Programming Mathematics as an Advanced Math Course

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MAA Mathfest
Portland, OR

Course Motivation

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Examples: complex numbers, Fractals

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Is a pre-req for Numerical Analysis courses

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MATLAB

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M,W: discuss mathematics and/or MATLAB syntax

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F: lab day and/or quiz day

Course Syllabus

Prerequisite: Intro to CS course

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Co-requisite: Intro. to Linear Algebra

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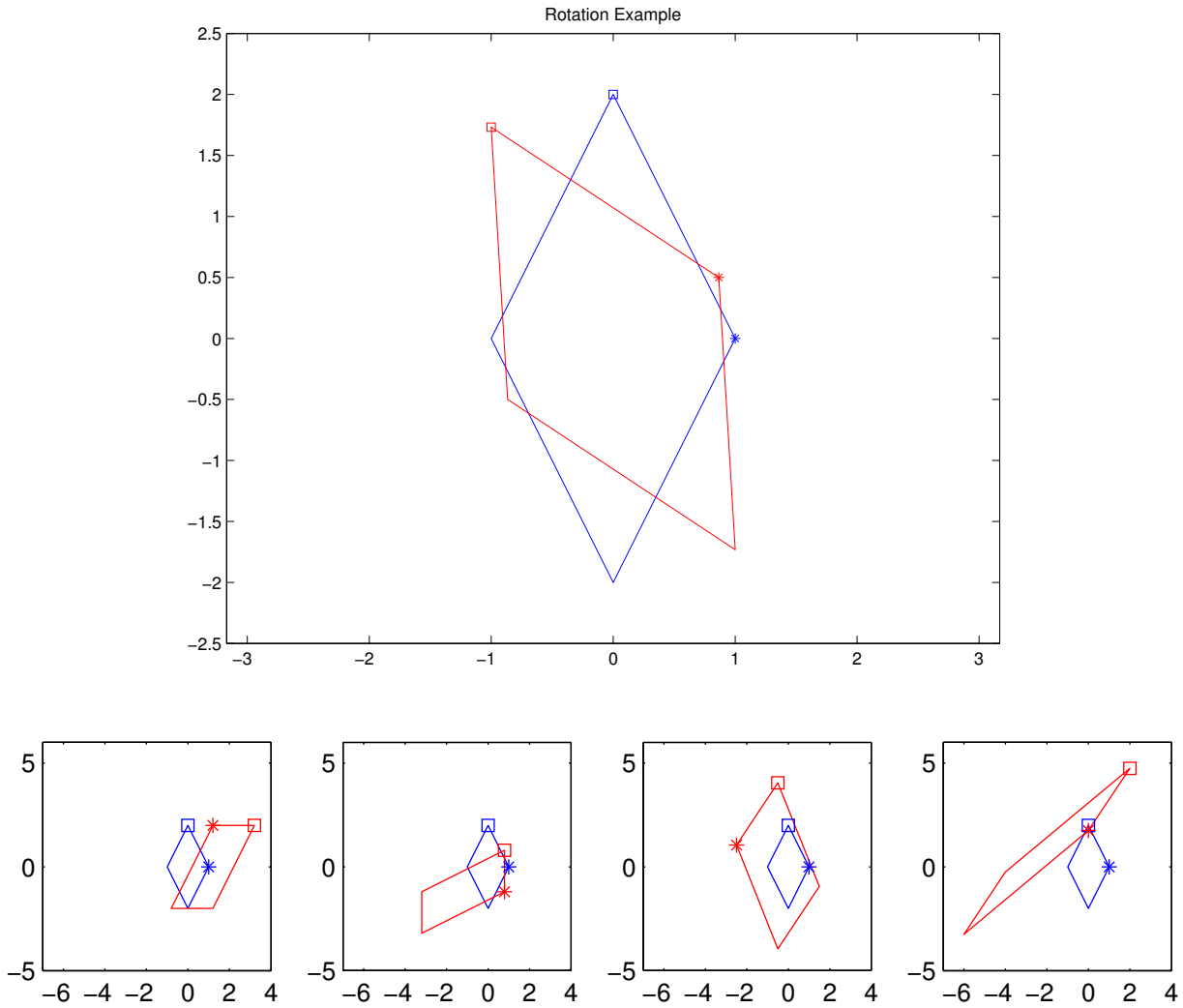
Quizzes (about every two weeks)	30%
Assignments (about 10 total)	40%
Final Project	30%

