1. Probabilistic Methods

- Basic techniques: 1st and 2nd moment methods, Alteration Techniques
- Exponential Concentration: Chernoff's Bound, Azuma's inequality, and applications to random graphs (edge and vertex exposure).
- Lovasz Local Lemma (Statement of Symmetric and Nonsymmetric case, Applications to Hypergraph Coloring and (sketch) lower bounds for R(3,t).
- Brun's Sieve, and application to the number of isolated vertices in $G(n,p)$.
- Random Graphs: $G(n,p)$ vs. $G(n,M)$. Structure of $G(n,p)$ for $p = \theta(\frac{1}{n})$ (sketch of proof). Monotone Properties and threshold functions. Thresholds for Connectedness and small subgraphs. Configuration model for random regular graphs.

2. Littlewood-Offord Problems

- The original result, including the proof via Sperner's Lemma
- Statement of Generalization to n dimensions due to Kleitman
- Generalizations of the original theorem due to Halasz (statement of result, plus explanation of how Fourier Analysis comes in)
- Statement of Inverse Littlewood-Offord results. Comparison with Freiman's theorem and the Balog-Gowers-Szemeredi theorem.

3. Prior Work on Random Matrices

- Komlós original proof of almost sure nonsingularity in the $(0,1)$ case
- Statement and sketch of proofs of more recent exponential bounds on the singularity probability, and why they don't work for symmetric matrices.
- Eigenvalue Density and Wigner's Semicircular law (statement, along with sketch of proof)