**IEDA 5230 (Fall 2023)**

**Homework Assignment 3**

Due date Nov 8, 2023

A Knapsack problem is defined as follows: Given *A*, a set of *n* elements, and a constant *c*, where each element *j* has a weight *wj* and a value *vj*­, find a subset of the elements, denoted by *B*, such that and is maximized.

Assume all *wj*, *vj* are positive integers, and . Let and .

1. Develop a dynamic programming of which the time complexity is *O*(*nW*) to solve the knapsack problem.
2. Develop a dynamic programming of which the time complexity is O(*nV*) to solve the knapsack problem.
3. There is a requirement of *B* such that for any three consecutive elements, *k*, *k*+1, and *k*+2, at most one of them is in *B*.
   1. Formulate this problem by integer linear programming.
   2. Develop a dynamic programming to solve this problem.
4. There is a requirement of *B* such that if element *k* is in B, at least one of {*k*-1, *k*+1} is in *B*.
   1. Formulate this problem by integer linear programming.
   2. Develop a dynamic programming to solve this problem.