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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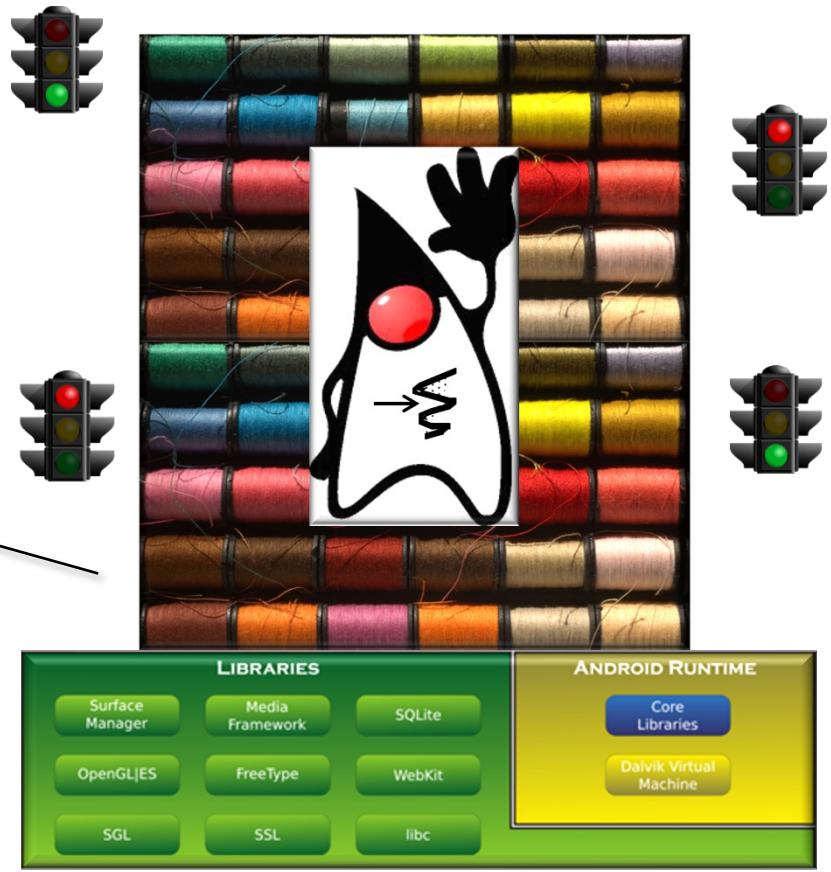
- Recognize the pros & cons of sequential programming

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



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- Pros of sequential programming

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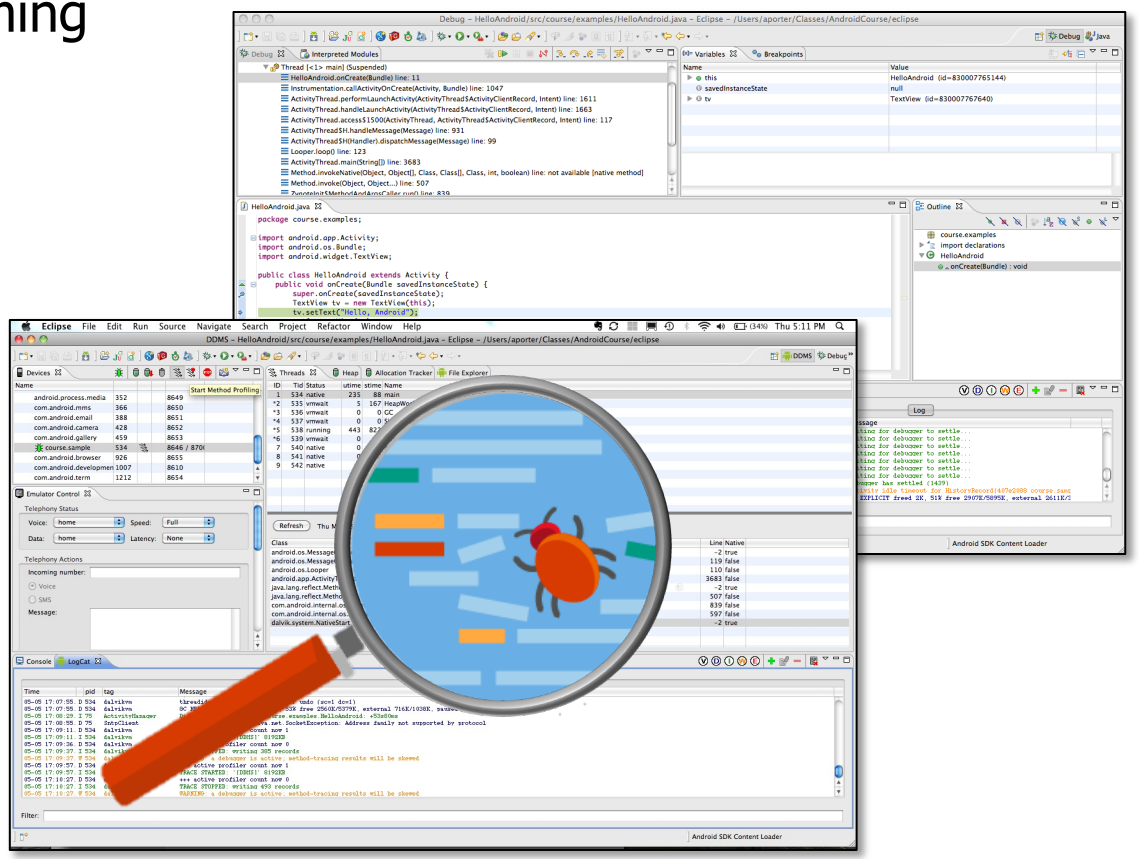
  - Easy to program & debug



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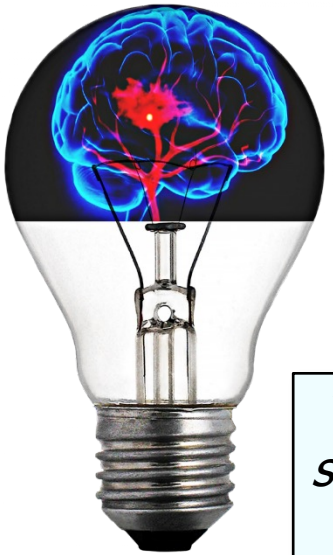
- Pros of sequential programming
  - Easy to program & debug
    - "Intuitive" since it matches the steps expressed in algorithms



