

# Final Topics

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The final exam is on Monday June 8th in the class room at 8am. You will not be allowed any notes, though calculators are allowed but will not be necessary. There will be five 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.

## 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).
- Know how to determine the asymptotic behaviour of the solution (Section 3.1).
- 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 and given proofs of all results in these sections. Omit 4.3 (Block decomposition).
- Be familiar with graph theoretic terminology and notation  $\Gamma(v)$ ,  $\Gamma(X)$ ,  $d(v)$ ,  $\delta(G)$ ,  $\kappa(u, v)$ ,  $\lambda(u, v)$ ,  $\kappa(G)$ ,  $\lambda(G)$ .

## 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 Menger's Theorem (Edge-form) (Theorem 3 Section 5.6), 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)