CS38
Introduction to Algorithms

Lecture 20
June 5, 2014

Outline

- three glimpses beyond material in this course
  - property testing
  - streaming algorithms
  - approximation via semidefinite programming

Sublinear algorithms

- Model:
  - random access to input x
  - goal: determine if x has property P
  - example: input is graph G, property is bipartiteness
  - need additional assumption: e.g., consider bipartite graph G and G' with 1 extra bad edge

Sublinear algorithms

- Model:
  - random access to input x
  - goal: determine if x has property P
  - promise: x either has property P or is ϵ-far from having property P
  - example: input is graph G
    - either G is bipartite
    - or need to change ϵn^2 edges to make bipartite

Sublinear algorithms

- example: input is graph G
  - either G is bipartite
  - or need to change ϵn^2 edges to make bipartite
- algorithm:
  - sample $\epsilon^{O(1)}$ vertices and edges between them
  - check if this subgraph is biparitite
  - # of queries does not depend on n!
  - this works!

Sublinear algorithms

- many properties testable in this fashion
- algorithms easy, analysis less easy
- some properties not testable with # of queries independent of n
- huge field
  - dense graph properties (theoretically) well-understood…

Streaming algorithms

- Andrew McGregor's slides

Semidefinite programming

- like linear programming with
  - variables replaced by vectors
  - constraints and objective function are linear in the inner-products of pairs of vectors
- solvable in P by generalizing ideas for LPs
- key example (Michael McCoy slides):
  - Goemans – Williamson approximation alg.

The last slide

- Reminder: final due Tuesday
  - office hours as usual this week
- please fill out TQFRs!
- Good luck!

Thank you!!