

# SPRING 2014: COT 6936 TOPICS IN ALGORITHMS

[HOMEWORK 1; NO NEED TO SUBMIT SOLUTIONS]

The purpose of this homework is to give you an opportunity to revise materials from your earlier course on “Introduction to Algorithms”. You are not expected to turn in solutions to this homework. Nevertheless, it may still be a good idea for you to write down formal solutions.

## Problems

1. The problem of finding the *largest* empty range in a sequence of sorted numbers can be solved by simply sorting and computing the  $n - 1$  differences between consecutive values and finding the largest. If the words *largest* were to be replaced by the word *smallest*, then the above statement would still be true. Yet, one of them is harder than the other in terms of complexity. Which is harder? Prove your answer.
2. How many bit changes occur in a binary counter when counting from 0 to  $n$ ?
3. A ship arrives at a port. Forty sailors go ashore for revelry. They return to the ship rather inebriated. Being unable to remember their cabin location, they find a random unoccupied cabin to sleep the night. How many sailors are expected to sleep in their own cabins?
4. Show that 2SAT is in  $\mathcal{P}$ .
5. The following are some problems from recent Programming Competitions. They test your knowledge of material from the introductory algorithms course, especially your knowledge of basic algorithmic paradigms (divide-and-conquer, greedy algorithms, and dynamic programming) and data structures.
  - (a) Fix The Pond:  
[http://uva.onlinejudge.org/index.php?option=com\\_onlinejudge&Itemid=8&page=show\\_problem&problem=3974](http://uva.onlinejudge.org/index.php?option=com_onlinejudge&Itemid=8&page=show_problem&problem=3974)
  - (b) Robot Challenge Problem:  
[http://www.cs.fiu.edu/~giri/teach/6936/S10/SER2009\\_RobotChallenge.pdf](http://www.cs.fiu.edu/~giri/teach/6936/S10/SER2009_RobotChallenge.pdf)
  - (c) Frequency Count Problem:  
<http://www.informatik.uni-ulm.de/acm/Locals/2007/html/frequent.html>
  - (d) Profits:  
[http://www.cs.fiu.edu/~giri/teach/6936/S12/SER\\_2010\\_Profits.pdf](http://www.cs.fiu.edu/~giri/teach/6936/S12/SER_2010_Profits.pdf)
  - (e) Family Fortune (see Problem H. from the problem set):  
[http://www.cs.fiu.edu/~giri/teach/6936/S12/SER\\_2011\\_AllProblems.pdf](http://www.cs.fiu.edu/~giri/teach/6936/S12/SER_2011_AllProblems.pdf)

6. Listen to Cool MP3:

<http://www.cs.princeton.edu/courses/archive/spring08/cos226/lectures/longest-path.mp3>