Question 2

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Solution:

Using the dynamic programming method, the truth table of (n+1)*(m+1) can be obtained, and the answer is subset(n, m)

Subproblems:

For subset(i, j) = subset(i-1, j) = True, the element S[i] is not in the subset s. For subset(i, j) = True and subset(i-1, j) = False, the element S[i] must be in the subset s. For subset(i, j) = True and subset(i-1, j) = False, the element S[i] must be in the subset s. In this case, subset(i-1, j-S[i]) = True, so that we can find the element in s by recursive method. For this problem, just start from subset(n, M).

Recurrence:

For $1 \leq i \leq n$ and $1 \leq j \leq m$, Let subset(i, j) denote the case where the subset of the first i elements in array A and less than j, then

If A[i] > j, then A[i] is not in the subset s.

If A[i] < j, there are two cases:

one case is that A[i] is not in subset s, then subset(i, j) = subset(i-1, j);

one case is that A[i] is in subset s, then subset(i, j) = subset(i-1, j - S[i]).

Base cases:

For i=0,1,2,… ,n, we have subset(i, 0)=True, for j=1,2,… ,M, we have subset(0, j)=False. if sum = 0 (return empty set).

Since i goes from 1 to N and j goes from 1 to M, the time complexity of the algorithm is $\boldsymbol{O(mn)}$.