Experiment 17

Write a program to implement the Backtracking algorithm to solve the Subset-sum problem.

Program:-

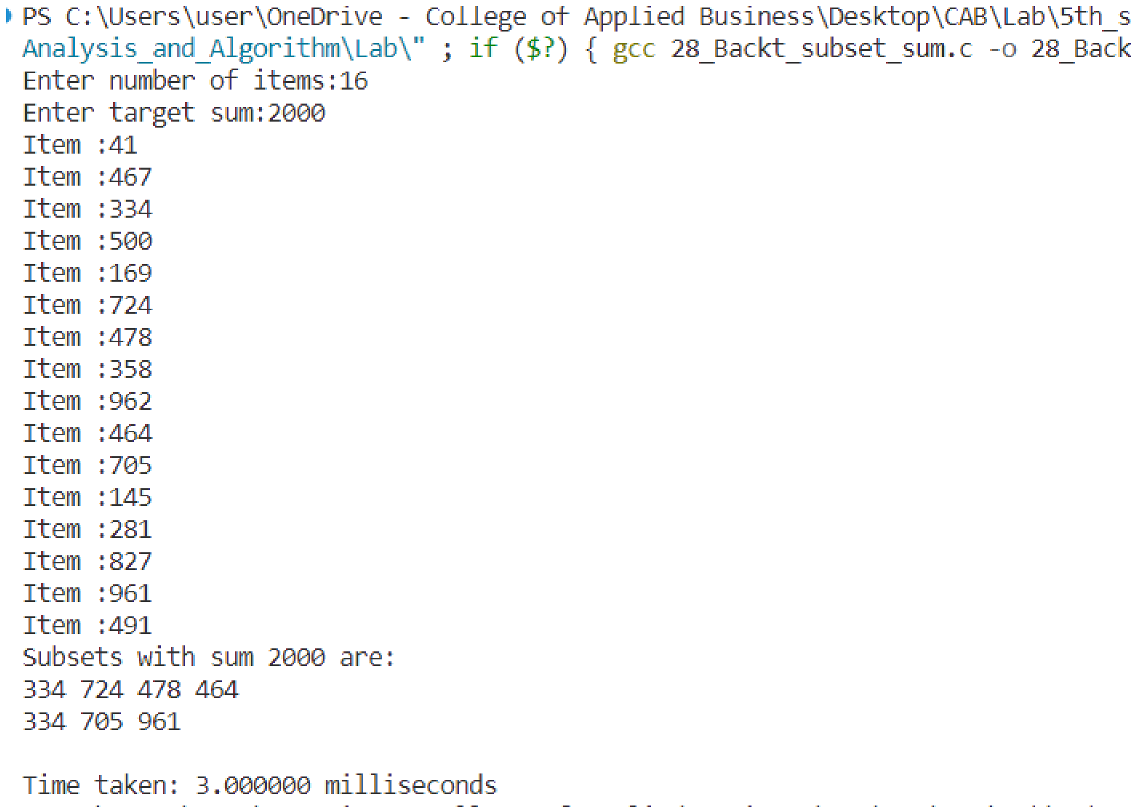
```
#include <stdio.h>
#include <stdlib.h>
#include <time.h>
void printSubset(int A[], int size) {
   for(int i = 0; i < size; i++) {
      printf("%d ", A[i]);
   }
   printf("\n");
}
void subsetSum(int S[], int T[], int S_size, int T_size, int sum, int ite, int const target_sum) {
   if(target_sum == sum) {
      printSubset(T, T_size);
      if(ite + 1 < S_size && sum - S[ite] + S[ite+1] <= target_sum) {
         subsetSum(S, T, S_size, T_size-1, sum - S[ite], ite + 1, target_sum);
      }
      return;
   }
   else {
      if(ite < S_size && sum + S[ite] <= target_sum) {
         for(int i = ite; i < S_size; i++) {
            T[T_size] = S[i];
            if(sum + S[i] <= target_sum) {
               subsetSum(S, T, S_size, T_size + 1, sum + S[i], i + 1, target_sum);
            }
         }
      }
   }
}
void generateSubsets(int S[], int size, int target_sum) {
   int *tuplet_vector = (int *)malloc(size * sizeof(int));
   subsetSum(S, tuplet_vector, size, 0, 0, 0, target_sum);
   free(tuplet_vector);
}

int main() {
   int weights[1000];
   int i, n, sum;
   double time;
   clock_t start, end;
   printf("Enter number of items:");
   scanf("%d", &n);
   printf("Enter target sum:");
   scanf("%d", &sum);
   start = clock();
   for(i = 0; i < n; i++) {
      weights[i] = rand() % 1000;
      printf("Item :%d \n", weights[i]);
   }

   printf("Subsets with sum %d are:\n", sum);
   generateSubsets(weights, n, sum);
   end = clock();
   time = ((double)(end - start) * 1000) / CLOCKS_PER_SEC;
   printf("\nTime taken: %lf milliseconds\n", time);

   return 0;
}
```

Output:



```
PS C:\Users\user\OneDrive - College of Applied Business\Desktop\CAB\Lab\5th_s
Analysis_and_Algorithm\Lab\" ; if ($?) { gcc 28_Backt_subset_sum.c -o 28_Back
Enter number of items:16
Enter target sum:2000
Item :41
Item :467
Item :334
Item :500
Item :169
Item :724
Item :478
Item :358
Item :962
Item :464
Item :705
Item :145
Item :281
Item :827
Item :961
Item :491
Subsets with sum 2000 are:
334 724 478 464
334 705 961

Time taken: 3.000000 milliseconds
```

Conclusion:

This experiment had been conducted in a 64-bit system with 16 GB RAM and Processor 12th Gen Intel(R) Core (TM) i5-12500H 3.10 GHz. The algorithm was implemented in C programming language in Visual Studio Code 1.85.1 Code Editor. The time taken by this algorithm for 16 number of input size is 3 milliseconds.. The running time is analyzed as O(2^n).