

# UAF DMS Guidelines for

## MATH 114X –Patterns and Society

Across all sections of Math 114X offered by UAF campuses (delivered in person or online), all syllabi must minimally satisfy the following requirements.

**Note: This course meets 1 hour per day 3 days a week (or should be set up for equivalent “class” time).**

1. General guidelines set by UAF; follow this link to the [UAF syllabus requirements](#)
2. GER Information (sample statement below):

This course is listed as a General Education Math Course as such this course is expected to meet the general learning outcomes 1 and 2.

1. Build knowledge of human institutions, sociocultural processes, and the physical and natural works through the study of mathematics. Competence will be demonstrated for the foundational information in each subject area, its context and significance, and the methods used in advancing each.
2. Develop intellectual and practical skills across the curriculum, including inquiry and analysis, critical and creative thinking, problem solving, written and oral communication, information literacy, technological competence, and collaborative learning. Proficiency will be demonstrated across the curriculum through critical analysis of proffered information, well-reasoned solutions to problems or inferences drawn from evidence, effective written and oral communication, and satisfactory outcomes of group projects.

3. Text: Excursions in Mathematics by Tannenbaum, 9<sup>th</sup> Edition

- Chapter 3: 3.1-3.6 (r)
- Chapter 4: 4.1-4.4 (r)
- Chapter 5: 5.1-5.4 (r)
- Chapter 6: 6.1-6.5 (r)
- Chapter 7: 7.1-7.3 (r)
- Chapter 8: 8.1-8.5 (r)
- Chapter 11: 11.1-11.7 (r)
- Chapter 12: 12.1-12.4 (r)
- Chapter 13: 13.1-13.4 (r)

4. Timing of material

For each of the following, the minimum time spent on the sections is listed.

This is a suggested outline with Mastery Assessments (score of 80% minimum) and comprehensive Final Exam.

Section Topic Approx. timing

3.1 Fair Division Games	1 day
3.2 The Divider-Chooser Method	1 day
3.3 The Lone-Divider Method	1 day
3.4 The Lone-Chooser Method	1 day
3.5 The Method of Sealed Bids	1 day
3.6 The Method of Markers	1 day
4.1 Apportionment Problems and Apportionment Methods	1 day
4.2 Hamilton’s Method	1 day
4.3 Jefferson’s Method	1 day
4.4 Adam’s and Webster’s Methods	1 day
4.5 The Huntington-Hill Method	1 day
4.6 The Quota Rule and Apportionment Paradoxes	1 day

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### Exam over Chapters 3 and 4

5.1 Street-Routing Problems	1 day
5.2 An Introduction to Graphs	1 day
5.3 Euler's Theorems and Fleury's Algorithm	1 day
5.4 Eulerizing and Semi-Eulerizing Graph	1 day
6.1 What is a Traveling Salesman Problem?	1 day
6.2 Hamilton Paths and Circuits	1 day
6.3 The Brute-Force Algorithm	1 day
6.4 The Nearest-Neighbor and Repetitive Nearest-Neighbor Algorithms	1 day
6.5 The Cheapest-Link Algorithm	1 day

### Exam over Chapters 5 and 6

7.1 Networks and Trees	1 day
7.2 Spanning Trees, MSTs and MaxSTs	1 day
7.3 Kruskal's Algorithm	1 day
8.1 An Introduction to Scheduling	1 day
8.2 Directed Graphs	1 day
8.3 Priority-List Scheduling	1 day
8.4 The Decreasing-Time Algorithm	1 day
8.5 Critical Paths and the Critical Path Algorithm	1 day

### Exam over Chapters 7 and 8

11.1 Rigid Motions	½ day
11.2 Reflections	½ day
11.3 Rotations	½ day
11.4 Translations	½ day
11.5 Glide Reflections	1 day
11.6 Symmetries and Symmetry Types	1 day
11.7 Patterns	1 day
12.1 The Koch Snowflake and Self-Similarity	1 day
12.2 The Sierpinski Gasket and the Chaos Game	1 day
12.3 The Twisted Sierpinski Gasket	1 day
12.4 The Mandelbrot Set	1 day
13.1 Fibonacci Numbers	1 day
13.2 The Golden Ratio	1 day
13.3 Gnomons	1 day
13.4 Spiral Growth in Nature	1 day

