

Final Topics

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The final exam is on March 19th in the class room. You will not be allowed any notes, though calculators are allowed but will not be necessary. There will be six questions, each with a few parts, and a total of three hours. The topics to prepare are listed below. The final will be somewhat easier but similar in layout to the practice finals posted online.

Course notes Part I

- Section 1.7 (Induction and trees) only. Omit everything else, including combinatorial proofs/bijections.

Course notes Part II

- Sections 2.8 – 2.8.2, 2.9, 2.9.1 only. Omit all other sections. (make sure you have latest notes).
- You will be asked one problem on compositions and one problem on binary strings.
- Know how to work with sums and formal power series.
 - See online notes on working with sums.
- Know how to state and use the Binomial Theorem
 - See online notes on binomial coefficients.
 - See online notes on working with sums.
- Know how to count compositions of various types.

This is Section 2.8 but omit 2.8.3.
- Know how to count binary strings of various types.

This is Section 2.9.

Course notes Part III

- Know how to solve recurrence equations (Theorem 1). Omit asymptotic behavior.
- Know how to get recurrence equations from generating functions (Section 3.2).
 - See some examples for binary strings and compositions and exercises of Section 3.3.

Course notes Part IV

- Sections 4.1, 4.2, 4.4. Know statements **but not proofs** of the results in these sections. In particular, know how to state Menger's Theorems. Omit 4.3 (Block decomposition).
- Be familiar with graph theoretic terminology and notation $\Gamma(v)$, $\Gamma(X)$, $d(v)$, $\delta(G)$, $\kappa(u, v)$, $\lambda(u, v)$, $\kappa(G)$, $\lambda(G)$.

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Course notes Part V

- Sections 5.1, 5.2, 5.3, 5.5, 5.6, 5.7. Know statements and given proofs of all results in these sections. Omit 5.4 (Variations) and proof of Lemma 1 (Section 5.3).
 - Main proofs to know: Proof of Max-Flow Min-Cut Theorem (Theorem 2 Section 5.3), Proof of Hall's Theorem (Theorem 7 Section 5.7).
 - Be familiar with and be able to define all terminology regarding flows: st -flow, st -cut, value of a flow, cut induced by S , ... (Sections 5.1–5.3)
- Be able to find a maximum flow in a given network. (Section 5.5)
- Be able to check Hall's Condition for a given graph.
 - with and be able to define all terminology regarding matchings: $\Gamma(X)$, Hall's Condition, maximum matching, perfect matching, ... (Section 5.7)

Course notes Part VI

- Sections 6.1, 6.2 only.
 - Main proofs to know: Euler's Formula (Theorem 6.1.2 Section 6.1), Theorem 6.1.3
 - Be familiar with how to apply Euler's Formula (show a graph like K_5 is not planar for example)
- Know how to prove the 5-colour theorem.