PRACTICAL NO : 03

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PART (A) :

Aim: Perform Fractional Knapsack for the given scenario

Problem Definition: Suppose you are a transport dealer and want to load a truck with different types of boxes. Assume there are 50 types of boxes (Box-1 to Box-50), which weigh different and that the truck has a maximum capacity (truckSize). Each box has a profit value associated with it. It is the commission that the transporter will receive after transporting the box. You can choose any box to put on the truck as long as the number of boxes does not exceed truckSize. You can load partial boxes.

Task-1: [SUBMISSION ON CLASSROOM]

A. Load the truck using different methods: Minimum weight, Maximum profit,

Profit/weight ratio. Compute the total profit using each method and infer the best performing

method.

B. Compute the time required in each method.

Given Data:

• Capacity of truck 850 Kgs

• Weight in kg for each box:

[7, 0, 30, 22, 80, 94, 11, 81, 70, 64, 59, 18, 0, 36, 3, 8, 15, 42, 9, 0, 42, 47, 52, 32, 26, 48, 55, 6, 29, 84, 2, 4, 18, 56, 7, 29, 93, 44, 71, 3, 86, 66, 31, 65, 0, 79, 20, 65, 52, 13]

• Profit in Rs for each box:

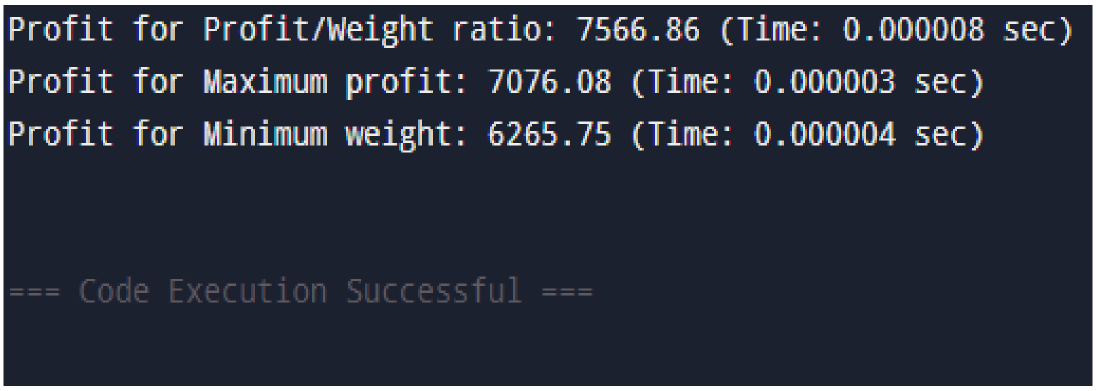
[360, 83, 59, 130, 431, 67, 230, 52, 93, 125, 670, 892, 600, 38, 48, 147, 78, 256, 63, 17, 120, 164, 432, 35, 92, 110, 22, 42, 50, 323, 514, 28, 87, 73, 78, 15, 26, 78, 210, 36, 85, 189, 274, 43, 33, 10, 19, 389, 276, 312]

