10. Thread, Drawing
Get Key & mouse input
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Draw Examples

• Open codes in drawExample
  – Run BouncingBall.java
Activity Diagram

{Client is registered with the brokerage system}

Client enters login name and password

Correct Login and password?

[Yes]

Client has successfully logged in

Client's settings are displayed

[No]

Invalid login/password

{Client logs into the system.}
Graphical User Interface (GUI) design
Interface

• **Unique** feature of Java
• Interface is a kind of Incomplete class
  – **Only has header** of methods
• To allow multi inheritance (kind of)
  – Java doesn’t allow multi-inheritance
• Use keyword *implements* like extends
  – To enforce implementation for users when they use a interface
• When?
  – Cooperate
  – Keyboard, action listener
Let’s look at zookeeper examples
Thread

- Use multi flow of probgam
- When?
  - To utilize 100% of multi-core cpu
  - To make interactive program
  - Ex) countdown while waiting key press

- Lets see some examples
  - Simple thread
  - Thread with detail (number)
  - Thread join
  - Thread by using runnable interface
Drawing Example

• Edit Bouncing ball
  – Change image instead of black dot
  – Apply keyboard input
  – Move object from keyboard input
Homework!

• 2 weeks later (September 20\textsuperscript{th})
  – Use MS powerpoint
  – Bring your idea to program
    • Name and what it is
  – Draw GUI
    • and Activity Diagram – optional
    • As detail as possible
  – At least 2 slides.
  – More detail!
Haven’t decided yet?

• GUI based games are easy and fun
  – Tetris, snake, .. Etc
  – https://www.youtube.com/watch?v=RHIdkKXiZgY
Drawing ball and key input

• By implement **KeyListener**
• Once implement KeyListener, you must implement related methods.
  – *keyTyped, keyPressed, and keyReleased*
• Using **KeyPressed** Methods
  – Cannot be called directly
  – ONLY called via KeyListener interface
  – Using If statement to each key input
KeyPressed method

```java
public void keyPressed(KeyEvent e) {
    int keyCode = e.getKeyCode();
    System.out.println("pressed: "+keyCode);
    synchronized (keyLock) {
        keysDown.add(e.getKeyCode());
    }
    if (e.getKeyCode() == KeyEvent.VK_RIGHT ) {
        //Right arrow key code
        rx += 0.1;
    } else if (e.getKeyCode() == KeyEvent.VK_LEFT ) {
        //Left arrow key code
        rx -= 0.1;
    } else if (e.getKeyCode() == KeyEvent.VK_UP ) {
        //Up arrow key code
        ry += 0.1;
    } else if (e.getKeyCode() == KeyEvent.VK_DOWN ) {
        //Down arrow key code
        ry -= 0.1;
    }
}
```
Drawing ball and mouse input

• Similar to keyinput

• Using MouseListener
  – For mouse click/press/unpressed
    – mouseClicked, mouseEntered, mouseExited, mousePressed, mouseReleased, and mouseDragged

• Using MouseMotionListener
  – For mouse movement
    – mouseDragged and mouseMoved

• Let’s apply mouse input event on drawing ball
  – Make object follow mouse pointer!
N-Dimensional Array

• We know how to allocate 1-dim array
  \[-\text{int}\[\] \text{a} = \text{new int}[10];\]

• What if dim is greater than 1 like 2 or more?
• Attach more bracket to imply multi dimension
  \[-\text{int}\[\][\] \text{a2} = \text{new int}[10][10];\]
  \[-\text{int}\[\][\][\] \text{a3} = \text{new int}[10][10][10];\]
Sleep!

- Need to make time based event
- Use `Thread.sleep(<time_val>)` method with try-catch statement
import java.util.Date;

public class SleepTest {

    public static void main(String[] args) {
        Date date = new Date(); // To measure current time
        System.out.println("before.." + date.getTime());
        try {
            Thread.sleep(1000);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
        date = new Date(); // To measure current time
        System.out.println("End! " + date.getTime());
    }
}
Now, ready to make your program

- Design GUI using scratch paper (or ppt)
- Create image file (or download)
- Create game map using array
- Next?
Questions
References

• IBM