Math 260
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Study Guide for Exam 3

In what follows is a **brief** synopsis of what we have covered in Sections 6.1–6.3, 7.1–7.4, 8.1–8.4, 8.6. Use this list a guide to help you make up your own study guide.

On the exam, you can expect several proofs, TRUE/FALSE questions, and give-an-example-of type questions. The problems that have been assigned but not necessarily graded or very similar problems could appear on the exam; therefore it is **highly** recommended that you make every effort to be sure that you understand **all** assigned problems, not just the graded problems.

Exam 3 Topics:

1. Systems of distinct representatives (SDR).
2. Necessary and sufficient conditions for a collections of sets to have an SDR (Hall's Theorem, 6.1).
3. Bipartite graphs, the matrix of a bipartite graph.
4. Matchings, maximum matchings, maximal matchings.
5. Necessary and sufficient conditions for a bipartite graph to have a matching saturating one of it's partite sets (Hall's Theorem, restates in terms of a bipartite graph).
6. Coverings, minimum coverings, minimal coverings.
7. The relationship between coverings and matchings (Theorem 6.2).
8. The algorithm for finding a maximum matching in a bipartite graph.
9. Networks: sink, source, capacity.
10. Flows in networks, requirements for a function to be a flow, the value of a network flow.
11. Cuts, finding the capacity of a cut.
12. The relationship between cuts and flows, Corollary to Theorem 7.2 and Theorem 7.3.
13. Using the flow augmentation algorithm for finding a maximum flow and minimum cut.
14. The Max-flow, Min-cut Theorem (Theorem 7.6).
15. Using networks to find maximum matchings in bipartite graphs.
16. The notation $C(n, r)$: what it means and how to calculate its value.
17. The Binomial Theorem.

18. The Pigeonhole Principle, the Multiplication Principle, the Addition Principle.
19. Permutations $P(n, r)$ and combinations $C(n, r)$.
20. Arrangements and selections with repetition.
21. The principle of inclusion-exclusion.