

# CSSE 220 Day 24

Multithreading

Checkout *Multithreading* project from SVN

# Exam results

Prob	P1	P2	P3	P4	P5	P6	P7	P8	C1	C2	PTot	Ctot	tot	percent
MAX	5	5	5	2	2	2	2	2	25	25	25	50	75	100
MEAN	3.2	4.3	2.8	1.6	1.9	1.5	1.6	1.6	23.4	12.4	18.5	35.8	54.3	72.4
MEDIAN	5.0	5.0	3.0	2.0	2.0	2.0	2.0	2.0	25.0	10.0	19.0	35.0	51.0	68.0
MEAN %	63.8	86.2	55.2	79.3	94.8	75.0	81.0	81.0	93.5	49.7	73.9	71.6	72.4	72.4
MEDIAN %	100.0	100.0	60.0	100.0	100.0	100.0	100.0	100.0	100.0	40.0	76.0	70.0	68.0	68.0

- ▶ A quick look at problems especially C2
- ▶ What questions do you have?

# Questions

# The World is Concurrent

»» Joe Armstrong,  
*Programming in Erlang*

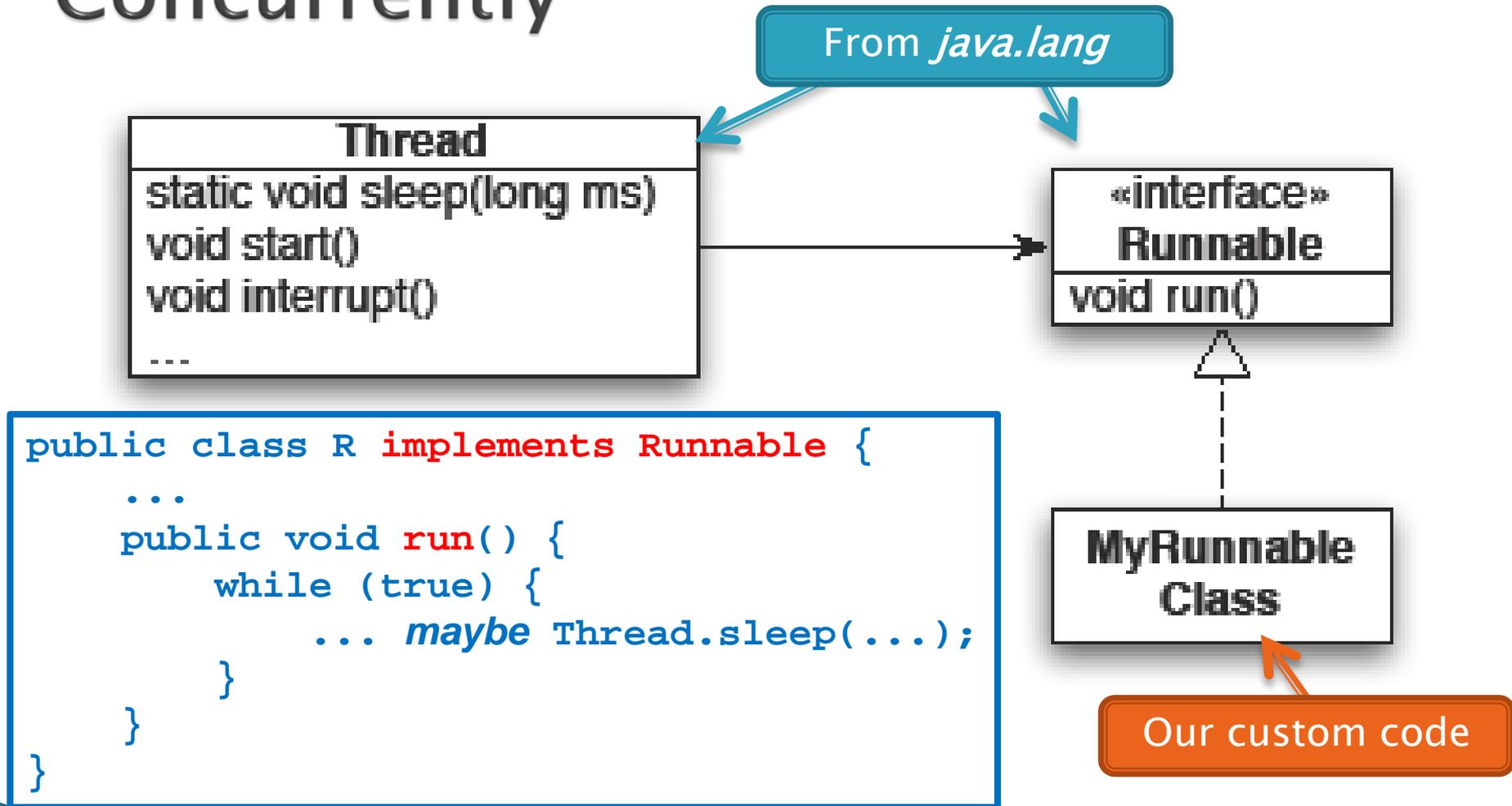
# Multithreading

- ▶ A technique to:
  - Run multiple pieces of code “simultaneously” on a single machine

Time → Slices	1	2	3	4	5	6	7	8	9	10	11	12	13	14
running thread 1	█	█	□	█	□	□	□	█	□	█	□	□	█	█
running thread 2	□	□	█	□	█	█	█	□	█	□	█	█	□	□

- Run different parts of a program on different processor cores

# Running Our Own Code Concurrently



Wherever you want to start the Thread:

```
new Thread(object of type R).start();
```

# Animation with Threads

- ▶ Example 1: A single object
  - “Animate” it with button clicks
  - Animate it with a Timer

```
Timer timer = new Timer(50, animatorButton);  
timer.start();
```

- Animate it by using a thread

```
public class R implements Runnable {  
    ...  
    public void run() {  
        while (true) {  
            ... maybe Thread.sleep(...);  
        }  
    }  
}
```

Wherever you want to start the Thread:

```
new Thread(object of type R).start();
```

# Animation with Threads

- ▶ Example 2: Multiple objects
  - Use separate thread for each object's "brain"
  - Another thread asks Java to update the GUI



# Other Uses for Threads

- ▶ Web servers: many users connecting
  - ▶ Desktop applications:
    - layout, spellchecking, auto-save, ...
  - ▶ Scientific computing
  - ▶ Weather forecasting
  - ▶ ...
- 

# Caution!

- ▶ What if one thread is in the middle of performing an action when its time slice ends?
- ▶ What if a second thread's action interferes with the first's action?
- ▶ See bank example in today's project

**Optional:** For a way to fix this, see Big Java Section 20.4

# Team Project

## »» Work time

*Be sure everyone is getting a chance to drive.*