EXPERIMENT NO.10

Sum Of Subset Problem

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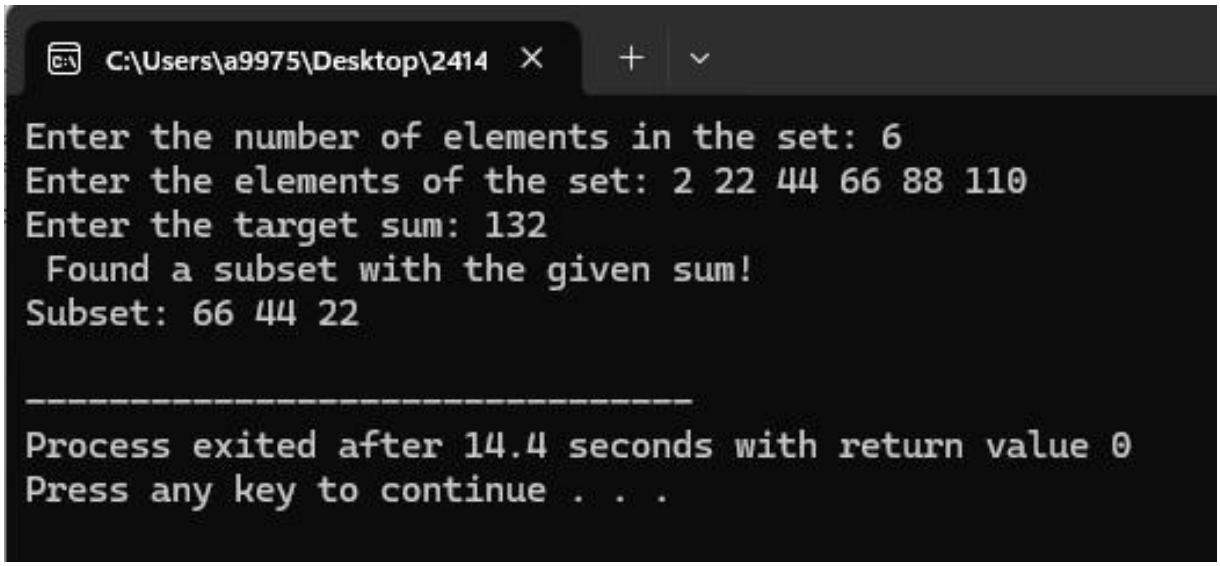
Program:-

```
#include <iostream>
#include <vector>
using namespace std;
bool isSubsetSumDP(vector<int>& set, int sum, vector<int>& subset) {
  int n = set.size();
  int i, j;
  vector<vector < bool > > dp(n + 1, vector<bool>(sum + 1, false));
  for ( i = 0; i <= n; ++i)
    dp[i][0] = true;
  for ( i = 1; i <= n; ++i) {
    for ( j = 1; j <= sum; ++j) {
      if (set[i – 1] > j)
        dp[i][j] = dp[i – 1][j];
      else
        dp[i][j] = dp[i – 1][j] || dp[i – 1][j – set[i – 1]];
    }
  }
  if (!dp[n][sum])
```

```
    return false;
  for ( i = n, j = sum; i > 0 && j > 0; --i) {
    if (!dp[i – 1][j]) {
      subset.push_back(set[i – 1]);
      j-= set[i – 1];
    }
  }
  return true;
}
int main() {
  int n,i, sum;
  cout << “Enter the number of elements in the set: “;
  cin >> n;
  vector<int> set(n);
  cout << “Enter the elements of the set: “;
  for ( i = 0; i < n; ++i)
    cin >> set[i];
  cout << “Enter the target sum: “;
  cin >> sum;
  vector<int> subset;
  if (isSubsetSumDP(set, sum, subset)) {
    cout << “ Found a subset with the given sum!\nSubset: “;
    for ( i = 0; i < subset.size(); ++i)
```

```
        cout << subset[i] << " ";
    cout << endl;
  } else {
    cout << "? No subset found with the given sum." << endl;
  }
  return 0;
}
```

Output:-



Algorithm:-

Input:Set of positive integers S = {s_1, s_2, ..., s_n}

Target sum d.

Output:-All subsets of S whose elements sum to dStep 1: Sort the set S (optional for optimization).

Step 2: Initialize variables:

sum = 0, k = 0 (starting index).

Step 3: Call subset(k, sum) recursively.

Step 4:

Subset(k, sum):

1. If sum == d:

   Print current subset; return.

2. If sum > d or k >= n:

   Return (backtrack).

3. Include S[k] in subset and call subset(k + 1, sum + S[k]).
4. Exclude S[k] and call subset(k + 1, sum).

Time Complexity: $O(2^n)$

Space Complexity: O(n)

List of Applications:-

1. Knapsack problem
2. Resource allocation
3. Budget planning
4. Cryptography
5. Load balancing
6. Data partitioning
7. Combinatorial optimization
8. Decision support systems
9. Scheduling tasks
10. Power set generation