# 61A Lecture 36

Friday, December 6

# Announcements

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  - Recursion and recursive data
  - Iterators, generators, and streams

# Implicit Sequences Example

## Example: Numerical Approximations

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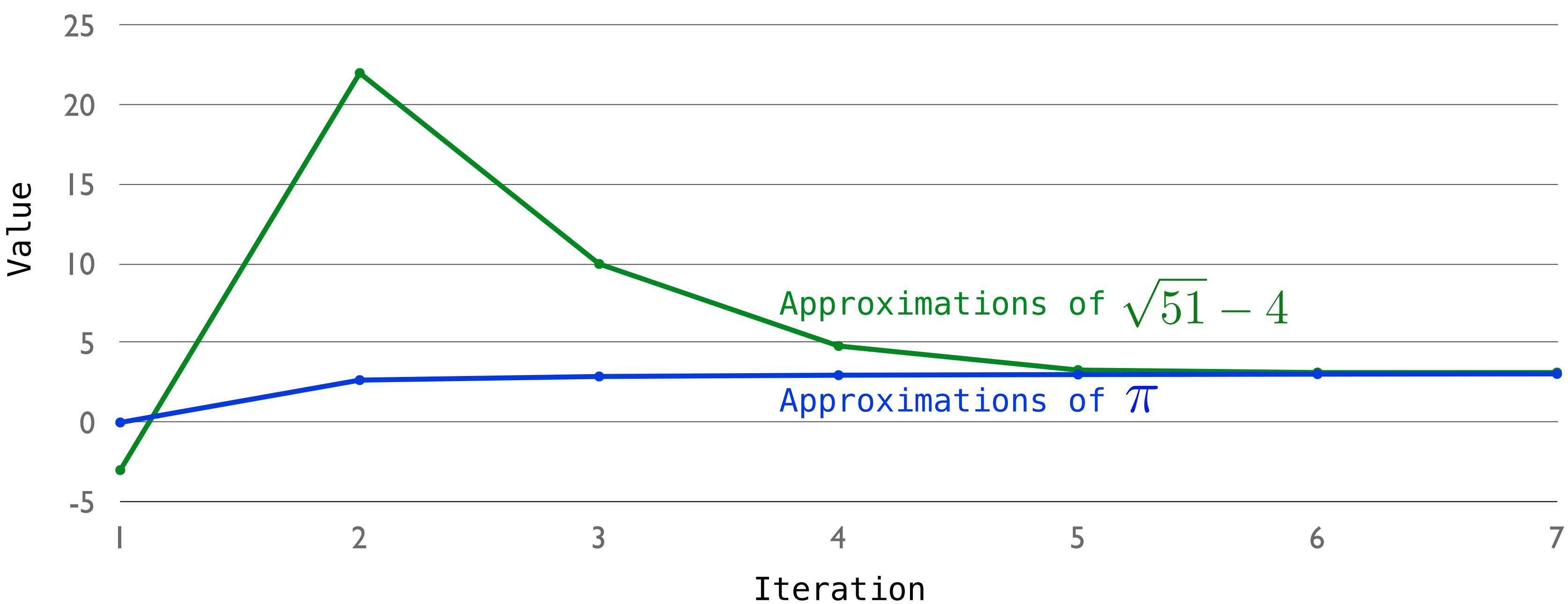

