

MCS 421 – Combinatorics – Spring 2013

Summary of Lectures

Undergraduate: 34232 LCD, Graduate: 34233 LCD
MWF 1–1:50, Thaft Hall 309
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Most of the material is from the book [1] unless stated otherwise.

1 Week 1: 1/14-1/18, 2013

1.1 January 14

Covered §2.1: Example bottom page 28, Example bottom page 29, Example top page 31, Example page 33. Started §2.2: Thm 2.2.1.

1.2 January 16

Pages 35 - 45. Did Examples on page 36, 37, 40 (middle of the page), 43.

1.3 January 18

Did pages 46 - 52.

2 Week 2: 1/23-1/25, 2013

2.1 January 23

§2.5, Started §2.6 pages 56 - 58.

2.2 January 25

Finished §2.6. Started §3.1. Did pages 72 (Including Application 4.)

3 Week 3-4: 1/28-2/8, 2013

3.1 January 28 - February 8

Pages 72-82, 87-118, 127-137.

4 Week 5: 2/11-1/15, 2013

4.1 February 11

Pages 137-142.

4.2 February 13

Pages 142-147.

4.3 February 15

Pages 147-149, 161-163.

5 Week 6: 2/18-1/22, 2013

5.1 February 18

Pages 163-169.

5.2 February 20

Pages 169-180.

5.3 February 22

Pages 181-183, Pages 206-210.

6 Week 7: 2/25-3/1, 2013

6.1 February 25

Pages 210-215

6.2 February 27

Review for the midterm.

6.3 March 1

Midterm

7 Week 8: 3/4-3/8, 2013

7.1 March 4

Solution of the midterm. Pages 215-222.

7.2 March 6

Pages 222-226

7.3 March 8

Pages 226-228.

8 Week 9: 3/11-3/15, 2013

8.1 March 11

Pages 229-244.

8.2 March 13

Pages 245-249.

Guessing a particular solution of nonhom. system

$$h_n = a_1 h_{n-1} + a_2 h_{n-2} + \dots + a_k h_{n-k} + b_n, \quad n = 0, 1, \dots$$

We assume that $a_k \neq 0$. Suppose that

$$b_n = \sum_{i=1}^N p_i(n) \rho_i^n, \quad n = 0, 1, \dots$$

Here $p_i(x)$ is a polynomial in the variable x . Using the linearity principle it is enough to find a particular solution for the problem $b_n = p(n)\rho^n$ where the degree of $p(x)$ is d . The guess must be of the form

$$h_n = n^m q(n) \rho^n, \quad q(x) = A_0 x^d + A_1 x^{d-1} + \dots + A_d.$$

Here A_0, \dots, A_d are unknown parameters, and m is the multiplicity of the root $r = \rho$ in the characteristic equation for the corresponding homogeneous recurrence system

$$r^k - a_1 r^{k-1} - \dots - a_k = 0$$

So if ρ does not satisfy the above equation then $m = 0$. If ρ is a simple root of the above characteristic equation then $m = 1$, and cetera.

8.3 March 15

Finished section 7.5. Gave quiz.

9 Week 10: 3/18-3/22, 2013

9.1 March 18

Pages 265-267.

9.2 March 20

Pages 267-269, 274-278.

9.3 March 22

Pages 278-286. Stated Theorem 8.2.6.

10 Week 11: 4/1-4/5, 2013

10.1 April 1

Pages 287-293. (Skipped Bell number pages 287-288.)

10.2 April 3

Finished 8.3. Will start with Section 10.2 on Friday.

10.3 April 5

Pages 353-355

11 Week 12: 4/8-4/12, 2013

11.1 April 8

Pages 355-358

11.2 April 10

Pages 359 - 365

11.3 April 12

Pages 365 - 370.

12 Week 13: 4/15-4/19, 2013

12.1 April 15

Pages 370-374.

12.2 April 17

Discussed construction of finite fields with p^m elements, where p is prime. See pages 350-352. Did pages 375-379.

12.3 April 19

Pages 380-384. Started Chapter 14. Pages 541-552.

13 Week 14: 4/22-4/26, 2013

13.1 April 22

Pages 552-556.

13.2 April 24

Pages 556-569.

13.3 April 26

Pages 569-572.

References

- [1] R. Brualdi, *Introductory Combinatorics*, Fifth Edition, Prentice Hall, 2010.