CHIRANJEEVI
IBM19CS403

Assignment

knapsack

Solve the following instance of knapsack problem with 4 objects and knapsack capacity = 10

* weights of 4 objects = 3, 4, 2, 3 respectively
* profit of 4 objects = 30, 45, 25, 36 respectively

Do not use memory functions

objects	weights	Profit
1	3	30
2	4	45
3	2	25
4	3	36

$$v[i,j] = \begin{cases} 0 & \text{if } i=0,\ j=0 \\ v[i-1,j] & \text{if } i>0,\ w_i > j \\ \max\{v[i-1,j],\ v[i-1,j-w_i]+p_i\} & \text{if } w_i \le j \end{cases}$$

n \ m	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	30	30	30	30	30	30	30	30
2	0	0	0	30	45	45	45	75	75	75	75
3	0	0	25	25	25	55	70	75	75	100	100
4	0	0	25	36	36	61	70	75	91	106	111

CHIRANJEEVI
1BM19CS403

Step 1: when $i=1$, $w_1=8$, $P_1=30$

$J=1$, $v[1,1] = v[0,1] = 0$
$J=2$, $v[1,2] = v[0,2] = 0$
$J=3$, $v[1,3] = \max\{v[0,3], v[0,0]+30\} = 30$
$J=4$, $v[1,4] = \max\{v[0,4], v[0,1]+30\} = 30$
$J=5$, $v[1,5] = \max\{v[0,5]; v[0,2]+30\} = 30$
$J=6$, $v[1,6] = \max\{v[0,6]; v[0,3]+30\} = 30$
$J=7$, $v[1,7] = \max\{v[0,7]; v[0,4]+30\} = 30$
$J=8$, $v[1,8] = \max\{v[0,8], v[0,5]+30\} = 30$
$J=9$, $v[1,9] = \max\{v[0,9], v[0,6]+30\} = 30$
$J=10$, $v[1,10] = \max\{v[0,10], v[0,7]+30\} = 30$

Step 2: when $i=2$, $w_2=4$, $P_2=45$

$J=1$, $v[2,1] = v[1,1] = 0$
$J=2$, $v[2,2] = v[1,2] = 0$
$J=3$, $v[2,3] = v[1,3] = 30$
$J=4$, $v[2,4] = \max\{v[1,4], v[1,0]+45\} = 45$
$J=5$, $v[2,5] = \max\{v[1,5], v[1,1]+45\} = 45$
$J=6$, $v[2,6] = \max\{v[1,6], v[1,2]+45\} = 45$
$J=7$, $v[2,7] = \max\{v[1,7], v[1,3]+45\} = 75$
$J=8$, $v[2,8] = \max\{v[1,8], v[1,4]+45\} = 75$
$J=9$, $v[2,9] = \max\{v[1,9], v[1,5]+45\} = 75$
$J=10$, $v[2,10] = \max\{v[1,10], v[1,6]+45\} = 75$

Step 3: when $i=3$, $w_3=2$, $P_3=25$

$J=1$, $v[3,1] = v[2,1] = 0$
$J=2$, $v[3,2] = \max\{v[2,1], v[2,0]+25\} = 25$
$J=3$, $v[3,3] = \max\{v[2,3], v[2,1]+25\} = 25$.

J=4, $v[3,4] = \max\{v[2,4], v[2,2]+25\} = 25$

J=5, $v[3,5] = \max\{v[2,5], v[2,3]+25\} = 55$

J=6, $v[3,6] = \max\{v[2,6], v[2,4]+25\} = 70$

J=7, $v[3,7] = \max\{v[2,7], v[2,5]+25\} = 75$

J=8, $v[3,8] = \max\{v[2,8], v[2,6]+25\} = 75$

J=9, $v[3,9] = \max\{v[2,9], v[2,7]+25\} = 100$

J=10, $v[3,10] = \max\{v[2,10], v[2,8]+25\} = 100$

Step 4: when $i=4$, $w_4=3$, $P_4=36$

J=1, $v[4,1] = v[3,1] = 0$

J=2, $v[4,2] = v[3,2] = 25$

J=3, $v[4,3] = \max\{v[3,3], v[3,0]+36\} = 36$

J=4, $v[4,4] = \max\{v[3,4], v[3,1]+36\} = 36$

J=5, $v[4,5] = \max\{v[3,5], v[3,2]+36\} = 61$

J=6, $v[4,6] = \max\{v[3,6], v[3,3]+36\} = 70$

J=7, $v[4,7] = \max\{v[3,7], v[3,4]+36\} = 75$

J=8, $v[4,8] = \max\{v[3,8], v[3,5]+36\} = 91$

J=9, $v[4,9] = \max\{v[3,9], v[3,6]+36\} = 106$

J=10, $v[4,10] = \max\{v[3,10], v[3,7]+36\} = 111$

Optimal Solution

$v[n,m] = v[4,10]$

$= 111$

4th object is selected as maximum profit

then $111 - 36 = 75$

then $v[3,7] = v[2,7] = 75$

Therfore 3rd object in not Selected

$v[2,7] \neq v[1,7]$

2nd object is selected

$75 - P_2 = 75 - 45 = 30$

$v[1,3] \neq v[0,3]$

$30 \neq 0$

1st Object is Selected

x_1	x_2	x_3	x_4
{ 1	1	0	1 }