CS69011: Computing Lab
Task : Linear Programming and Integer Programming

September 6, 2023

==========Instructions==========
1. In the case of user input, assume only valid values will be passed as input.
2. Regarding submission: Create a separate Python file for each task : **<RollNo>_T4.py** **<RollNo>_T5.py**
3. Create a zipped file of all these Python files with the name:
   <RollNo>_LP_TS_2.zip and submit it to Moodle.
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T4 (20 mins) - Solve the 0/1 Knapsack Problem using Python OR-Tools (pywraplp).

0/1 Knapsack Problem - Given **N** items where each item has some weight and profit associated with it and also given a bag with capacity **W**, [i.e., the bag can hold at most **W** weight in it]. The task is to put the items into the bag such that the sum of profits associated with them is the maximum possible.

Input Format:-

- First line contains “N” number of items
- Second line contains “W” total weight
- Third line contains “n” space separated numbers denoting the weights of each item
- Fourth line contains “n” space separated numbers denoting the value of each item

Output Format:-

Maximum profit and items taken

Sample Input:-

4
11
2 3 5 7
10 5 15 7

Sample Output:-

Total Value: 30.0
Items to take:
Item 1 - Weight: 2.0, Value: 10.0
Item 2 - Weight: 3.0, Value: 5.0
Item 3 - Weight: 5.0, Value: 15.0
Item 4 - Weight: 0.0, Value: 0.0

T5 (10 mins) - Solve the Fractional Knapsack Problem using Python OR-Tools (pywraplp).

Fractional Knapsack Problem - Same as 0/1 Knapsack but but items can be divided in smaller units with weight and value proportional to the breakdown ratio

Input Format:-

- First line contains “N” number of items
- Second line contains “W” total weight
- Third line contains “n” space separated numbers denoting the weights of each item
- Fourth line contains “n” space separated numbers denoting the value of each item

Output Format:-

Maximum profit and items taken

Sample Input:-

4
11
2 3 5 7
10 5 15 7

Sample Output:-

Total Value: 31.0
Items to take:
Item 1 - Weight: 2.0, Value: 10.0
Item 2 - Weight: 3.0, Value: 5.0
Item 3 - Weight: 5.0, Value: 15.0
Item 4 - Weight: 1.0, Value: 1.0