

COMP362 Exercise Set (not Assignment!) 1

Formulate each of the following problems as either an Integer Linear Program or a Linear Program.

- 1) Knapsack: An instance consists of a set I_1, \dots, I_n of items, where item I_j has real weight w_j and real value v_j , and a knapsack which can hold total weight W . A solution is a subset of the items which can fit in the knapsack (i.e. their combined weight is at most W). Our objective is to choose a solution whose total value is as large as possible.
- 2) Matching: An instance consists of a graph G with vertex set V and edges set E (each edge is a pair of vertices). A solution is a matching, that is a disjoint set of edges. Our objective is to find as large a matching as possible.
- 3) Maximum: An instance consists of a set a_1, \dots, a_n of n reals. The unique solution is the largest of these integers. Our objective is to find it.
- 4) Maximum Flow: An instance consists of a directed graph G with vertex set V and edge set E , and a nonnegative real capacity $c(e)$ for each edge e , a specified source vertex s , and sink vertex t . A solution consists of a flow as defined in COMP252, that is a nonnegative flow amount along each edge so that for each vertex v of $V-s-t$, the amount flowing along the edges into v is the same as the amount flowing along the edges out of v . The volume of the flow is the net amount flowing out of s . Our objective is to find a maximum value flow.
- 5) Minimum Weight Spanning Tree: An instance consists of a graph G and a real weight $w(e)$ for each edge e . A solution consists of a spanning tree for G . Our objective is to find a spanning tree of minimum total weight.