Define how Knapsack Problem is Solved by dynamic programming.

Consider n=3(w, w, $w_1$)=(2, 3, 3), (P,, $P_2$, $P_2$)=(1,2,4) and 6. Find optimal solution.

n = 3 (number of items)

$w_1$ = 2, $w_2$ = 3, $w_3$ = 3 (weights of the items)

$P_1$ = 1, $P_2$ = 2, $P_3$ = 4 (values of the items)

W = 6 (maximum weight capacity)

## Step 01:

Create table.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | | | | | | |
| 2 | 0 | | | | | | |
| 3 | 0 | | | | | | |

## Step 02:

Fill in the table:

For item 1 ($w_1$ = 2, $P_1$ = 1):

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0 |  |  |  |  |  |  |
| 3 | 0 |  |  |  |  |  |  |

## Step 03:

For item 2

($w_2 = 3$, $P_2 = 2$):

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0 | 0 | 1 | 2 | 2 | 2 | 2 |
| 3 | 0 |  |  |  |  |  |  |

## Step 04:

For item 3

($w_3 = 3$, $P_3 = 4$):

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| --- | --- | --- | --- | --- | --- | --- | --- |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 2 | 0 | 0 | 1 | 2 | 2 | 2 | 2 |
| 3 | 0 | 0 | 1 | 4 | 4 | 4 | 6 |

The optimal solution is the value in the bottom-right corner of the table, which is dp[3][6] = 6. Therefore, the maximum value that can be achieved without exceeding the weight capacity of 6 is 6.