

Math 8803/4803, Spring 2008: Discrete Mathematical Biology

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Lecture 8 – January 25, 2008

Course projects

- 60% of the class grade, 30% quality of the work and 30% quality of the oral presentation.
- Oral presentations will be scheduled the last two weeks of class: April 14, 16, 18, 21, 23, and 25. Scheduling will be determined by preferential lottery.
- Each student will give a 20 minute presentation, with 5 minutes for questions.

Course projects cont.

- Each student will submit a 5 - 10 page written project report, due on Friday, April 11 (5 pages for new results, 10 pages for existing results).
- Students may work individually, in pairs or even triples, but the expected output for a project is multiplied by the appropriate factor.
- Options range from critical analysis of existing research to producing new results, and any combination in between.

Critical analysis of existing research

- Choose a particular topic from (discrete) mathematical biology, and narrow the focus to a specific question.
- Identify 3 - 5 key publications with recent results on that problem and at least ten related ones. The list of publications must include both biological / experimental and mathematical / theoretical results.
- Read (critically) the key publications, and summarize the main contributions of each paper. Compare and contrast the work, and state at least one open problem related to the question.

Producing new results

- Choose a particular topic from discrete mathematical biology and narrow the focus to a specific question.
- Articulate an open problem related to the specific question.
- Try to solve the open problem.
- Repeat when possible and/or as needed.

Possible DNA topics

- DNA word design (random De Bruijn sequences, stochastic local search, . . .)
- motif finding (string statistics, hidden Markov models, . . .)
- chromosome rearrangements (sorting by reversals, . . .)
- sequencing by hybridization (shortest superstring problem, Euler circuits, . . .)

Possible RNA topics

- pseudoknots (dual graphs, generating functions, Polya enumeration? . . .)
- epsilon base pairings (stochastic context free grammars?, . . .)
- configuration comparison (metrics on trees, meanders?, . . .)
- folding (parametric sequence alignment, polytopes, . . .)

Other possible topics

- phylogenetics
- biological networks
- discrete dynamical systems
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Benchmarks

- Talk to me about possible project topics (today or early next week).
- Submit project proposal (Friday, February 8).
- Submit progress report (Friday, March 7).
- Submit final report (Friday, April 11).
- Oral presentations (April 14 - April 25).

Literature search

- Through GT Library
 - MathSciNet <http://www.ams.org/mathscinet/>
 - PubMed <http://www.ncbi.nlm.nih.gov/sites/entrez/>
 - ACM Digital Library <http://portal.acm.org>
 - IEEE Xplore <http://ieeexplore.ieee.org>
- Freely available
 - Google Scholar <http://scholar.google.com/>
 - arXiv <http://arxiv.org/>
 - CiteSeer <http://citeseer.ist.psu.edu/>