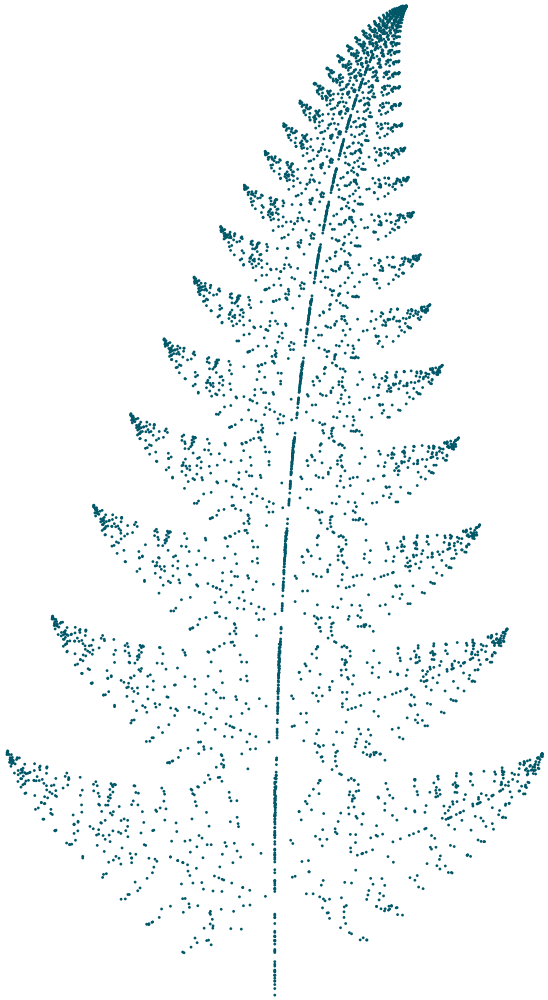
Final project: program(s), written report, and short presentation

