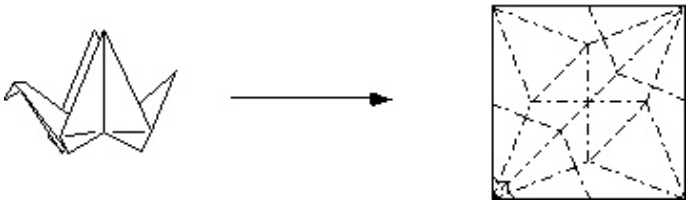
Exploring Mathematics through Origami

Spring 2025

Mentor:	Evuilynn Nguyen	**Email:**	evtnguyen@ucdavis.edu
Time:	TBD	**Place:**	MSB: Room TBD

Description: This seminar will explore mathematical concepts using the Japanese art of paper folding, origami. We will demonstrate how paper folding can be used to visualize and solve geometric and algebraic problems. Students will learn fundamental origami techniques, explore mathematical concepts, and discover real world applications of origami in science and engineering. Each week combines theory with hands-on activities, culminating in a final show and tell where students show off an origami model that interested them mathematically.



Prerequisites: None.
Texts: No text will be required. Students may be asked to watch a video or read a brief article in which case the resources will be provided.

Learning Objectives:

- Students will learn to fold basic origami models.
- Students will develop an understanding and appreciation of basic geometric topics.
- Students will be able to analyze an origami model from a mathematical perspective.
- Students will develop an appreciation for mathematics at the intersection of science, engineering, and art.

Expectations:

- The necessary materials for origami constructions will be provided but students are welcome to bring their own paper, rulers, and/or protractors.
- Students should actively participate in meetings and be willing to work with other students as some models will require collaboration.
- Students may be asked to watch a video or read a brief article outside of weekly meetings, but very little time commitment outside of meetings is required.
- Students are encouraged to ask questions and share observations.
- Students will be expected to present an origami model that interested them mathematically or artistically at the last meeting. Student must construct this model on their own time and it can be of any level of difficulty. However, students will be expected to explain why their model interested them.

Course Outline: Topics and pacing may be modified according to students' interests. If necessary, one meeting may be skipped.

- Meeting 1:
  - Introductions
  - History and Motivation of Origami
  - Basic folds
- Meeting 2:
  - Symmetry
  - Exploring properties of polygons and polyhedrons
- Meeting 3:
  - Huzita's Axioms
  - Angle Trisection Problem
  - Solving cubic equations using paper folds
- Meeting 4:
  - Graphs and graph colorings
  - Computational origami
- Meeting 5:
  - Flat vertex models
  - Impossible crease patterns
  - Maekawa Theorem and Kawasaki Theorem
- Meeting 6:
  - Self Similarity
  - Fractals
- Meeting 7:
  - Tessellations
  - Miura folds
- Meeting 8:
  - Hamiltonian cycles using Buckyball constructions
  - OR Combinatorics and Burnside's Theorem using the Square Twist (group theory not required)
- Meeting 9:
  - If necessary, continuation of previous meeting's activity.
  - Recap of learned topics
  - Show and tell