This algorithm can be understood by reading it as written, i.e., there are no "surprises"

```
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 jeremymanson.blogspot.com/2007/08/atomicity-visibility-and-ordering.html

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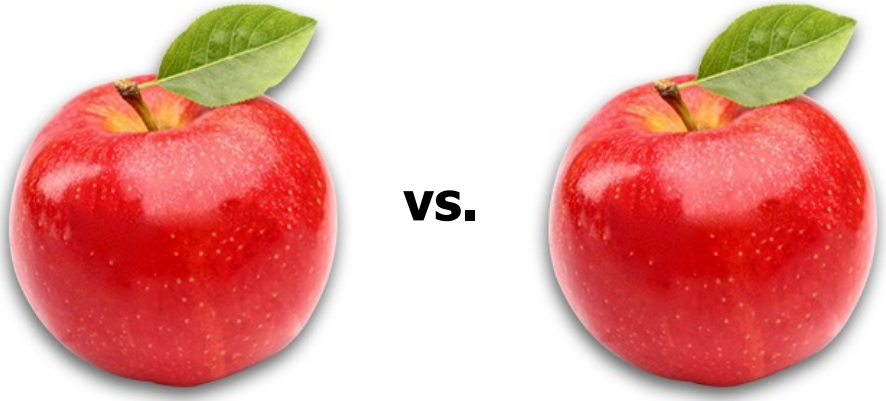
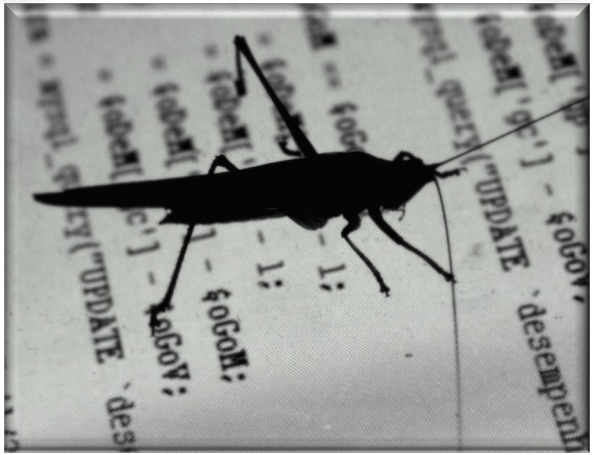
    - The behavior in the debugger reflects actual program behavior





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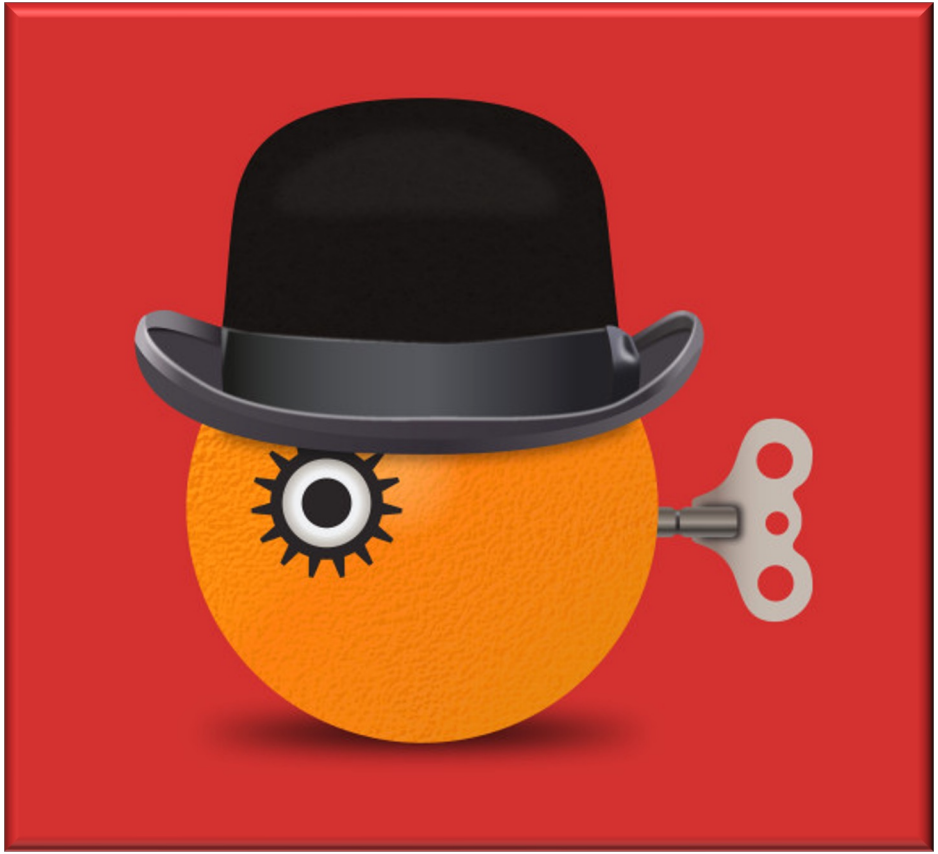
- Pros of sequential programming
  - Easy to program & debug
    - "Intuitive" since it matches the steps expressed in algorithms
