

Summer 2022
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CSCI/MATH 8080

Assignment One

The Partitioning Problem: Given a set of n positive integers, partition the integers into two subsets such that the difference between the sums of the elements in the two subsets is minimum.

- a) (8 pts) Since no polynomial solutions are known for the above problem, implement an exponential algorithm for finding the optimal solution for any instance of the problem and test it for small input samples. Identify the maximum input size for which an optimal solution is possible to obtain using your algorithm in reasonable time.
Hint: Every possible partition (solution) can be represented by a binary array of size n .
- b) (8 pts) Implement one heuristic for solving the partitioning problem. Specify several input cases for the heuristic for which the heuristic performs different. Your input samples should include two cases in which the algorithm succeeds and fails to find the optimal solution. Compare the results of the heuristic to the results of the exponential algorithm using small input samples. Also, compare the results of the two heuristics using larger input samples.
- c) (4 pts) Although the general version of the partitioning problem is intractable, special cases of the problem may have polynomial solutions. For example, assume that each of the input integers is either x or $2x$, for some small positive integer x . Can you suggest a polynomial and optimal algorithm for finding the best partitioning in this case?

Notes:

- Complexity analysis of all algorithms is required.
- Reports are due on Canvas Friday 7/12/2022