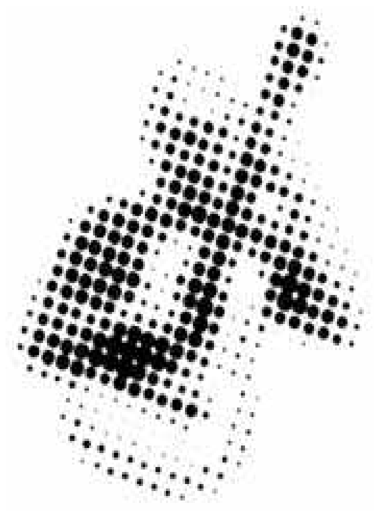
- Large staff of Undergraduate Teaching Assistants (UTAs) 1UTA/8 students
  - Allow for 60+ office hours per week
  - UTAs lead help sessions for every program to go over high-level design concepts and to answer questions about support code, requirements, etc.
  - Provide detailed feedback on design decisions in both written design hand-ins and programs

- Introduce the excitement of CS with short show-and-tell by other profs, cameos by former students, typically female

Sample CS15 Slide: Location/Dimension

- The screen is a grid of **pixels** (tiny dots)
  - "**pi**cture **el**ement**s**"

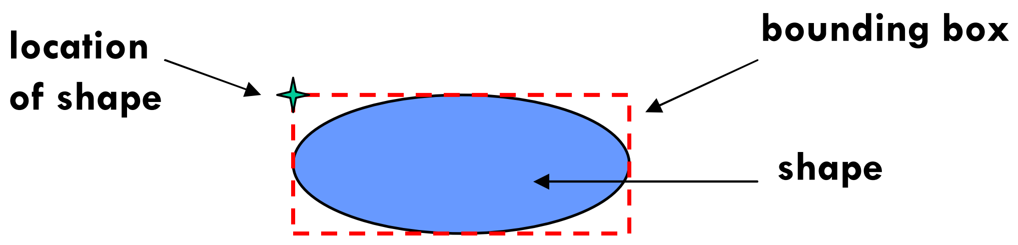




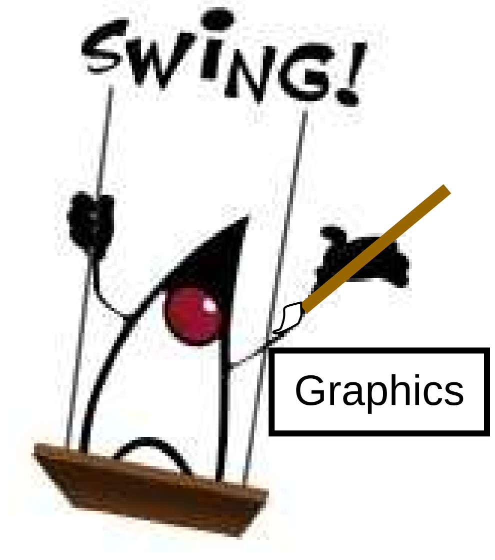
Pixel Art

- Unlike a Cartesian plane!
  - the **origin** is in the **upper-left corner**
  - the **y-axis increases** **downward**

- The **location** of any shape is described by the **upper-left corner** of it's bounding box

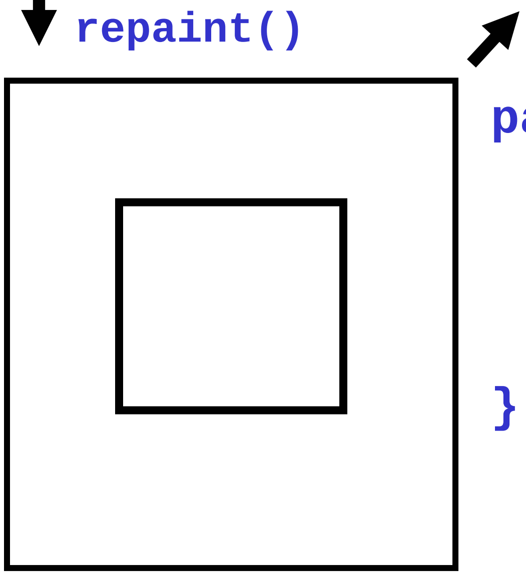


Sample CS15 Slide: Repaint!



Someone

```
repaint()
```



```
paintComponent( Graphics2D ) {
   super.paintComponent(g);
   Graphics2D brush =
             (Graphics2D) g;
   _rectangle.paint(brush);
}
```

JPanel

```
paint(           brush) {
   brush.setColor(_borderColor);
   brush.draw(_shape);
   brush.setColor(_fillColor);
   brush.fill(_shape);
}
```

Panel Questions (rephrased)

- Best approach?
  - Whatever prof is passionate about
- How to get more suckers into the tent?
  - Game design, Alice and other forms of much more instant gratification, Digital Visual Literacy, …
- Does approach scale?
  - Yes. Need UTAs, vanilla machines
- Is lack of experience an inhibitor?
  - No evidence at Brown, and I prefer newbies
- Turn-off factors?
  - Pace/intensity
  - Lack of collaboration
  - Lack of real-world applicability – would be great if in an intro course you could solve a societal problem in well-defined steps, in synch with the machinery being taught