Evaluating the Pros & Cons of Sequential Programming

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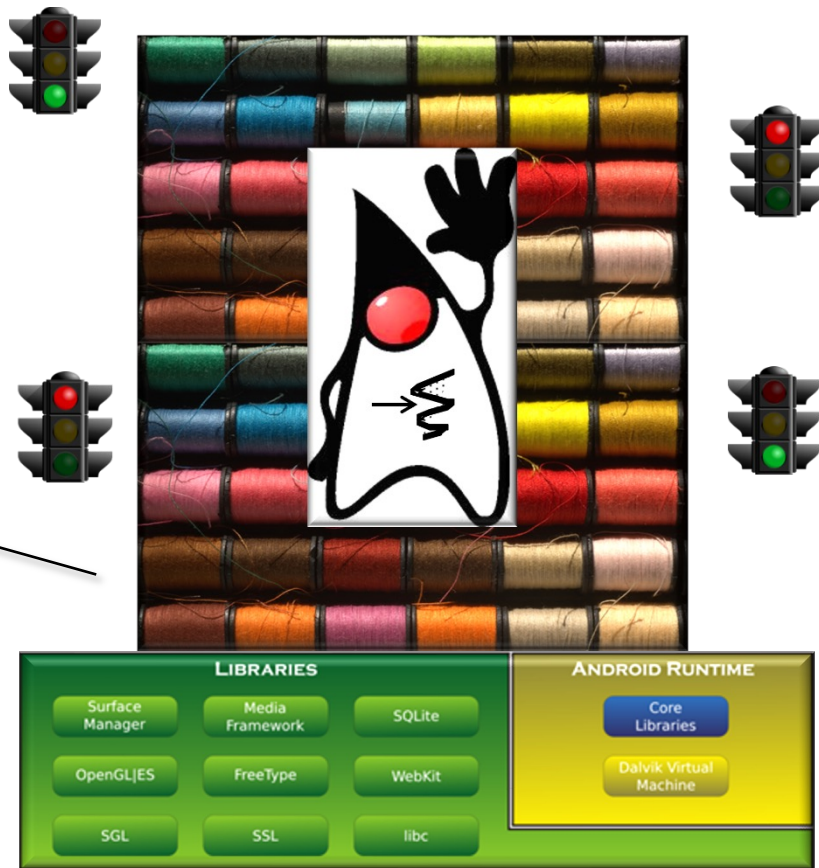
Learning Objectives in this Lesson

- Recognize the pros & cons of sequential programming

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- Recognize the pros & cons of sequential programming

Overcoming these 'cons' motivates our upcoming focus on concurrent & parallel programming techniques for the Java & Android platforms

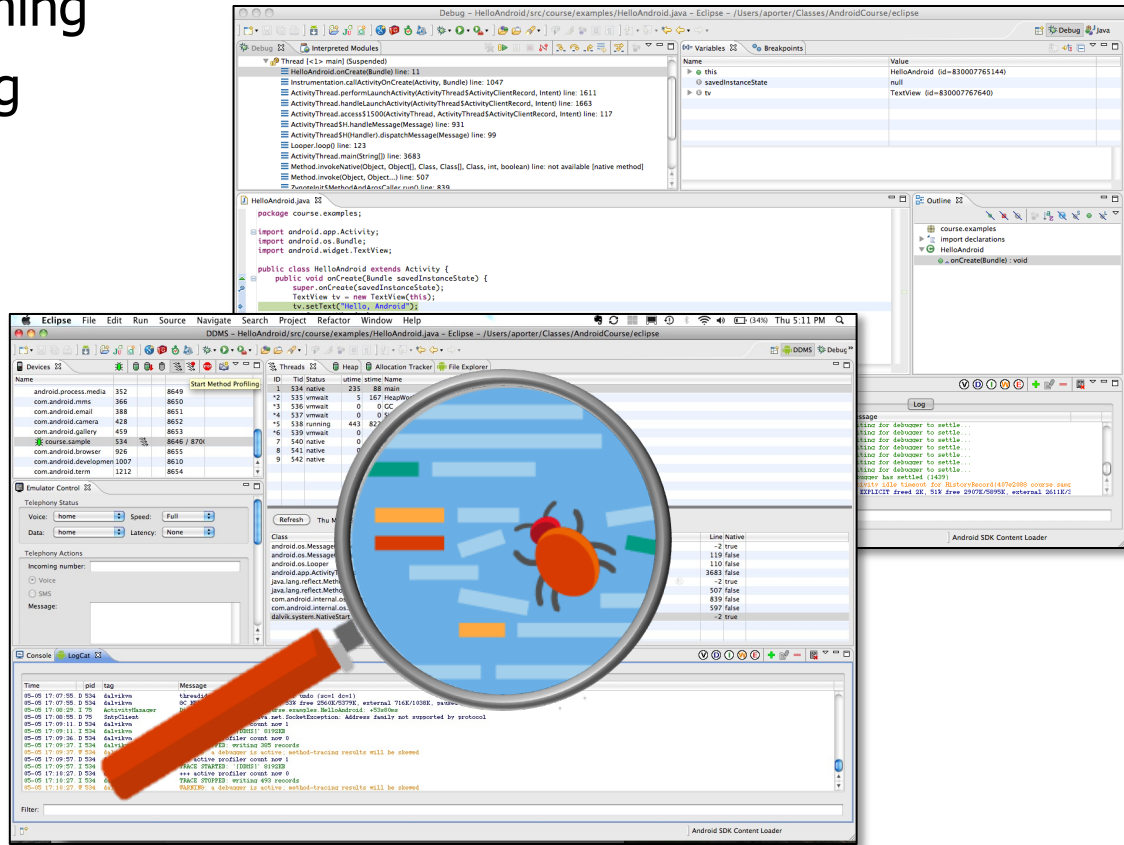# Evaluating the Pros & Cons of Sequential Programming

