0/1 Knapsack using Branch & Bound

Introduction to 0/1 Knapsack Problem using Branch & Bound method

- Here we first arrange all item in descending order of pi/wi ratio.
- By using B& B we have a bound that none of item can have total sum more than knapsack capacity m & must give maximum possible profit.

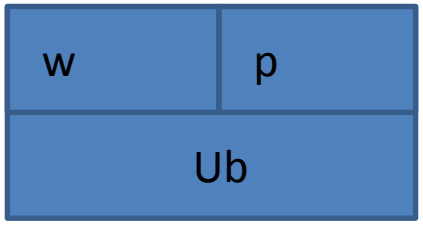
o/1 Knapsack problem

- The implicit tree for this tree can be calculated as a binary tree, where left branch signifies the inclusion of item & right branch signifies exclusion.

0/1Knapsack problem

- Here xi be one of selected item, otherwise its value is zero. Thus we require us to maximize
- $\sum^{n}$xipi subject to $\sum^{n}$xiwi≤m
- i=1 i=1

- The node structure is as follows Node is divided into three parts, the first part include the total weight of the item, the second part indicate the value of current item & the third part include the upper bound for the node



- The upper bound of the node can be calculated as
- $Ub=p+(m-w)(v_{i+1}/w_{i+1})$

0/1knapsack problem

- Example n=3,m=3

Item	w	p
x1	1	2
X2	2	3
X3	3	4

- First calculate profit per weight ratio &arrange the table according to descending values of ratio

Item	w	p	pi/wi
x1	1	2	2
X2	2	3	1.5
X3	3	4	1.3

Now we start with the root node, the upper bound for the root node can be computed as

Ub=0+(3-0)*2=6 where p=0,w=0,m=3,pi/wi=2

Application & scope of research

- To develop 0/1knapsack problem which is more efficient in term of time complexity

Assignment

Q.1) How knapsack problem is solved using Branch & Bound method?

Q.2)What is the time complexity of 0/1 knapsack problem using Branch and & Bound method