Code :

```
#include <stdio.h>
#include <stdlib.h>
#include <time.h>
typedef struct {
    int profit;
    int weight;
} Item;
int compareByRatio(const void* a, const void* b) {
    Item* item1 = (Item*)a;
    Item* item2 = (Item*)b;
```

```
   double r1 = (item1->weight == 0) ? (double)item1->profit :
(double)item1->profit / item1->weight;

    double r2 = (item2->weight == 0) ? (double)item2->profit :
(double)item2->profit / item2->weight;

    return (r2 > r1) - (r2 < r1);

}

int compareByProfit(const void* a, const void* b) {

    Item* item1 = (Item*)a;

    Item* item2 = (Item*)b;

    return item2->profit - item1->profit;

}

int compareByWeight(const void* a, const void* b) {

    Item* item1 = (Item*)a;

    Item* item2 = (Item*)b;

    return item1->weight - item2->weight;

}

double knapsack(Item* items, int n, int capacity) {

    double totalValue = 0.0;

    int remaining = capacity;

    for (int i = 0; i < n; i++) {

        if (items[i].weight == 0) {

            totalValue += items[i].profit;

            continue;

        }
        if (items[i].weight <= remaining) {
            totalValue += items[i].profit;
            remaining -= items[i].weight;
        } else {
            totalValue += ((double)items[i].profit / items[i].weight) *
remaining;
            break;
        }
    }
    return totalValue;
}
void result(const char* label, Item* originalItems, int n, int capacity,
int (*cmp)(const void*, const void*)) {
    Item* tempItems = (Item*)malloc(n * sizeof(Item));
    for (int i = 0; i < n; i++) tempItems[i] = originalItems[i];
    clock_t start = clock();
    qsort(tempItems, n, sizeof(Item), cmp);
    double profit = knapsack(tempItems, n, capacity);
    clock_t end = clock();
    double time_taken = (double)(end - start) / CLOCKS_PER_SEC;
    printf("%s: %.2f (Time: %.6f sec)\n", label, profit, time_taken);
    free(tempItems);
}
int main() {
   int profit[] = {360, 83, 59, 130, 431, 67, 230, 52, 93, 125, 670, 892,
600, 38, 48, 147, 78, 256, 63, 17, 120,
                164, 432, 35, 92, 110, 22, 42, 50, 323, 514, 28, 87, 73, 78,
15, 26, 78, 210, 36, 85, 189, 274,
                43, 33, 10, 19, 389, 276, 312};
   int wt[] = {7, 0, 30, 22, 80, 94, 11, 81, 70, 64, 59, 18, 0, 36, 3, 8, 15,
42, 9, 0, 42, 47, 52, 32, 26, 48, 55,
             6, 29, 84, 2, 4, 18, 56, 7, 29, 93, 44, 71, 3, 86, 66, 31, 65, 0,
79, 20, 65, 52, 13};
   int capacity = 850;
   int n = sizeof(profit) / sizeof(profit[0]);
   Item* items = (Item*)malloc(n * sizeof(Item));
   for (int i = 0; i < n; i++) {
      items[i].profit = profit[i];
      items[i].weight = wt[i];
   }
   result("Profit for Profit/Weight ratio", items, n, capacity,
compareByRatio);
   result("Profit for Maximum profit", items, n, capacity,
compareByProfit);
   result("Profit for Minimum weight", items, n, capacity,
compareByWeight);
   free(items);
   return 0;
}
```

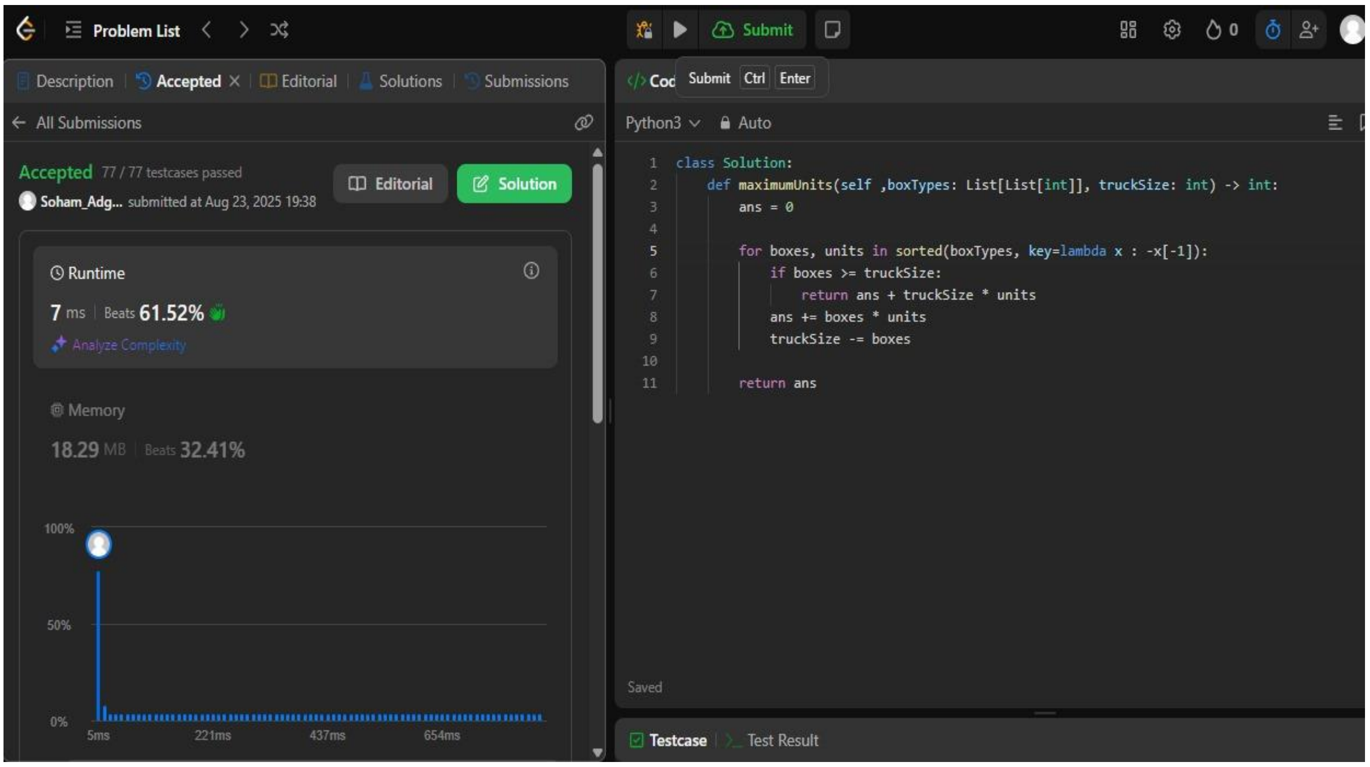
Output :



```
Profit for Profit/Weight ratio: 7566.86 (Time: 0.000008 sec)
Profit for Maximum profit: 7076.08 (Time: 0.000003 sec)
Profit for Minimum weight: 6265.75 (Time: 0.000004 sec)


=== Code Execution Successful ===
```

