Fall 2013

About the Final

The same as the midterm. There will be n problems, the total score will be at least 122, and any score higher than 100 will be counted as 100. The exam will be 3 hours.

You are allowed to bring 2 sheets of A4 paper, you can write or draw whatever pattern on it. Other than that, you can only bring your pen, water, and food; none of them can be digital. I will try to provide some water. N.B. No any electronic device is allowed.

Graphs and hypergraphs. basic definitions and notations.

Ramsey theory. Ramsey theorems on graphs and their proofs. Ramsey theorem on hypergraphs and how to use it to prove Schur and Erdös-Szekeres.

Probabilistic method. Know the basics: What is a probability space, what are random variables and their expectations, what are the events and their probability, linearity of expectation, Markov. Basic probabilistic proofs on the bound of sum-free sets and Ramsey numbers. Use alteration to slightly improve Ramsey numbers. Proof on the existence of graphs with high girth and big chromatic number. Property-B, 2^{r-1} lower bound. Understand independent events. Understand the statement of L.L.L. and how to apply it.

Geometry. Crossing lemma and its proof. Unit distance graphs. Use crossing lemma to prove the $n^{4/3}$ bound on the unit distances. The three proofs of De Bruijn-Erdös.

Linear algebra methods. Oddtown and Eventown theorems. Proof of Erdös-Rényi-Sós (the algebra part).

And mostly importantly, Merry Christmas!