

# 0/1 Knapsack with Dynamic Programming

$$P = [2, 5, 8, 1]$$

$$W = [10, 15, 6, 9]$$

$$m = 30.$$

$$S^0 = \{0, 0\}$$

$$S_1^0 = \{2, 10\}$$

form  $S_1^0$  by considering 1<sup>st</sup> element. Add 1<sup>st</sup> element to all the items of  $S^0$ .

$$S^1 = \{(0, 0), (2, 10)\} \rightarrow \text{check with pruning rule}$$

$$S_1^1 = \{(5, 15), (7, 25)\} \rightarrow \text{consider 2<sup>nd</sup> element } (5, 15).$$

$$S^2 = \{(0, 0), (2, 10), (5, 15), (7, 25)\} \rightarrow \text{check with pruning rule}$$

$$S_1^2 = \{(8, 6), (10, 16), (13, 21), (15, 31)\} \rightarrow 3^{\text{rd}} \text{ element}$$

$$S^3 = \{(0, 0), (2, 10), (5, 15), (7, 25), (8, 6), (10, 16), (13, 21), (15, 31)\} \rightarrow \text{Apply Pruning rule}$$

$$\text{Compared to } (8, 6) \rightarrow \text{kill } (7, 25) \\ (5, 15) \\ (2, 10)$$

$$S^3 = \{(0,0), (8,6), (10,16), (13,21), (15,31)\}$$

$$S_1^3 = \{(1,9), (9,15), (11,25), (14,30), (16,40)\}$$

$$S^4 = \{(0,0), (8,6), (10,16), (13,21), (15,31), (1,9), (9,15), (11,25), (14,30), (16,40)\}$$

→ Apply Pruning rule.

= Compared to (8,6) kill (1,9).  
(13,21) kill (11,25).

$$S^4 = \{(0,0), (8,6), (10,16), (13,21), (15,31), (9,15), (14,30), (16,40)\}$$

$$\text{Solution} = (14,30)$$

(14,30) originated by considering 4<sup>th</sup> element  $x_4=1$  in  $(S_1^3)$

$$(14,30) - (1,9) = (13,21)$$

(13,21) originated by considering 3<sup>rd</sup> element ie in  $S_1^2$ ,  $x_3=1$

$$(13,21) - (8,6) = (5,15)$$

(5,15) originated in  $S_1$  by considering 2<sup>nd</sup> element  $x_2=1$

$$\therefore \text{Solution } [0, 1, 1, 1]$$