Linear and Affine Transformations

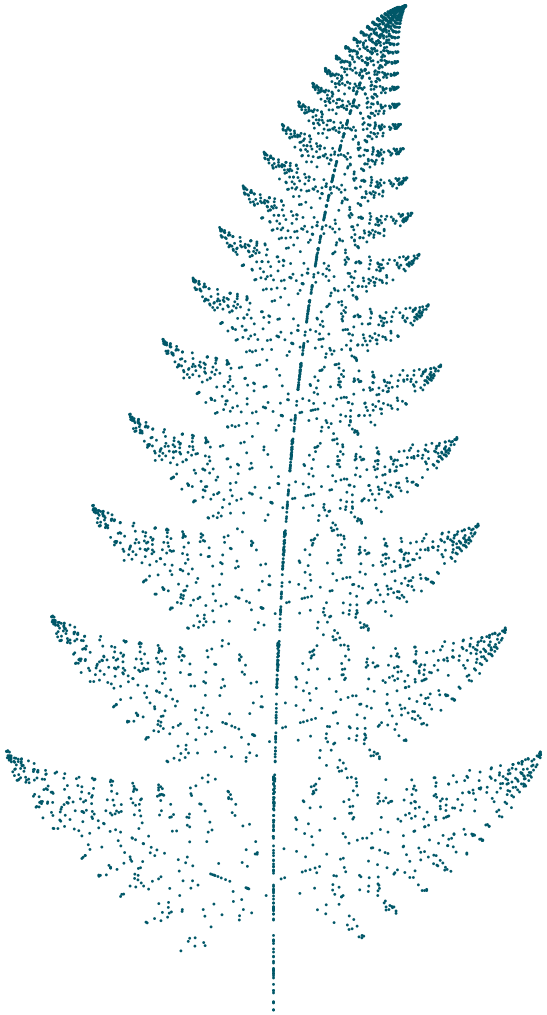


Fern Fractals and Code Improvement

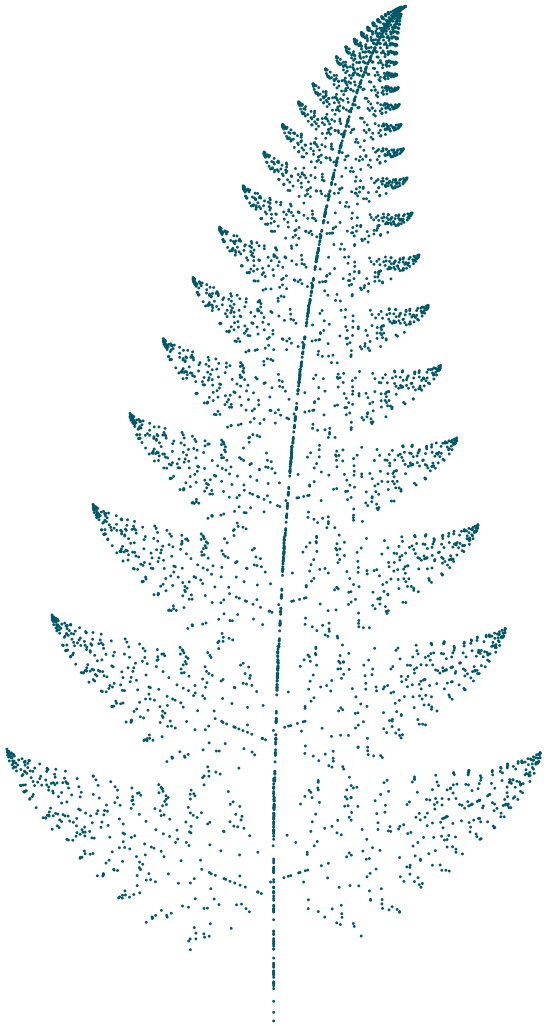
Fern 1 with n=5000 iterations
took 2.389344 seconds



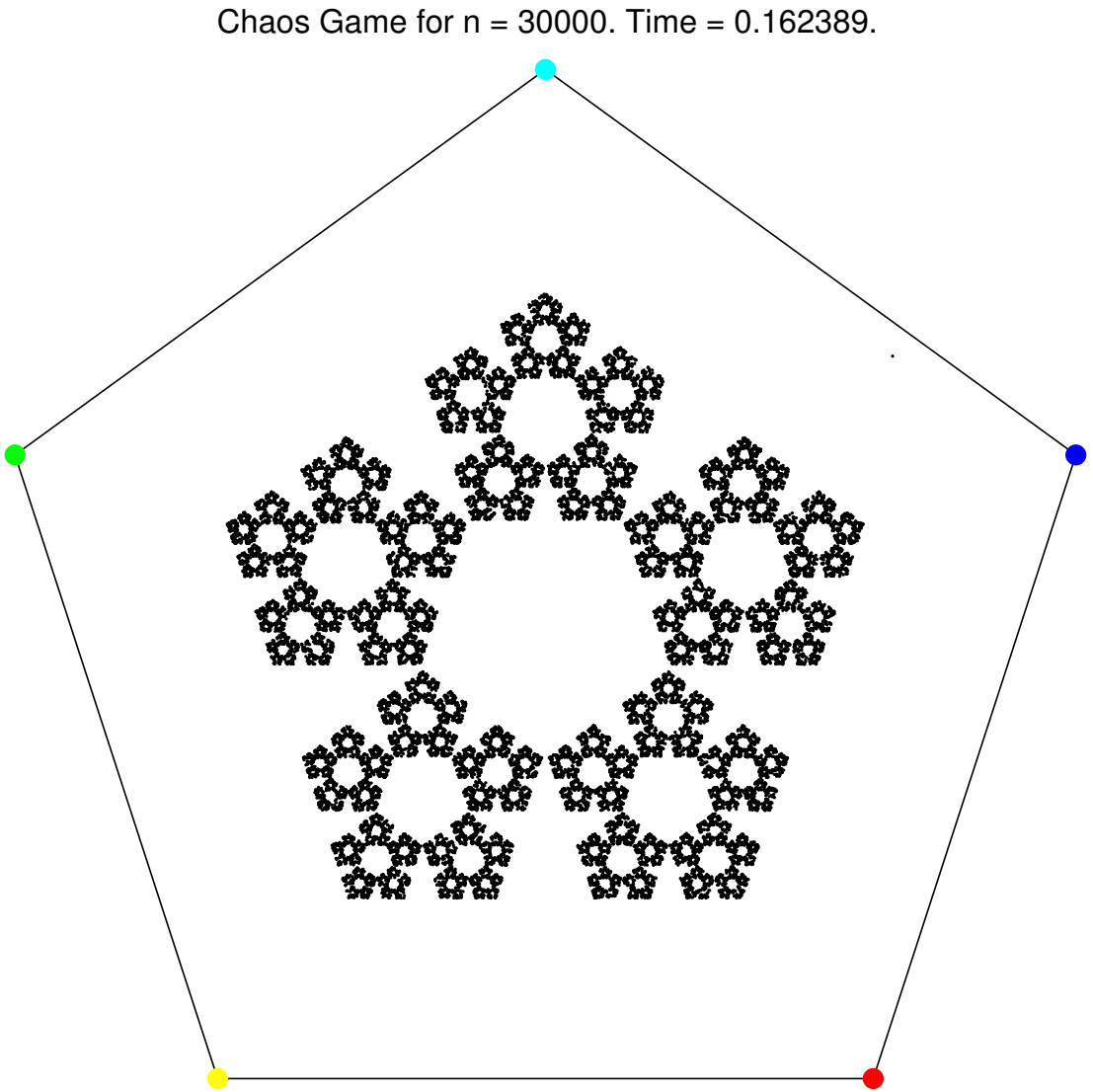
Fern 2 with n=5000 iterations
took 0.899850 seconds



