The Sum Finder Problem

1 Introduction

Can the number 16 be obtained by summing and sub-collection of the numbers 5, 8, 2, 3, or 7? In this project we will use dynamic programming to answer such questions.

2 Objective

The goal of this activity is to use dynamic programming to answer the following question: given a set of positive integers $a_1, a_2, \ldots, a_n$ and K, is there a sub-collection of the a_is that sums up to K? It is guaranteed that $1 \leq a_i, K \leq 1000$ for $1 \leq i \leq n$ and $5 \leq n \leq 10$.

3 Additional Notes

1. This problem is *very* similar to the 0/1 Knapsack Problem.
2. Consider creating a binary matrix where the entry in the (i, j) position is 0 or 1 depending on whether or not the value j can be obtained by considering sums of sub-collections of $a_1, \ldots, a_i$. Determine a way to compute the entries in the ith row based on the $(i-1)$st row.

4 Grading Criteria

This project is worth a total of 10 points:

- (3 points) Introduction and Discussion - Introduce the problem and explain how your algorithm/function works.
- (5 points) Algorithm and Implementation - The algorithm designed and implemented in Python solves the problem. You will not receive credit for a brute-force method.
- (2 points) Neatness and Timeliness - Your write-up is neat, clear, and turned in on time. The assignment must be typed (as a Jupyter notebook) and completed by 11:59pm on November 18th.