

### Q5: (5+8+7 Marks)

- a) Please recall **Knapsack (0/1)** in your mind and write its complete recurrence with all the base cases and details. [In variable terms]

You have been given data to solve some questions, **capacity for the Knapsack is 18**. Total 8 items are there for the selection

<b>W</b>	4	7	5	3	2	6	5	4
<b>V</b>	3	10	8	7	8	3	6	8

- b) You have to calculate value for **V[3, 10]**, through **recursive function calls**. First try to understand what is asked and then show step by step all the calls what are to be used in the form of recursion tree. [At every step it should be clearly mentioned that what was the decision at the step, with reason]
- c) You have to calculate value for **V[4,13]**, through **table filling method**. First try to understand what is asked, then fill the required cells in the table. At the end show which items were selected step by step, and how it was decided.

- Complete table of knapsack with the given weights and value.
- Green one's are the selected one's and in case of same values make it selected.

wi	Vi
4	3
7	10
5	8
3	7
2	8
6	3
5	6
4	8

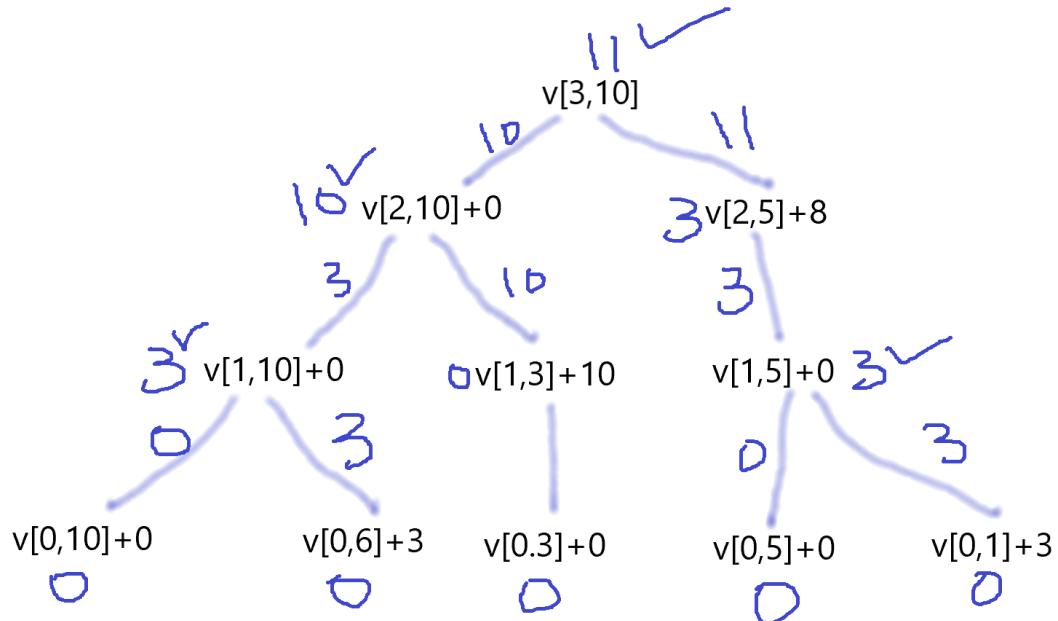
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	0	0	0	0	3	3	3	10	10	10	10	13	13	13	13	13	13	13	13
3	0	0	0	0	3	8	8	10	10	11	11	13	18	18	18	18	21	21	21
4	0	0	0	7	7	8	8	10	10	11	11	13	18	18	18	20	25	25	25
5	0	0	8	8	8	15	15	16	16	18	23	23	25	25	26	26	28	33	33
6	0	0	8	8	8	15	15	16	16	16	23	23	25	25	26	26	28	33	33
7	0	0	8	8	8	15	15	16	16	16	23	23	25	25	26	29	29	33	33
8	0	0	8	8	8	15	16	16	16	23	24	24	25	25	31	31	33	33	34

a)

- Recurrence : if  $w_i > j$  then  $v(i-1, j) + 0$       else if  $w_i \leq j$  then  $\max(v(i-1, j-w_i) + v_i, v(i-1, j) + 0)$
- Variables :  $w_i$  = weight of item       $v_i$  = value of item       $w$  = total weight       $v$  = total value  
 $i$  = number of item       $j$  = number of weight
- Base case :  $i == 0 \mid\mid j == 0$  return 0;

b)

$v[3,10]$  through recursion.



c)

Table till  $v[4,13]$

	0	1	2	3	4	5	6	7	8	9	10	11	12	13
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	3	3	3	3	3	3	3	3	3	3
2	0	0	0	0	3	3	3	10	10	10	10	13	13	13
3	0	0	0	0	3	8	8	10	10	11	11	13	18	18
4	0	0	0	7	7	8	8	10	10	11	11	13	18	18

This table is made now check the items selected or not till this in this max weight is 13.

$v[4, 13]$	$w=13$	$v=0$
$v[3, 10]$	$w=10$	$v=7$
$v[2, 5]$	$w=5$	$v=15$
$v[1, 5]$	$w=5$	$v=15$
$v[0, 1]$	$w=1$	$v=18$

In this when the index written got selected value just simple minus  $w_i$ (weight of item) from  $w$ (total weight) and add  $v_i$ (value of item) to  $v$ (total value).

The final answer is item number 1,3,4 are selected.