Evaluating the Pros & Cons of Sequential Programming

- Pros of sequential programming

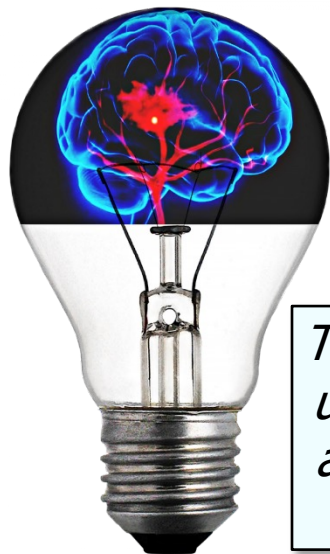# Evaluating the Pros & Cons of Sequential Programming

- Pros of sequential programming

  - Easier to program & debug

Compared with concurrent & parallel programs

Evaluating the Pros & Cons of Sequential Programming

- Pros of sequential programming
  - Easier to program & debug
    - "Intuitive" since it matches the steps expressed in algorithms

This selection sort can be understood by reading it as written, i.e., it has no "surprises" lurking here

```
int i, j, len = ...;

for (i = 0;
     i < len - 1;
     i++) {
  int min = i;

  for (j = i + 1;
       j < len;
       j++)
    if (a[j] < a[min])
      min = j;

  if (min != i)
    swap(a[i], a[min]);
}
```
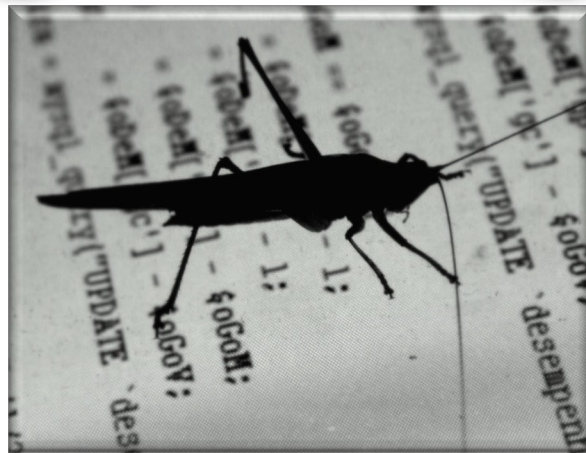
```
8
5
2
6
9
3
1
4
0
7
```

See en.wikipedia.org/wiki/Selection_sort

Evaluating the Pros & Cons of Sequential Programming

- Pros of sequential programming

  - Easier to program & debug

    - "Intuitive" since it matches the steps expressed in algorithms

    - The behavior in the debugger reflects actual program behavior

vs.