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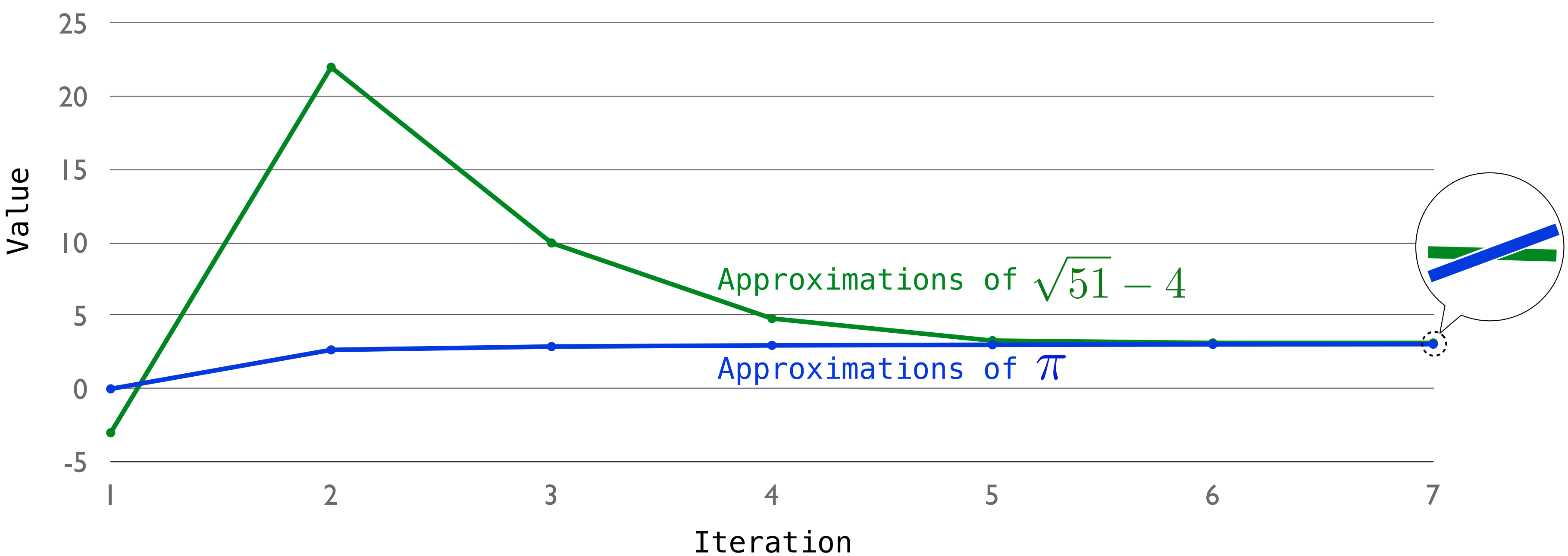

## Approximating Square Roots

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Implicitly define a SoA to $\sqrt{a}$ .

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How to compute square_root(a):

**Idea:** Iteratively refine a guess x about the square root of a.

$$x = \frac{x + \frac{a}{x}}{2}$$

***From lecture 6***

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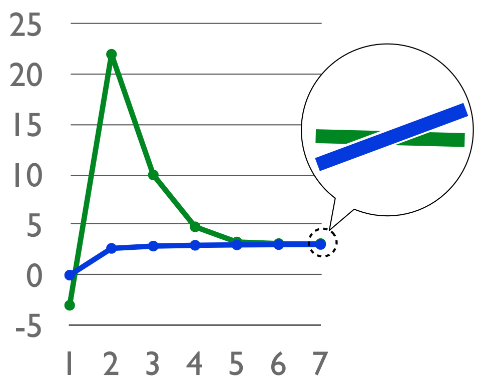

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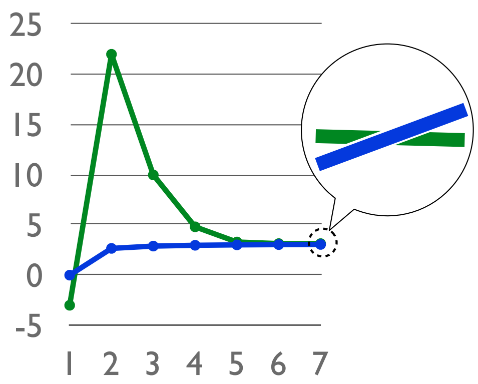

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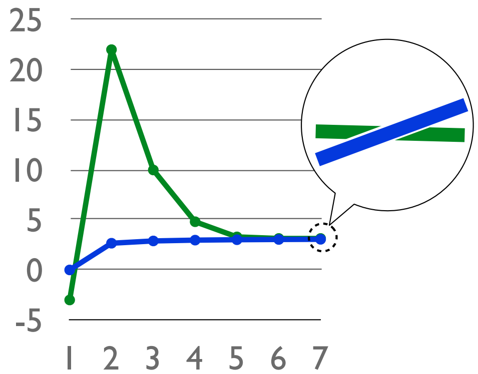

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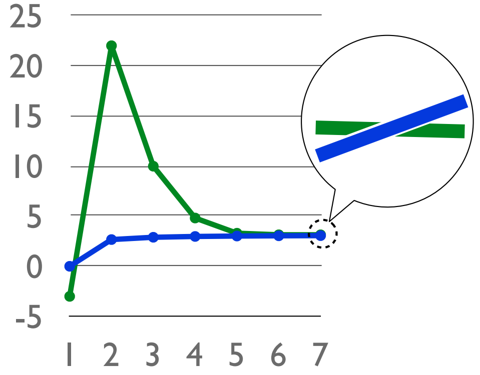

# Sequences of Approximation

Is $\sqrt{51} - 4$ < $\pi$ ? Is $\sqrt{51} - 4 - \pi$ < 0?

