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Part - B

Q.3] Knapsack :-

↳ Algorithm :-

//Input : n is total number of items; W is the capacity w[ ] stores weights of each item & v[ ] stores values.

//Output : Returns total value of selected items from knapsack.

```
for (i ← 0 to n) do {
for (j ← 0 to w) do {
 table[i,0] = 0
 table[0,j] = 0 }}

for (i ← 0 to n) do {
for (j ← 0 to w) do {
 if (j < w[i]) then {
        table[i,j] ← table[i-1,j] }
else if (j >= w[i]) then
   table[i,j] ← max[table(i-1,j), (v[i+j) +
                                table[i-1,j-1])}}

return table[n,w]
```

Time efficiency = O(nW)

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Sailesh

→ Given, n=4, w=[1,2,2,3] P=[18,16,6,4]
capacity = 4.

	P	w
1	18	1
2	16	2
3	6	2
4	4	3

	0	1	2	3	4
0	0	0	0	0	0
1	0	18	18	18	18
2	0	18	18	34	34
3	0	18	18	34	34
4	0	18	18	34	34

Formula: $V[i,w] = \max\{v(i-1,w), v(i-1, w-w[i]) + P[i]\}$

$V[1,1] = \max\{V(0,1), V[0,1-1)+18\} = 18$
$V[1,2] = \max\{V(0,2), V(0,2-1)+18\} = 18$
$V[1,3] = \max\{V[0,3], V(0,3-1)+18\} = 18.$
$V[1,4] = \max\{V(0,4], V[0,4-1]+18\} = 18.$
$V[2,1] = \max\{V(1,1], V[1,1-2]+16 = 18.$
$V(2,2) = \max\{$ ~~V(0,2)~~ $V(1,2), V[1,2-2]+16\} = 18$
$V[2,3] = \max\{V(1,3), V(1,3-2)+16\} = 34$
$V[2,4] = \max\{V(1,4), V(1,4-2)+16\} = 34$
$V[3,1] = \max\{V(2,1), V(2,1-2]+6\} = 18.$
$V[3,2] = \max\{V(2,2), V(2,2-2)+6\}$
$= \max(18,6) = 18.$
$V[3,3] = \max\{V(2,3), V(2,3-2)+6\} = \max(34,24) = 34$
$V[3,4] = \max\{V(2,4), V(2,4-2)+6\} = \max(34,18+6) = 34$
$V[4,1] = \max\{V(3,1), V(3,1-2)+4\} = \max(18,-) = 18.$
$V[4,2] = \max\{V(3,2), V(3,2-2)+4\} = \max(18,4) = 18$
$V[4,3] = \max\{V(3,3), V(3,3-2)+4\} = \max(34,22) = 34$
$V[4,4] = \max\{V(3,4), V(3,4-2)+4\}$
$= \max\{34,22\} = 34$

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Hence Max value is 34
As table[4,4] = table[3,4]
& table[3,4] = table[2,4]
we dont select 4th & 3rd item.

Selecting item 1 & 2 :-
∴ Solution will be (1,1,0,0)

Profits: 34 - 16 = 18 ⟶ 2nd item
18 - 18 = 0 ⟶ 1st item.