See

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- Pros of sequential programming

  - Easier to program & debug

    - "Intuitive" since it matches the steps expressed in algorithms

    - The behavior in the debugger reflects actual program behavior

      - Conversely, non-sequential programs often differ when run in a debugger vs. "in the wild"

These differences stem from perturbations in timing from the different execution contexts

See queue.acm.org/detail.cfm?id=1035623

Evaluating the Pros & Cons of Sequential Programming

- Pros of sequential programming
  - Easier to program & debug
  - Deterministic execution order simplifies reasoning about & assuring program behavior

See screenprism.com/insights/article/what-is-the-ludovico-technique-and-how-does-it-work
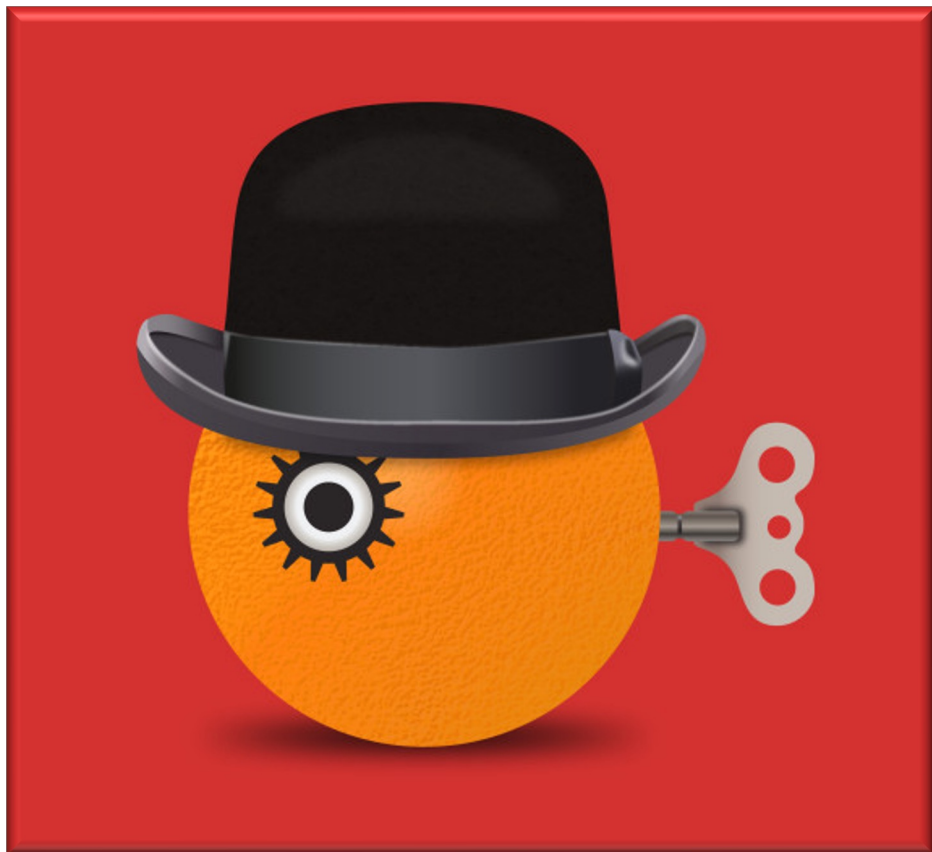
Evaluating the Pros & Cons of Sequential Programming

- Pros of sequential programming
  - Easier to program & debug
  - Deterministic execution order simplifies reasoning about & assuring program behavior
    - Especially for safety-critical cyber-physical systems

See en.wikipedia.org/wiki/Cyber-physical_system

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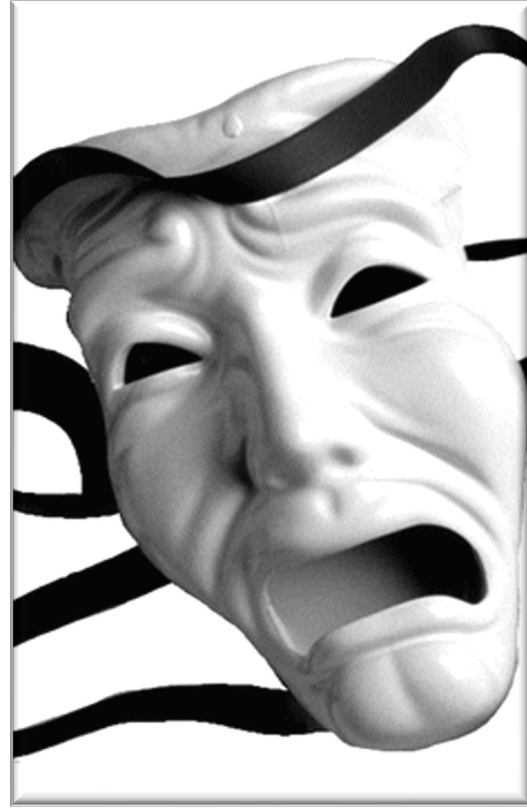
- Pros of sequential programming
  - Easier to program & debug
  - Deterministic execution order simplifies reasoning about & assuring program behavior
    - Especially for safety-critical cyber-physical systems

