

MATH 236 — RANDOM STRUCTURES — FALL 2013

Guidelines and Suggestions for Individual Topic Research

Individual Topic Research Each student will work with a partner and research a topic of their choosing, and write a brief paper on at least one mathematical result within this topic. The topic and result must be approved by the instructor, mainly to assure that the topic and result are of sufficient scope, not too broad and not too narrow. Each student pair will summarize their work in a 15 minute (approximate) presentation to the class the last week of the semester. The written paper will be due on the last day of the semester, December 20. The written report will be worth 10 % of your grade, and the in-class presentation will be worth 5 % of your grade.

Topic I want to impose as few restrictions as possible on students' topic choices. The main requirement is that the topic be related to the theory or applications of randomness and probability. Other important requirements are that you learn something new and that you have fun with this! Some possible topic suggestions:

- Random graphs (isolated vertices, trees, cycles, threshold functions)
- Random matchings and bipartite graphs
- Random permutations (fixed points, cycle decomposition)
- Random walks (state classification, limiting behavior, migration models, birth and death models)
- Random networks and applications to social networking
- Random number generation (entropy)
- Random functions (digraphs, cycle decomposition)
- Limit theorems and applications
- Monte Carlo integration
- Estimators and estimation theory
- Markov processes
- Moment generating functions and probability generating functions
- Probability distributions on groups
- Solving deterministic problems with probability
- the list is nearly endless please explore on your own as well

Report Your written report must be typed. Your paper should have an introduction, detailed development and description of the topic, precise problem statements and solutions, a sketch of the proofs of any useful theorems, and then a wrap-up and discussion. I subscribe to the philosophy of engineering school when it comes to the length of a paper — *the correct length of a paper is the shortest length that gets the job done!*

In-Class Presentation Try to keep your presentation to about 15 minutes. As best as you can, target your presentation to the mathematical level of our class. Once again, have fun. If you are enjoying your topic, it will be infectious!

Visit me frequently and let me know how things are going. — BDJ.