

Design and Analysis of Algorithms

Problem #1

Let A and B be two sequences of n integers each. Given an integer m , describe an $O(n \log n)$ time algorithm for determining if there is an integer a in A and an integer b in B such that $m = a + 2b$.

Problem #2

Bob loves computer science and wants to plan his course schedule for the following years. He is interested in the following nine CS courses: CS15, CS16, CS22, CS31, CS32, S126, CS127, CS141, and CS169. The course prerequisites are:

- CS15: (none)
- CS16: CS15
- CS22: (none)
- CS31: CS15
- CS32: CS16, CS31
- CS126: CS22, CS32
- CS127: CS16
- CS141: CS22, CS16
- CS169: CS32

Find the sequence of courses that allows Bob to satisfy all the prerequisites. Describe your method briefly.

Problem #3

We are given a line L that represents a long hallway in an art gallery. We are also given a set $X = \{x_0, x_1, \dots, x_{n-1}\}$ of real numbers that specify the positions of paintings in this hallway. Suppose that a single guard can protect all the paintings within distance at most **1** of his or her position (on both sides). Design a linear time algorithm for finding a placement of guards that uses the minimum number of guards to guard all the paintings with positions in X .