SELF-DRIVING CAR CRASH

Cyber-Physical Systems

The right answer delivered too late becomes the wrong answer

- Cons of sequential programming

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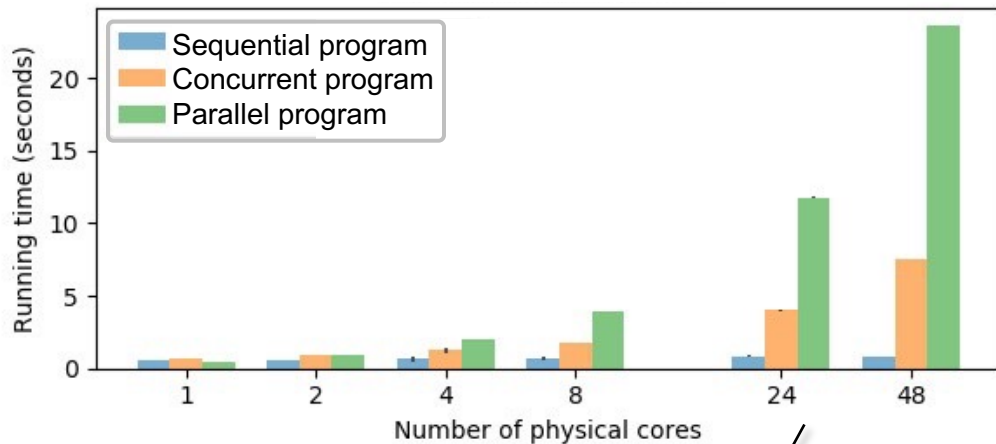
- Cons of sequential programming
  - Cannot leverage the parallelism available in multi-core systems

Multi-core Processor
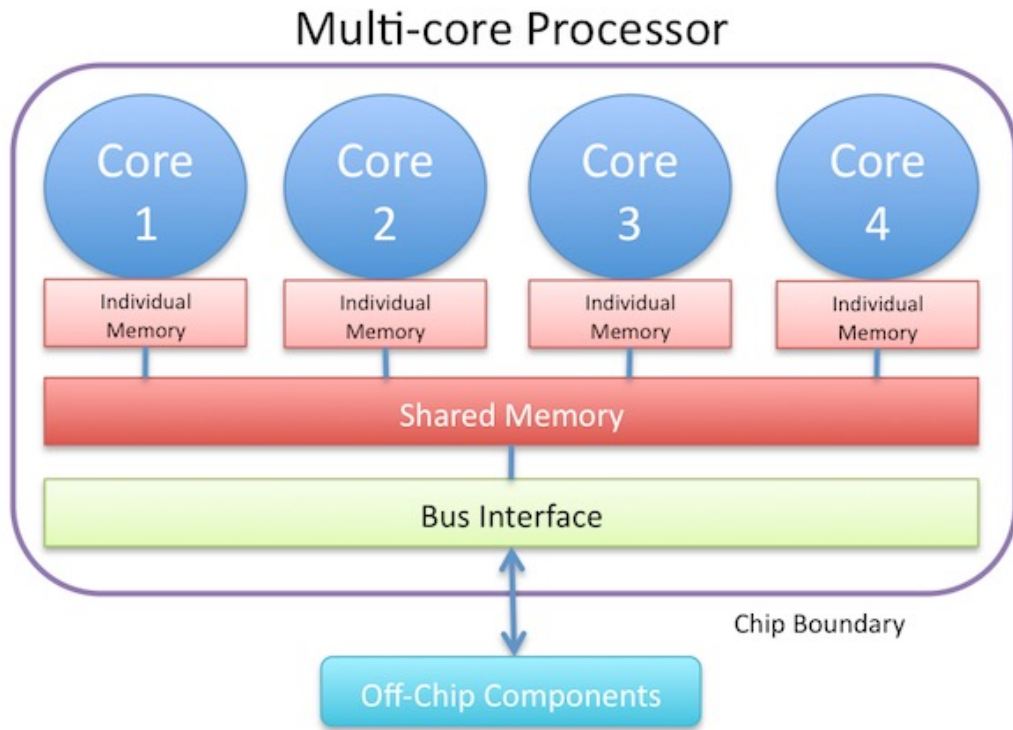
See en.wikipedia.org/wiki/Multi-core_processor

