

# \* Subset Sum Problem using Dynamic Programming:-

Let 'A' be an array or set which contains 'n' non negative integers, find a subset 'x' of set 'A' such that sum of all elements of  $x = w$ .

Here 'w' is another input (Sum)  
\* Use Set value only once to make sum(w).

Example:- Set = {2, 3, 7, 8, 10}

0 - F  
1 - T

(Sum) Total = 11

When we reach 0<sup>th</sup> column then STOP  $j \rightarrow$

	0	1	2	3	4	5	6	7	8	9	10	11
2	T	F	T	F	F	F	F	F	F	F	F	F
3	T	F	T	T	F	T	F	F	F	F	F	F
7	T	F	T	T	F	T	F	T	F	T	T	T
8	T	F	T	T	F	T	F	T	T	T	T	T
10	T	F	T	T	F	T	F	T	T	T	T	T

we make sum = zero (0) by using Empty set  $\therefore a[i,0] = T/1$

Ans = {3, 8} = 11

Rule ①:-

If  $a[i] > j$  then Copy above value.

Rule ②:-

③  $\Rightarrow$  If above value is "True" then we can't consider left element (in this case 8 step back is 'F') So, we can't consider F value. Simply copy above 'T' value to  $a[i,j]$  position

// by for  $a[3,10] \Rightarrow$  copy just above value  $\therefore$  it is 'T' & can't go back to 8<sup>th</sup> position

①  $\Rightarrow$  If  $a[i] > 3$   
 $3 > 3 \times$   
else  
a) Go above  
b) then 3 step towards left  
c) Pick that value & copy at  $a[i,j]$  position

②  $\Rightarrow$  Here  $a[i] > j$  then just copy as above value

$$\text{Set } a[i] = \{ \underset{a_0}{2}, \underset{a_1}{3}, \underset{a_2}{7}, \underset{a_3}{8}, \underset{a_4}{10} \}$$

Formula:-

$T[i, j] \Rightarrow \text{Matrix}$

if  $a[i] > j$  then

$$T[i, j] = T[i-1, j]$$

else if  $(T[i-1, j] = \text{"True"} / \text{"1"})$  then

$$T[i, j] = T[i-1, j]$$

else

$$T[i, j] = T[i-1, j - a[i]]$$

Using Previous Example Suppose we want to fill

$$T[\overset{i}{3}, \overset{j}{8}] \Rightarrow \begin{cases} \text{if } a[3] > 8 \\ 8 > 8 \quad \times \end{cases}$$

$$\begin{aligned} \text{else if } (T[3-1, 8] = T) \\ (T[2, 8] = T) \\ F \neq T \end{aligned}$$

else

$$\begin{aligned} T[3, 8] &= T[2, 8 - a[3]] \\ &= T[2, 8 - 8] \\ &= T[2, 0] \\ &= T \quad \checkmark \end{aligned}$$

Another Method to Solve the by using  
Formula :-

$M[i, j] = "1"/"T" \quad :- \quad \underbrace{3 \text{ Cases of Putting value} = 1 \text{ or } T}$

①  $a[i] = j$

②  $M[i-1, j] = 1$

③  $M[i-1, j-a[i]] = 1$