CS 624: Notes 25

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December 14, 2022

1 Administrative

- Final exam conflicts
  email soon
- Homework 01, 02 graded
  - still a few issues
  - regrade requests open Friday
- Homework 05
  extend deadline? Friday midnight
- Office hours: tomorrow after 2pm
- Course evaluation (end of class, link on course page)

2 Final Exam

The final exam is cumulative

- Review of material from midterms 1 and 2
- new material since midterm 2

Kinds of questions:

- run an algorithm, do a calculation
- invent an algorithm using familiar pieces
- analyze a problem based on a story

Notes policy:

- lecture notes (”[auxNN]”)
- plus up to 10 pages of additional notes

Topics:
• graphs walks
  – topological sorting, SCCs
• maximum flow
  – flow networks, flow, cuts,
  – residual graph, augmenting path
  – application: the marriage problem
• complexity classes
  – decision problems vs optimization problems
  – polynomial time reductions
  – the definition of class P
  – the definition of class NP
    * nondeterministic Turing machine
    * “yes certificate” is verifiable in polynomial time
  – the definitions of NP-hard and NP-complete
  – known NP-complete problems:
    * SAT (really, CNF-SAT, 3CNF-SAT)
    * vertex cover (VC)
    * clique, independent set
    * integer linear programming (ILP)
    * subset sum
  – how to prove a problem is NP-complete
    * CNF-SAT ≤_P 3CNF-SAT
    * 3CNF-SAT ≤_P VC
    * VC ≤_P independent set =_P clique
    * VC ≤_P ILP
    * VC ≤_P subset sum (!)
• and also the topics from Midterm 1 and Midterm 2

Grading philosophy
3 Sources of word problems

Roundtripping
- take a problem
- write a description of it (maybe change superficial details, like eggs to bookbags)
- pause long enough to forget the solution (or trade descriptions with a friend)
- try to solve it

Programming contests
- Advent of Code
- hacker rank
- leetcode

4 Notes on answering questions

General:
- DO make a checklist of what to provide
  suggested reading: Atul Gawande, *The Checklist Manifesto*
- DO show your work (helpful for partial credit)
- DON’T recite definitions that are in the notes
  but DO refer to them and use them as appropriate
  - eg, “Since $f = O(n^2)$, that means there is $n_0$ and $c$ such that…”
  - eg, “Since $A$ is NP-complete, there is a polynomial-time reduction $f$
    from SAT to $A$, so we can apply $f$ to…”
- DO mention properties/consequences relevant to the problem
  - eg, “After running RANDOMIZED-SELECT($A, m$), the $m$ least elements
    of the array are in $A[1..m]$."
  - eg, “BFS explores the entire component connected to the start node,
    and at the end every node in that component is colored black.”
- DO describe your data, not just the actions your algorithm takes
  - eg, “Aux is an array that maps vertex indexes to component labels.”
5 Course evaluation

(Link on course web page)

https://umassboston.co1.qualtrics.com/jfe/form/SV_5ziZDsTmMXcMHI2

This evaluation is designed to provide information about the quality of this course to the instructor and department. All submissions will be anonymous and these questionnaires will be treated as confidential information. The instructor will not review your responses until after the final grades for this course have been submitted to the Registrar.