Evaluating the Pros & Cons of Sequential Programming

- Cons of sequential programming

  - Cannot leverage the parallelism available in multi-core systems

    - Performance may therefore suffer relative to concurrent & parallel programs
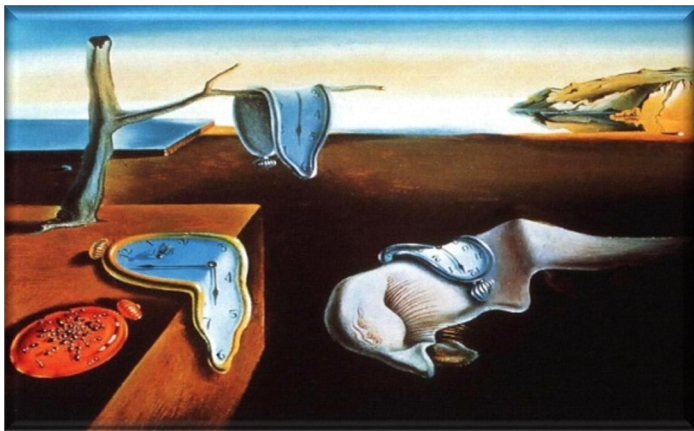
Well-written concurrent & parallel programs can leverage multi-core processors effectively

Evaluating the Pros & Cons of Sequential Programming

- Cons of sequential programming

  - Cannot leverage the parallelism available in multi-core systems

  - Responsiveness suffers when handling many I/O sources/sinks

e.g., mouse movement/clicks, touch events, GPS location signals, network connections, asynchronous storage read & write completions, etc.

See en.wikipedia.org/wiki/Responsiveness

Evaluating the Pros & Cons of Sequential Programming

- Cons of sequential programming

  - Cannot leverage the parallelism available in multi-core systems

  - Responsiveness suffers when handling many I/O sources/sinks

Having only a single thread of control complicates the structure of sequential programs for blocking operations

See en.wikipedia.org/wiki/Event-driven_programming

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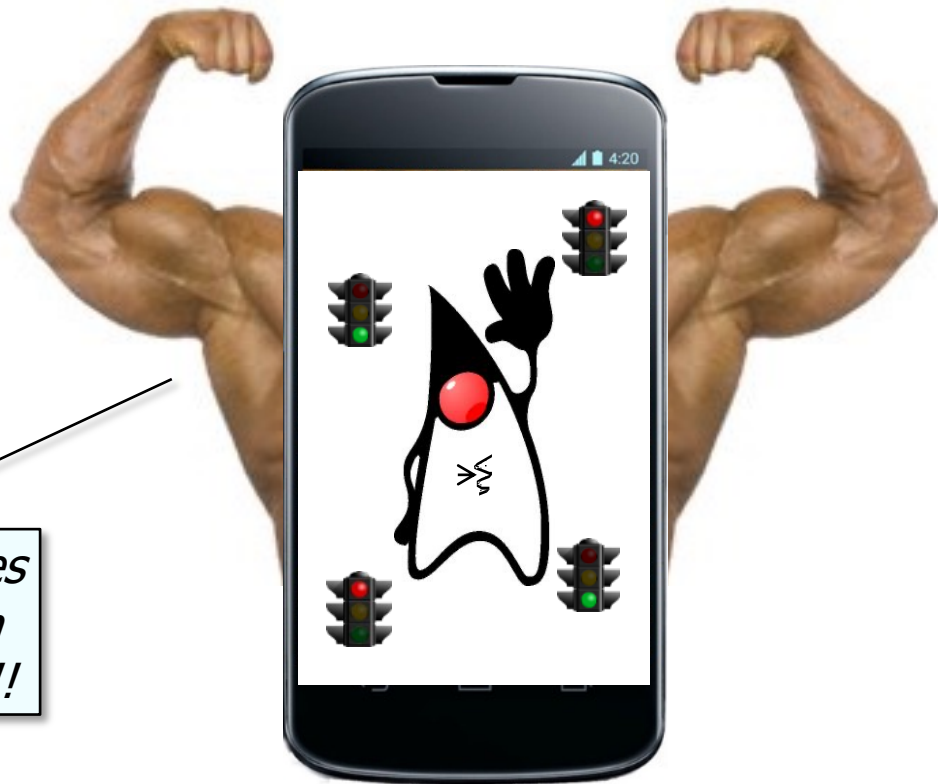 - Responsiveness suffers when handling many I/O sources/sinks

Overcoming these 'cons' motivates all the concurrency & parallelism topics that we cover henceforth!!!

End of Evaluating the Pros & Cons of Sequential Programming