Fern 3 with n=5000 iterations
took 0.022540 seconds

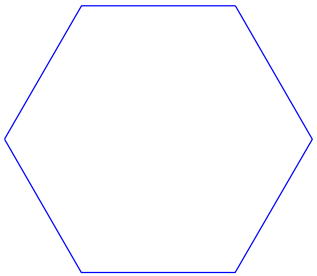


Complex Numbers and the Chaos Game

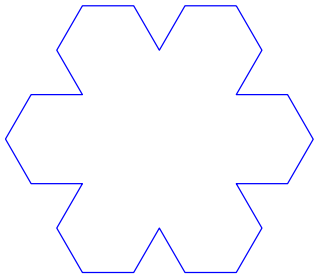


Fractal

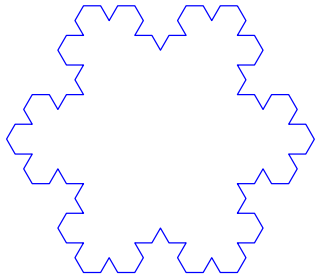
n = 0, 0.003208 s



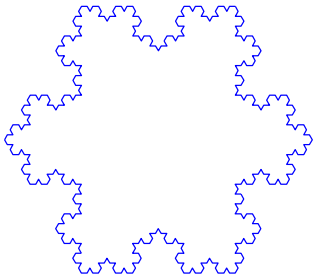
n = 1, 0.003566 s



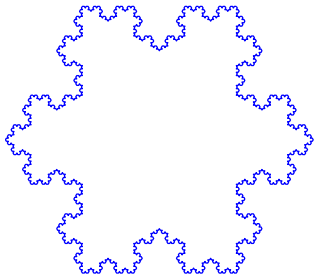
n = 2, 0.003675 s



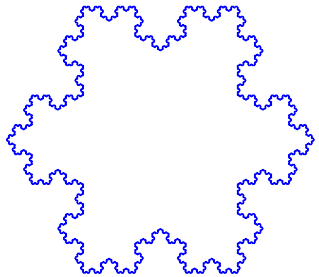
n = 3, 0.003483 s



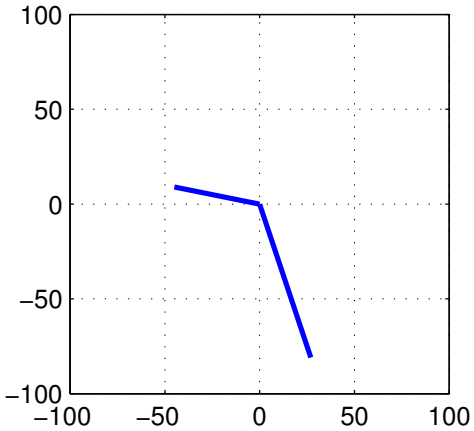
n = 4, 0.004863 s

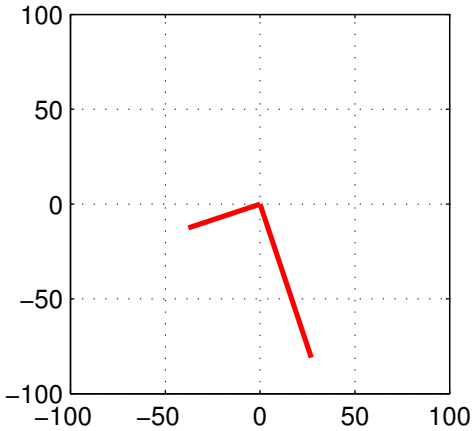


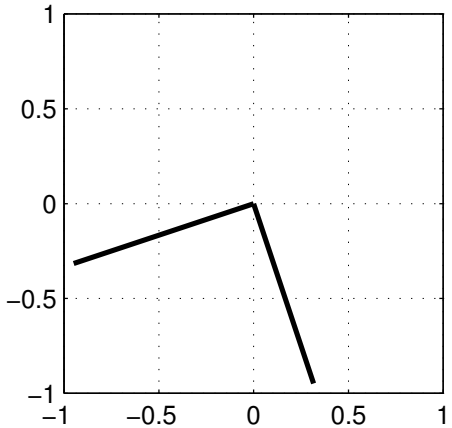
n = 5, 0.011567 s

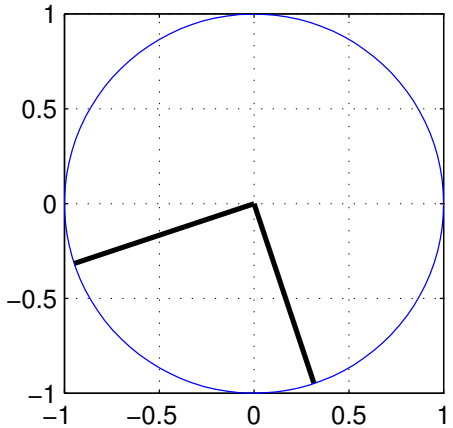


Gram-Schmidt Method









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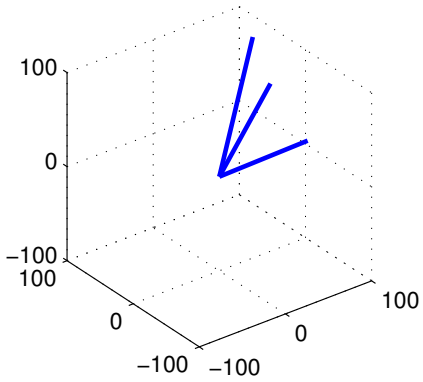

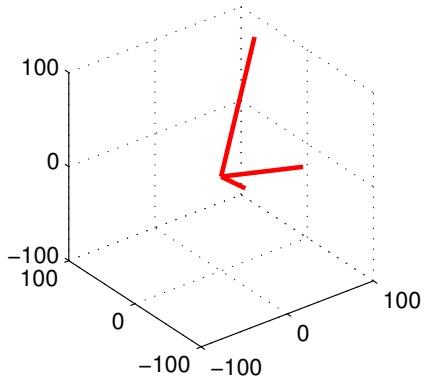

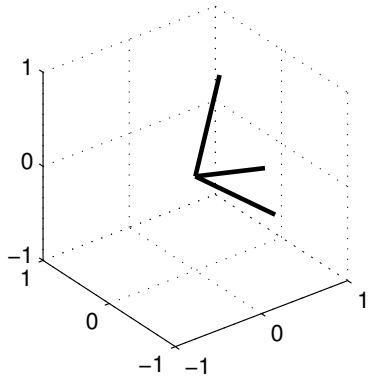

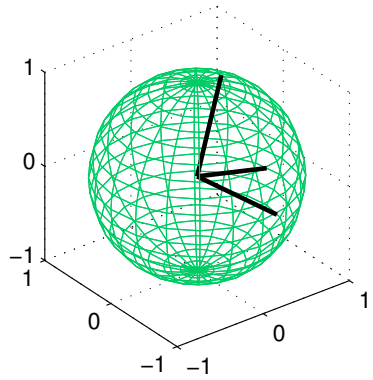

Final Projects

Students can choose from a list:

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- Ciphers (substitution and columnar transposition)
- Game of Pig
- Volumes of revolution demo
- Linearization and Newton's Method

Final Projects

Or come up with their own:

- Game simulations
  - blackjack
  - LCR
  - baseball
  - hangman
  - Sudoku
- RSA Encryption
- Image reading and distortion
- Sorting algorithms
- Practice game of Set

General Feedback

- More interest from employers (internships and job offers)

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- More interest from employers (internships and job offers)
- REUs and summer research
- More programming in other courses
- Better appreciation/understanding of the mathematics

Student Feedback

"Allowed us to use creativity"

"Skills can be used in the future"

"We completed a variety of projects which were relevant to the math knowledge I have"

"The graphs (especially for Riemann sums, fractals) actually furthered my understanding b/c I was able to visualize the concepts"

Thank you!

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