

UAF & DMS SYLLABUS GUIDELINES FOR MATH113X – CONCEPTS AND CONTEMPORARY APPLICATIONS OF MATHEMATICS

Across all sections of MATH113X offered by UAF campuses (delivered in-person or online), all syllabi must satisfy the following requirements.

1. General guidelines set by UAF; follow this link to [UAF syllabus requirements](#)

2. Content

- *Excursions in Mathematics* by Tannenbaum (2014), 8th edition is the textbook adopted by DMS and must be used for the course.
- All of the required (r) sections from the textbook listed below must be covered. Optional (o) topics should be considered as time permits.
 - Chapter 1: The Mathematics of Elections: 1.1-1.6 (r)
 - Chapter 2: The Mathematics of Power: 2.1-2.4 (r)
 - Chapter 5: The Mathematics of Getting Around: 5.1-5.4 (r)
 - Chapter 6: The Mathematics of Touring: 6.1-6.5 (r)
 - Chapter 7: The Mathematics of Network: 7.1-7.3 (r)
 - Chapter 15: Graphs, Charts, and Numbers: 15.1-15.3 (r)
 - Chapter 16: Probabilities, Odds, and Expectations: 16.1-16.5 (r)
 - Chapter 17: The Mathematics of Normality: 17.1-17.4 (r)
- Time permitting, one or more of the following chapters in the adopted textbook may be used as optional material:
 - Chapter 3: The Mathematics of Sharing (o)
 - Chapter 4: The Mathematics of Apportionment (o)
 - Chapter 8: The Mathematics of Scheduling (o)
 - Chapter 10: Financial Mathematics (o)
 - Chapter 13: Fibonacci Numbers and the Golden Ratio (o)
 - Chapter 14: Censuses, Surveys, Polls, and Studies (o)

3. Types of assessments

- Exams
 - at least two midterm exams during the semester
 - exams must be timed, proctored, closed book, closed notes
 - exams must be majority written answer (not multiple choice)
 - exams must be pencil-and-paper exams, written and graded by a faculty member
 - exams should not be reused from previous semesters, limited reuse of edited problems is acceptable
- Final exam
 - must be cumulative and representative of the entire course
 - any optional (o) section that you choose to cover should not be on the final exam
 - must include problems from each of the Assessment Criteria listed on the next page
- Other Assessed Work
 - instructors should provide written feedback to students approximately weekly throughout the semester. This can be through humanly-graded assignments or email correspondence
 - students must have a mechanism for estimating their current grade in the course
 - there must be human feedback prior to the first exam

4. Grading Policy

- The syllabus must include a grading scale in some form.
- Plus/minus grading is at the discretion of the instructor, but 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%
Online Assessed Work	At most 15%
Midterm Exams	At least 40%
Comprehensive Final Exam	At least 20%

Assessment criteria

Final exams should contain problems that demonstrate the students' acquired knowledge of the following topics.

- Problem solving skills
 - developing and carrying out a solution path for non-routine problems
 - explaining reasoning, justifying a solution
- Manipulation of abstract symbols:
 - using appropriate notation for course topics (e.g. weighted voting systems, probability)
 - summarizing procedures with appropriate formulas (e.g. ${}_nP_r = n!/(n-r)!$)
 - though calculators can be used, students need to demonstrate an ability to work with fractions (adding, reducing – especially when working with probabilities) and manipulate the expression ${}_nP_r$ and ${}_nC_r$ without a calculator
- Voting systems and measures of power:
 - plurality, plurality with elimination, Borda count, pairwise comparison
 - fairness criteria, strategic voting
 - Banzhaf and Shapley-Shubik power indices
 - weighted voting system, dictator, dummies, veto power
- Graph theory and its applications:
 - basic properties of graphs, paths, circuits and trees
 - Euler circuits, Hamilton circuits, minimum spanning tree (MST)
 - algorithms for finding Hamilton circuits and MST
 - making graph models and knowing which type of graph theory (Euler, Hamilton, or trees) is required to solve a given problem
- Basic statistics:
 - bar graphs, box plot
 - mean, median, interquartile range, percentiles, standard deviation
- Probability:
 - probability space, events, expected value, randomness
 - permutations, combinations
- Normal distributions:
 - mean and standard deviation of a normal curve
 - 68-95-99.7 rule
 - honest-coin and dishonest-coin principles

Final exams will be evaluated by the Core Assessment Committee based on the described desired outcomes for the course. Six questions on the exam corresponding to six of the bulleted points above will be chosen for closer review. The overall content of the exam and students' ability to write proper mathematics will also be assessed.