    - The behavior in the debugger reflects actual program behavior
      - Conversely, the behavior of non-sequential programs often differ when run in a debugger vs. "in the wild"

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

Evaluating the Pros & Cons of Sequential Programming

- Pros of sequential programming
  - Easy 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
  - Easy 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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Cyber-Physical Systems

The right answer delivered too late becomes the wrong answer

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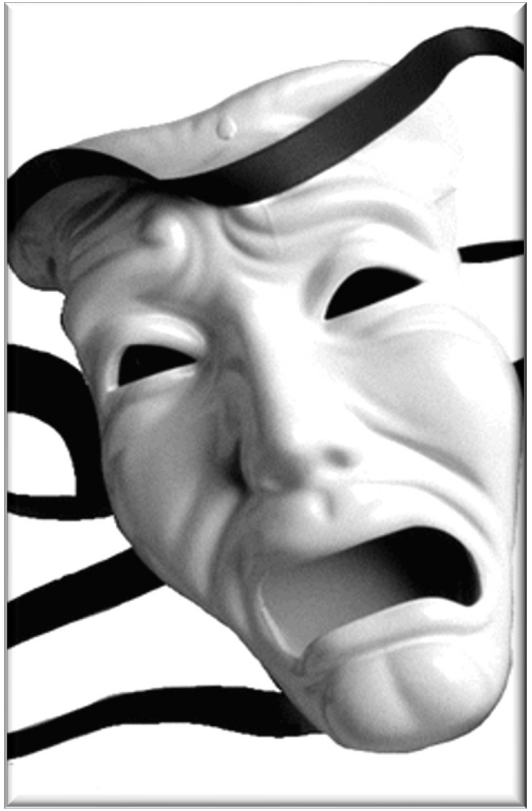