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>>> a = subtract(sqrt(51), four())
>>> less_than_0(subtract(a, pi()))
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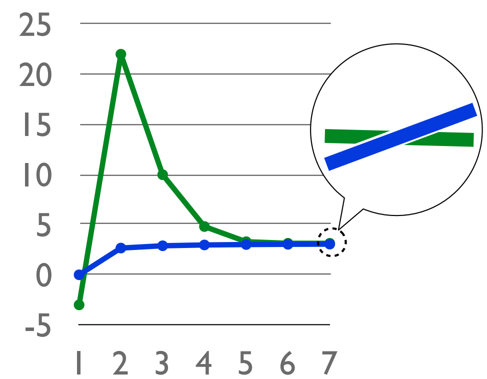

## Sequences of Approximation

Is $\sqrt{51} - 4$ < $\pi$ ? Is $\sqrt{51} - 4 - \pi$ < 0?

```
>>> a = subtract(sqrt(51), four())
>>> less_than_0(subtract(a, pi()))
```

```
def sqrt(a):
    x = 1
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        yield x
        x = (x + a/x)/2
```

```
def pi():
    total, k = 0, 1
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        total += 8/((4*k-3)*(4*k-1))
        k += 1
```

```
def four():
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def subtract(x, y):
    while True:
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```

(C) Assume that **s** is a SoA to **y** and each element of **s** is closer to **y** than the last.
Define less_than_0(s) that returns True if it is certain that **y** < 0.

```
def less_than_0(s):
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    while True:
        last, current = current, next(s)
        if ______________________________:
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```

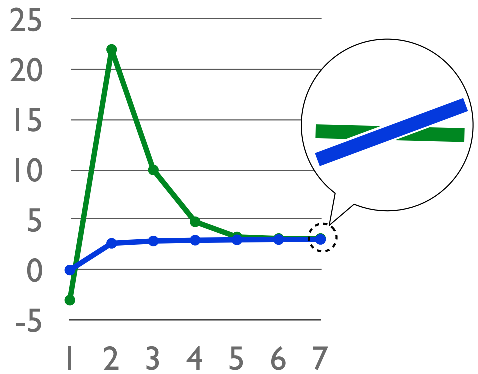

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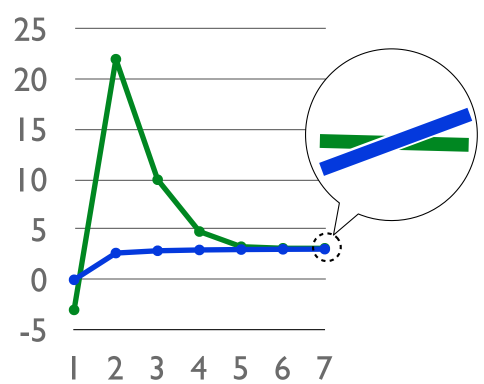

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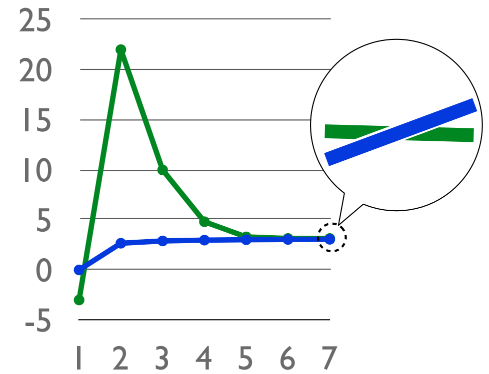
(Demo)



Computer Science

# 61A was Designed to Introduce the Big Ideas in Computer Science

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What are functions, data, sequences, trees, programs, languages, and interpreters.

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- *Artificial intelligence*
- *Lots of other subfields: graphics, theory, scientific computing, security, etc.*

Life

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- Contribute to the world.

Thanks for being amazing!

Please stay for the HKN survey.