TASK-2: SUBMISSION ON LEETCODE

Link : https://leetcode.com/problems/maximum-units-on-a-truck/submissions/1745460033/



Accepted 77 / 77 testcases passed
Soham_Adg... submitted at Aug 23, 2025 19:38

Runtime
7 ms | Beats 61.52%

Memory
18.29 MB | Beats 32.41%

```python
class Solution:
    def maximumUnits(self ,boxTypes: List[List[int]], truckSize: int) -> int:
        ans = 0

        for boxes, units in sorted(boxTypes, key=lambda x : -x[-1]):
            if boxes >= truckSize:
                return ans + truckSize * units
            ans += boxes * units
            truckSize -= boxes

        return ans
```

PART (B)

Aim: Implement activity selection algorithm for the given scenario.

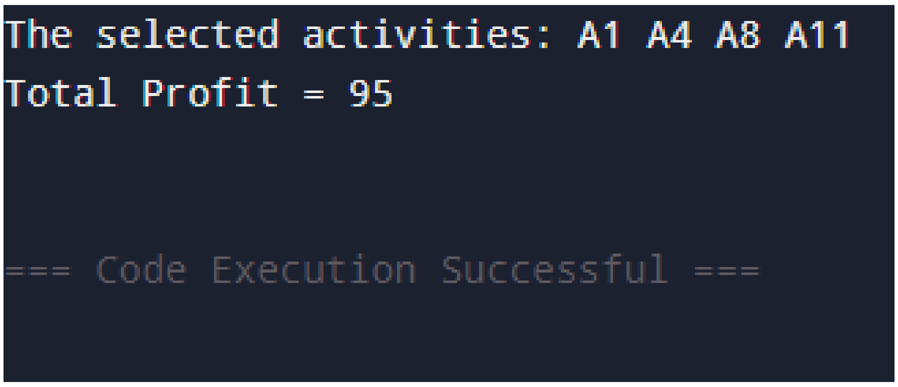
Problem Definition: In the single-machine scheduling problem, we are given a set of n activities Ai. Each job i has a starting time (si), deadline di and profit pi. At any time instant, we can do only one job. Doing a job i earns a profit (pi). Generate a solution to select the largest set of mutually compatible jobs and calculate the total profit generated by the machine. The greedy algorithm for single-machine scheduling selects the job using activity selection algorithm.

Code :

```
#include <stdio.h>

#include <string.h>

int main() {

   int n = 11;

   int s[] = {1,3,0,5,3,5,6,8,8,2,12};

   int f[] = {4,5,6,7,9,9,10,11,12,14,16};

   int p[] = {10,15,14,12,20,30,32,28,30,40,45};

   char* a[] =
{"A1","A2","A3","A4","A5","A6","A7","A8","A9","A10","A11"};

   int totalProfit = 0;

   int lastFinish = f[0]

   printf("The selected activities: ");

   printf("%s ", a[0]);

   totalProfit += p[0];

   for(int i = 1; i < n; i++) {

      if(s[i] >= lastFinish) {

         printf("%s ", a[i]);
```

```
            totalProfit += p[i];
            lastFinish = f[i];
        }
    }
    printf("\nTotal Profit = %d\n", totalProfit);
    return 0;
}
```

Output :



```
The selected activities: A1 A4 A8 A11
Total Profit = 95


=== Code Execution Successful ===
```