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Assignment

Solve the following instance of knapsack problem with 4 objects and knapsack capacity = 10.
Weight of 4 objects = 3, 4, 2, 3 respectively.
Profits of 4 objects = 30, 45, 25, 36 respectively.
Do not use memory functions.

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

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

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

Step 1: when $i=1$, $w_1=3$, $P_1=30$

$j=1$, $v[1,1] = v[0,1] = 0$
$j=2$, $v[1,2] = v[0,2] = 0$
$j=3$, $v[1,3] = \max\{v[0,3], v[0,0]+30\} = 30$
$j=4$, $v[1,4] = \max\{v[0,4], v[0,1]+30\} = 30$
$j=5$, $v[1,5] = \max\{v[0,5], v[0,2]+30\} = 30$
$j=6$, $v[1,6] = \max\{v[0,6], v[0,3]+30\} = 30$

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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, w2=4, P2=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, w3=2, P3=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

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

therefore 3rd object is 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