- Cons of sequential programming



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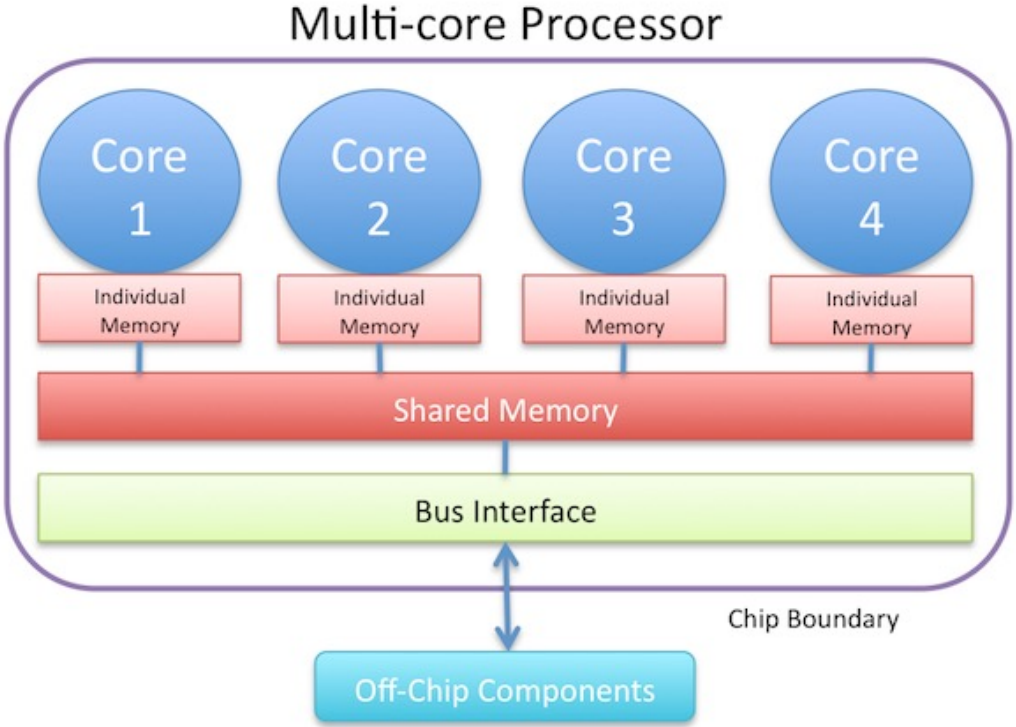
- Cons of sequential programming
  - Cannot leverage the parallelism available in multi-core systems



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

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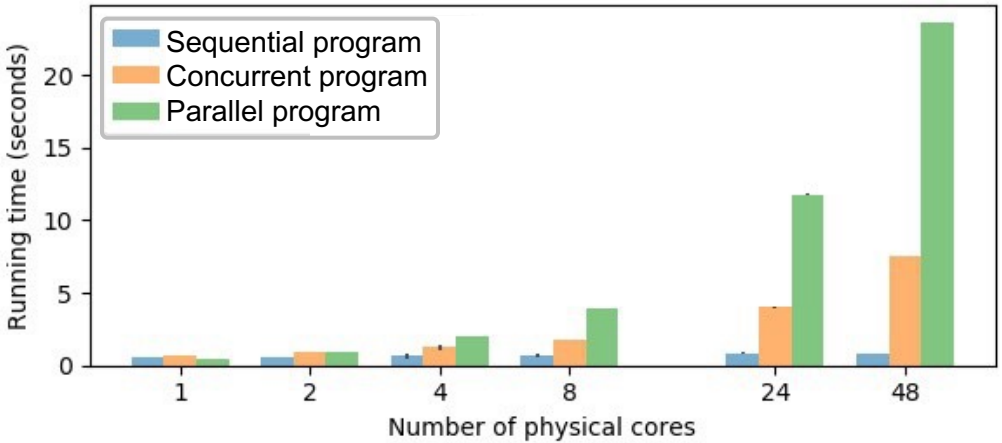
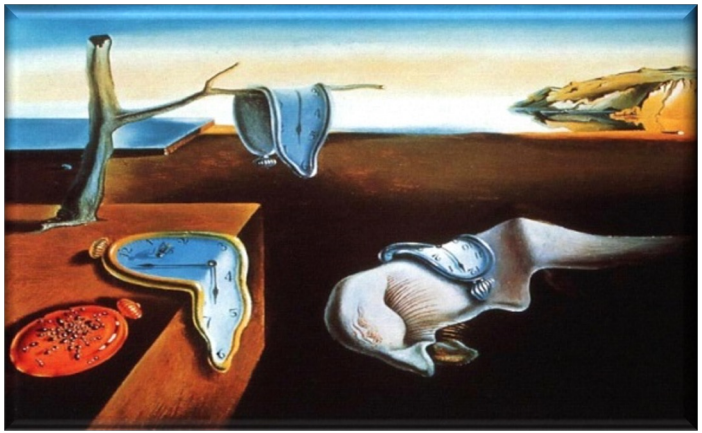
  - Cannot leverage the parallelism available in multi-core systems
    - Performance may therefore suffer relative to concurrent & parallel programs





Evaluating the Pros & Cons of Sequential Programming

- Cons of sequential programming
  - Cannot leverage the parallelism available in multi-core systems
  - It's hard to be responsive to multiple 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

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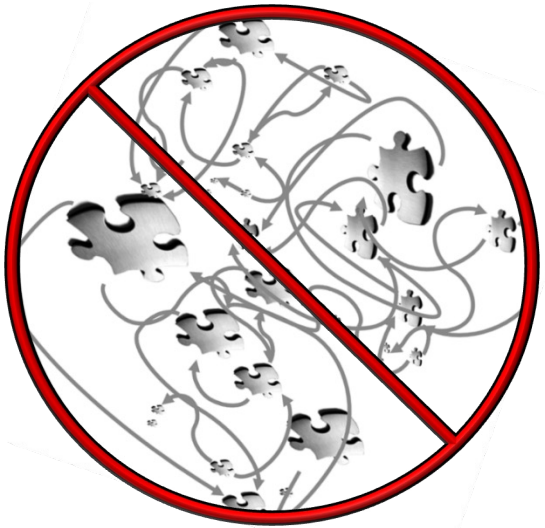

Having only a single thread of control complicates the structure of sequential programs for blocking operations

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

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  - It's hard to be responsive to multiple I/O sources/sinks

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

End of Evaluating the Pros & Cons of Sequential Programming