

CSE 21

Lecture 6: Induction on Graphs (contd ...)

Outline of the course

Till now in Week 1 and 2:

- Basic Induction
- Basic graphs: definitions and motivations
- Graph Induction

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Chapters from the books:

- Bender-Williamson: Section 1 and Section 2 from
Unit GT: Basic Concepts of Graph Theory
- Hunter: Chapter 2: Relational Thinking

Outline of the course

- **Week 3 and 4:** Recurrence Relations and Asymptotic notations.

Section 2 & 4 from Unit DT: Decision Tree and Recursion, and

Section 4 from Unit GT: Basic Concepts in Graph Theory, and

Section 1 & 2 from Unit CL: Basic Counting and Listing from **B-W**/

Chapter 3: Recursive thinking from **Hunter**

Outline of the course

- **Week 5 and 6:** Probability and more counting.
Section 1 & 2 from Unit CL: Basic Counting and Listing, and
Section 1,2 & 3 from Unit: Fn: Functions, and
Section 1 & 3 from Unit DT: Decision Tree and Recurssion, from **B-W**
Chapter 4:Quantitative Thinking from **Hunter**

Outline of the course

- **Week 7 and 8:** Graphs
Unit GT: Basic Concepts in graph theory from **B-W**
- **Week 9 and 10:** Analysing algorithms and Problem Solving.

Outline of the course

Quizzes and Midterm:

- Quiz 2: on 3rd February
- Midterm: on 14th February
- Quiz 3: on 26th February
- Quiz 4: on 5th March
- Quiz 5: on 12th March

Graph Induction: Problem 1

In a room there are $2n$ people. Some of the people shake hand with each other in such a way that if persons A and B shake hand and persons B and C shake hand then person A and C does not shake hand.

What is the maximum number of handshakes possible in this case?

Ans: n^2

Graph Induction: Problem 2

Assignment 1, Problem 7:

Let $n > 1$ be an integer. In a football league there are n teams. Every two teams have played against each other exactly once, and in match no draw is allowed. Prove that it is possible to number the teams in such a way that team i beats $(i + 1)$ for $i = 1, 2, \dots, n - 1$.

Graph Induction: Problem 3

Assignment 2, Problem 6:

For natural number p and q , the Ramsey number $R(p, q)$ is defined as the smallest integer n so that among any n people, there exist p of them who know each other, or there exist q of them who don't know each other. Prove that

Note that $R(p, 1) = R(1, q) = 1$. Prove that:

- 1 $R(p + 1, q + 1) \leq R(p, q + 1) + R(p + 1, q)$
- 2 $R(p, q) \leq C_{p-1}^{p+q-2}$