ηαυλακhi

Navlakhi®

0/1 Knapsack
Dynamic Programming

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m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

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P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
(1)	1								
(4)	3								
(5)	4								
(7)	5								

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0							
(4)	3	0							
(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 1(kg)
Have 1(kg)
Got profit 1

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1						
(4)	3	0							
(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 2(kg)
Can get only 1(kg)
So profit of 1
Have 1(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1					
(4)	3	0							
(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 3(kg)
Can get only 1(kg)
So profit of 1

Have 1(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1				
(4)	3	0							
(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 4(kg)
Can get only 1(kg)
So profit of 1

Have 1(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1			
(4)	3	0							
(5)	4	0							
(7)	5	0							

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m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 5(kg)
Can get only 1(kg)
So profit of 1

Have 1(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1		
(4)	3	0							
(5)	4	0							
(7)	5	0							

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m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

& so on

Have 1(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0							
(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 1 kg
So cant select 3kg
hence we retain the old profit

Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1						
(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 2 kg
So cant select 3kg
hence we retain the old profit

Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1					
(5)	4	0							
(7)	5	0							

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m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 3 kg
hence we retain the old profit and reject this item OR
We select this after emptying the bag by 3kg means
going to previous row 3 (kg) positions backwards
From these two options choose the max

Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	1 OR				
(5)	4	0							
(7)	5	0							

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(1)	1	0	1	1	1	1	1	1	1
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(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$

Need 3 kg
hence we retain the old profit and reject this item OR
We select this after emptying the bag by 3kg means
going to previous row 3 (kg) positions backwards
From these two options choose the max

Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	(1) OR (4+0) =4				
(5)	4	0							
(7)	5	0							

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m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 4 kg HAVE 3 KG
hence we retain the old profit and reject this item OR
We select this after emptying the bag by 3kg means
going to previous row 3 (kg) positions backwards
From these two options choose the max

Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4				
(5)	4	0							
(7)	5	0							

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(7)	5	0							

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(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	1 OR			
(5)	4	0							
(7)	5	0							

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(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	1 OR			
(5)	4	0							
(7)	5	0							

$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$

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(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	1 OR (4+1) =5			
(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 5 kg HAVE 3 KG
hence we retain the old profit and reject this item OR
We select this after emptying the bag by 3kg means going to previous row 3 (kg) positions backwards
From these two options choose the max

Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5			
(5)	4	0							
(7)	5	0							

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(1)	1	0	1	1	1	1	1	1	1
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(5)	4	0							
(7)	5	0							

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(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	1 OR		
(5)	4	0							
(7)	5	0							

$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$

m= 7 (knapsack capacity)
P=(1,4,5,7)
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Need 5 kg HAVE 3 KG
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Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	1 OR (4+1) =5		
(5)	4	0							
(7)	5	0							

$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Similarly

Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	1 OR (4+1) =5	
(5)	4	0							
(7)	5	0							

$$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$$

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Similarly

Have 3(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	1 OR (4+1) =5
(5)	4	0							
(7)	5	0							

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m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 1 kg
So cant take this item
Old profit retained

Have 4(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0							
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 1 kg HAVE 4 kg
So cant take this item
Old profit retained

Have 4(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1						
(7)	5	0							

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 2 kg HAVE 4kg
So cant take this item
Old profit retained

Have 4(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1					
(7)	5	0							

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m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 3 kg HAVE 4kg
So cant take this item
Old profit retained

Have 4(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4				
(7)	5	0							

$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 4 kg HAVE 4kg
So either reject this item and continue with old profit
OR take this item and create place by moving 4 (kg) positions to the left

Have 4(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5 OR (5+0) =5			
(7)	5	0							

$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 5 kg HAVE 4kg
So either reject this item and continue with old profit
OR take this item and create place by moving 4 (kg) positions to the left

Have 4(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	5 OR (5+1) =6		
(7)	5	0							

$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 6 kg HAVE 4kg
So either reject this item and continue with old profit
OR take this item and create place by moving 4 (kg) positions to the left

Have 4(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	5 OR (5+1) =6	
(7)	5	0							

$$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$$

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 7 kg HAVE 4kg
So either reject this item and continue with old profit
OR take this item and create place by moving 4 (kg) positions to the left

