CS6130 : Advanced Graph Algorithms

SLOT : C Slot [M:10, T:9, W:8, F:12]

INSTRUCTOR : Meghana Nasre.

TA : Girija Limaye.

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Broad Course Goals

Goal 1 : Efficient Algos for fundamental Problems

Flows, Cuts, Matchings

Goal 2 : Study recent advances

Matching markets, dynamic algos

approx. algos.

Goal 3 : Provide a gateway to research in graph algorithms.

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Course Contents :

Theme 1 : Flows, Cuts and Bipartite Matchings.

Theme 2 : Matchings in general graphs

Theme 3 : Linear programming, duality and applications

Theme 4 : Matching markets (stable matchings, house allocation)

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Theme 1 : Flows, Cuts and Bipartite matchings

- The flow problem and its relation to cuts and connectivity
- Efficient algorithms for computing max-flow
- Applications of flows to solve real world problems.

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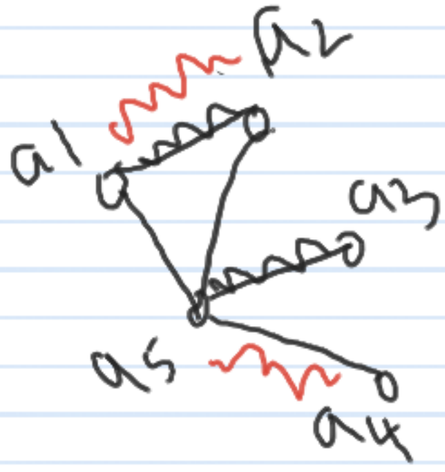
Theme 2 : Matchings in general graphs

- Edmond's algo for non bipartite matchings
- Tuttes theorem and proof
  - optimality certificates
- Gallai Edmonds Decomposition theorem
  - properties invariant of max matching



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Theme 3. : Linear programming, duality and applications

- Formulating problems as linear programs
- Constructing dual
- Primal dual algorithms
- Using dual certificates to prove optimality.

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Theme 4. : Matching markets

- How to assign students to courses ?
  (SEAT, IDDP allotments)

- How to assign faculty to office rooms
  (house allocation problem)

- How does organ exchange take place
  (the kidney exchange problem)

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Intended Audience :

(1) Students looking for a second course in algorithms

(2) Students interested in diving into research in graph algorithms.

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Tentative grading Policy

(1) Midsem [before mid March] : 30%

(2) Endsem [as per calendar] : 30%

(3) Paper Reading and presentation : 25%

(4) Short in class Quizzes : 15%.

How to get most out of the course?

1) Attend all lectures

- attend and not just login

2) Participate in the class

- ask questions listen to others questions

3) Well known proverb

I hear : I forget ; I see : I remember

I do : I understand.