Experiment 11

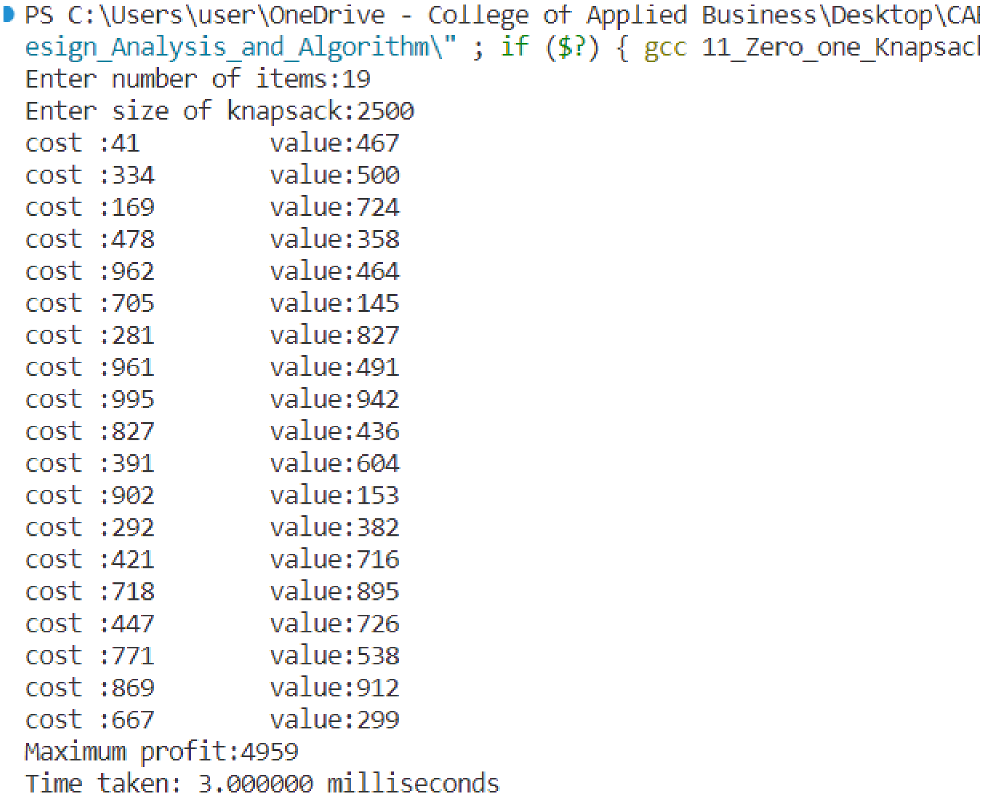
Write a program to implement the dynamic algorithm to solve the Zero-one Knapsack problem.

Program:-

```
#include <stdio.h>
#include <stdlib.h>
#include <conio.h>
#include <time.h>
int max(int a, int b) {
  return (a > b) ? a : b;
}
int knapsack(int W, int wt[], int val[], int n)
{
  int i, w;
  int K[n + 1][W + 1];
  // Build table K[n][w] in bottom up manner
  for (i = 0; i <= n; i++) {
    for (w = 0; w <= W; w++) {
      if (i == 0 || w == 0)
        K[i][w] = 0;
      else if (wt[i - 1] <= w)
        K[i][w] = max(val[i - 1] + K[i - 1][w - wt[i - 1]], K[i - 1][w]);
      else
        K[i][w] = K[i - 1][w];
    }
  }

  return K[n][W];
}
```

```
int main()
{
  int i, n, val[1000], wt[1000], W;
  int randNum1, randNum2 ;
  double time;
  clock_t start, end;

  printf("Enter number of items:");
  scanf("%d", &n);

  printf("Enter size of knapsack:");
  scanf("%d", &W);

  start = clock();
  for (i = 0; i < n; i++)
  {
    randNum1 = rand() % 1000;
    wt[i] = randNum1;
    randNum2 = rand() % 1000;
    val[i] = randNum2;
    printf("cost :%d \t value:%d \n", wt[i], val[i]);
  }
  printf("Maximum profit:%d", knapsack(W, wt, val, n));
  // end clock
  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\CAI
esign_Analysis_and_Algorithm\" ; if ($?) { gcc 11_Zero_one_Knapsacl
Enter number of items:19
Enter size of knapsack:2500
cost :41          value:467
cost :334         value:500
cost :169         value:724
cost :478         value:358
cost :962         value:464
cost :705         value:145
cost :281         value:827
cost :961         value:491
cost :995         value:942
cost :827         value:436
cost :391         value:604
cost :902         value:153
cost :292         value:382
cost :421         value:716
cost :718         value:895
cost :447         value:726
cost :771         value:538
cost :869         value:912
cost :667         value:299
Maximum profit:4959
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 15 number of input size is 1 milliseconds.. The running time is analyzed as O(nW).