### Exam over Chapters 16 and 17

Final Exam or Project

## 5. Types of Assessments

- Exams
  - at least three exams during the semester
  - exams must be proctored and timed
  - use of non-graphing calculators are allowed in this course
  - exams must be majority written answer (not multiple choice)
  - exams must be paper-and-pencil exams, written and graded by faculty members
  - exams should not be reused from previous semesters, limited reuse of edited problems is acceptable
- Final Exam or Project
- Other Assessed Work
  - for online work through MyMathLab, mastery level (if used) should be no less than 75%
  - instructors should provide written feedback to students approximately weekly throughout the semester; this can be through humanly-graded assignments or email correspondence

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### 6. Grading Policy

- The syllabus must include a grading scale of some form.
- Plus/minus grading is at the discretion of the instructor, but must be stated explicitly.
- Withdrawal and Incomplete policies must be stated explicitly.
- The final grade in this course must adhere to the following:
  - Written Assessed Work at least 15% and at most 30%
  - MyMathLab at least 10% and at most 20%
  - Exams at least 40%
  - Final or Project at least 15%

### 7. Tutoring Services

DMS Math and Stat Lab: If you need extra math help, there is free tutoring available. The Math and Stat Lab is located in CHAP 305 and is staffed by Math Graduate students, upper-division Math students and Math faculty. This lab operates on a walk-in basis and schedules are posted that provide tutor times.

DMS One-on-one Tutoring: Free tutoring by appointment. This service is available to any UAF student registered in a core MATH course. Tutoring is available in CHAP 210. Appointments can be made for 30 minutes or an hour and can be scheduled up to two weeks in advance. Students can sign up for an appointment at <https://fairbanks.go-redrock.com>

DMS Online Tutoring: Free tutoring available Monday - Saturday! This service is available to any UAF student registered in a MATH or STAT course. Tutoring is accessible through Zoom. Appointments can be made for 30 minutes or an hour and can be scheduled up to two weeks in advance. To schedule an appointment students can sign up for an appointment at <https://fairbanks.go-redrock.com>

## Assessment Criteria

Midterm Exams in this course should demonstrate the students' acquired knowledge of the following main topics.

- Problem Solving Skills
  - Developing and carrying out a solution path for non-routine problems
  - Explaining, reasoning, or justifying a solutions
- Manipulation of Abstract Symbols
  - Use appropriate notation
  - Summarizing procedures with appropriate formulas
- Fair Division
  - Correctly identify shares using different methods
  - Correctly identify fair divisions using different methods
- Apportionment
  - Identify standard divisors, standard quotas, populations
  - Differentiate between the different methods: Hamilton, Jefferson, Adams, Webster, Huntington-Hill
  - Understand the quota rule and paradoxes
- Euler Paths and Circuits
  - Modeling with graphs
  - Graph theory terminology
  - Identify paths/circuits
  - Identify Euler path/circuits
  - Use Euler's theorems/ Fleury's Algorithm
  - Eulerize/Semi-eulerize a graph
- Hamilton Paths and Circuits
  - Modeling with graphs
  - Identify Hamilton paths/circuits

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- Count Hamilton paths and circuits on a complete graph
  - Use Brute-Force, Nearest-Neighbor, Repetitive Nearest-Neighbor, and Cheapest-Link Algorithms
- Trees
  - Modeling with graphs/networks
  - Identify and draw trees and spanning trees
  - Count spanning trees in a graph
  - Use Kruskal's Algorithm to find MST or MaxST
- Scheduling
  - Understand terminology
  - Draw digraphs and project digraphs
  - Identify paths/cycles on a digraph
  - Schedule tasks using the different algorithms
- Symmetry
  - Differentiate between reflections, rotations, translations, and glide reflections
  - Identify symmetries of an object
  - Understand patterns
- Fractal Geometry
  - Construct a Koch snowflake and its variations
  - Construct a Sierpinski Gasket and box fractals
  - Calculate terms of the Mandelbrot sequence using complex numbers
- Fibonacci Numbers and the Golden Ratio
  - Calculate Fibonacci numbers/Fibonacci-like sequences
  - Solve a quadratic equation
  - Use the Golden Ratio to calculate values
  - Use similarity to find gnomons

For a project in this course students should show an understanding of how mathematics is used in everyday life or show how it is used in a particular application to the student's field of study.