Have 4(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	5 OR (5+4) =9
(7)	5	0							

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m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 1 kg HAVE 5kg
So cannot take the present item
Continuing with old profit

Have 5(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
(7)	5	0	1						

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 2 kg HAVE 5kg
So cannot take the present item
Continuing with old profit

Have 5(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
(7)	5	0	1	1					

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 3 kg HAVE 5kg
So cannot take the present item
Continuing with old profit

Have 5(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
(7)	5	0	1	1	4				

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Need 4 kg HAVE 5kg
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(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
(7)	5	0	1	1	4	5			

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m= 7 (knapsack capacity)
P=(1,4,5,7)
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Need 5 kg HAVE 5kg
So either reject this item and continue with old profit
OR take this item and create place by moving 5 (kg) positions to the left

Have 5(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
(7)	5	0	1	1	4	5	6 OR (7+0) =7		

$$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$$

m= 7 (knapsack capacity)
P=(1,4,5,7)
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Need 6 kg HAVE 5kg
So either reject this item and continue with old profit
OR take this item and create place by moving 5 (kg) positions to the left

Have 5(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
(7)	5	0	1	1	4	5	7	6 OR (7+1) =8	

$$f_i(y) = MAX\{f_{i-1}(y), f_{i-1}(y-w_i)+p_i)\}$$

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

Need 7 kg HAVE 5kg
So either reject this item and continue with old profit
OR take this item and create place by moving 5 (kg) positions to the left

Have 5(kg)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
(7)	5	0	1	1	4	5	7	8	9 OR (7+1) =9

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
(7)	5	0	1	1	4	5	7	8	9

Final Profit is 9
now let us see how to get the element list selected in our knapsack

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
~~(7)~~	~~5~~	0	1	1	4	5	7	8	9

Since copy of the above value HENCE this item is a REJECT
So item4 = 5kg REJECT and we move up

Navlakhi®

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	**4**	0	1	1	4	5	6	6	9
~~(7)~~	~~5~~	0	1	1	4	5	7	8	9

Since NOT copy of the above value HENCE this item is a TAKEN
So item3 = 4kg TAKEN and we move up and 4 (kg) positions left

Navlakhi®

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	**4**	0	1	1	4	5	6	6	9
~~(7)~~	~~5~~	0	1	1	4	5	7	8	9

Since NOT copy of the above value HENCE this item is a TAKEN
So item3 = 4kg TAKEN and we move up and 4 (kg) positions left

Navlakhi®

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0	1	1	1	1	1	1	1
(4)	**3**	**0**	**1**	**1**	**4**	**5**	**5**	**5**	**5**
(5)	**4**	**0**	**1**	**1**	**4**	**5**	**6**	**6**	**9**
~~(7)~~	~~5~~	0	1	1	4	5	7	8	9

Since NOT copy of the above value HENCE this item is a TAKEN
So item2 = 3kg TAKEN and we move up and 3(kg) positions left

Navlakhi®

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
(1)	1	0 ←	1 ←	1 ←	1	1	1	1	1
(4)	**3**	**0**	**1**	**1**	**4**	**5**	**5**	**5**	**5**
(5)	**4**	**0**	**1**	**1**	**4**	**5**	**6**	**6**	**9**
~~(7)~~	~~5~~	0	1	1	4	5	7	8	9

Since NOT copy of the above value HENCE this item is a TAKEN
So item2 = 3kg TAKEN and we move up and 3(kg) positions left

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
~~(1)~~	~~1~~	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
~~(7)~~	~~5~~	0	1	1	4	5	7	8	9

Since this is the first ROW and value is zero so we REJECT this item
So item1 = 1kg REJECTED

m= 7 (knapsack capacity)
P=(1,4,5,7)
W=(1,3,4,5)

(P)	W	0	1	2	3	4	5	6	7
~~(1)~~	~~1~~	0	1	1	1	1	1	1	1
(4)	3	0	1	1	4	5	5	5	5
(5)	4	0	1	1	4	5	6	6	9
~~(7)~~	~~5~~	0	1	1	4	5	7	8	9

Final answer : selected items item2 and item3
Total profit : 4+5 = 9