

Structuring a Course Around Reading Mathematics

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Reading Goal

Department-wide goal:

“A graduate from our program should be able to read with precision for understanding.”

Example assessment benchmarks:

- Can use a definition to verify properties or construct correct examples and counterexamples and clearly connect them to the definition in simple cases.
- Can articulate the logic of a valid straightforward argument; can identify and clearly describe obvious flaws in an invalid argument.

Daily Routine

- Before each class period:
 - Read a section of the book
 - Do exercises based on that reading
 - Submit exercises before class begins (paper or CMS)

- During class:
 - Reading quiz
 - Discussion about the reading process
 - Very targeted discussion about reading exercises
 - Student presentations and/or group work

Assessing Reading Ability

Daily reading assignments

- “The goal of the daily assignment is to exercise your reading ability. Having a correct answer to each question is neither sufficient nor necessary to demonstrate this.”
- Feedback on daily assignments after class, 0/1/2 grade

Quizzes

- Questions about defs/thms/results from the reading

Tests

- Questions with new definitions, new theorems

Final exam

- 1-2 pages of new reading with questions

MAS 100: Concepts of Mathematics

Common topics:

- Voting theory

“None of you will run an election.”

- Graph theory

“None of you will grow up to be a traveling salesman.”

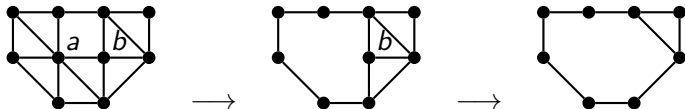
- Fair division

“If you use a sliding knife algorithm at a party, your friends will pretend they don't know you.”

Simple but interesting definitions, theorems, algorithms, proofs.

Example Quiz Questions

- Define what it means for a graph to be *connected*.
- Explain the difference between the book's definition of coloring a *map* and coloring a *graph*.
- **You are planning to use the algorithm given in the reading to 6-color the graph pictured on the left below. You start by choosing to delete the vertex marked *a*, followed by the vertex marked *b*, resulting in the middle and rightmost pictures below, respectively. **Are you following the algorithm correctly so far?** Explain why or why not.**



Example Test Question

Recall: A graph is called **connected** if there exists a path between every pair of vertices in the graph. A graph is called **disconnected** if it is not connected. A **tree** is a connected graph with no cycles.

A graph is called **fragile** if it is connected and the removal of any edge from the graph would cause the graph to be disconnected.

Prove that if a graph is fragile then the graph is a tree.

Example Test Question

In an election, a set \mathcal{R} of candidates is called a **copycat set** if no voter places any candidate not in \mathcal{R} between any two candidates in \mathcal{R} on their ballot. A copycat set is called **nontrivial** if it contains at least two candidates and not all candidates.

Give an example of a **nontrivial copycat set** in the election shown below, and explain.

Rank	# Voters		
	16	11	4
1	B	D	B
2	A	A	D
3	D	C	A
4	C	B	C

Final Thoughts

- Accountability is key.
- Grading daily assignments is a ton of work.
- The students hate it.
- “I understand now why we did all those reading assignments.”

Thank you!

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