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1  import Data.List (delete, sortBy)
2  import Data.Ord (comparing)
3  import Data.String (words)

4  ----- DATA TYPES -----
5  type Number = Double

6  -- | An MKP item
7  --     tuple: (profit, capacities)
8  type Item = (Number, [Number])

9  -- | The MKP instance representation
10 --     tuple: (list of items, capacities)
11 type MKP = ([Item], [Number])

12 -- | The MKP solution representation
13 --     tuple: (selected itens, profit, weights)
14 type MKPSolution = ([Int], Number, [Number])

15 -- | Insert the given item on a MKP solution, updating its profit and weights.
16 addItem :: Item -> Int -> MKPSolution -> MKPSolution
17 addItem (itemProfit, itemWeights) idx (solIdxs, solProfit, solWeights) = (solIdxs', solProfit', solWeight')
18     where
19         solIdxs' = solIdxs ++ [idx]
20         solProfit' = solProfit + itemProfit
21         solWeight' = map (uncurry (+)) $ zip itemWeights solWeights
22 -----

23 ----- DOMINATING SETS -----
24 -- | Answer if the first set dominates the second.
25 dominates :: MKPSolution -> MKPSolution -> Bool
26 dominates (_, p1, cs1) (_, p2, cs2) = betterProfit || dominateWeights
27     where
28         betterProfit = (p1 > p2)
29         dominateWeights = or $ map (uncurry (<)) $ (zip cs1 cs2)

30 -- | Returns all dominating sets of a MKP instance.
31 domSets :: MKP -> [MKPSolution]
32 domSets (items, _) = domSets' 1 items []
33     where
34         -- recursively computes dominating sets
35         domSets' _ [] set = set
36         domSets' idx (it:items) sets = domSets' (idx+1) items newSets
37             where
38                 newSets = [x | x <- merged, and $ map (dominates x) (delete x merged)]
39                 merged = sets ++ map (addItem it idx) sets ++ [(idx, fst it, snd it)]
40 -----

41 ----- SOLVING MKP -----
42 -- | Solves the MKP using domating sets generation.
43 --     Among the feasible sets the most protitable is selected.
44 solve :: MKP -> MKPSolution
45 solve mkp = optimum
46     where
47         getProfit (_, p, _) = p
48         dummySet = ([], 0, snd mkp) -- for filtering
49         feasibles = filter (not.(dominates dummySet)) $ domSets mkp
50         optimum = head $ reverse $ sortBy (comparing getProfit) feasibles
51 -----

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