Kevin Shah Batch-C 23107006O

Date
Page

DAA Lab-3

Aim : To understand how visual studio code works and its installation process, code editing, productivity tips and learning about its extensions. Writing an algorithm to find gross and net salary of 2000 employees of ABC Co. ltd and find maximum and minimum salary using divide and conquer.

Input : CSV file having salary information of 2000 employees along with the breakup.

Theory : According to salary literature
. Gross salary → Base salary + HRA + other Allowances
. Net salary → Gross salary - Professional tax - Employee provident fund - Income Tax

Columns of csv file contain all these elements and row represents each employee.

Gross and net salaries of employees:

function calculate_salaries (employee):

```
//input : employee contains basic_salary, HRA,
        other allowances, Income_Tax, Professional_Tax,
        Employee_Provident_Fund.

If any value < 0 in any column:
    employee.gross_salary = "Invalid"
    employee.net_salary = "Invalid"
Else:
    employee.gross_salary = employee.Basic_Salary +
    employee.HRA + employee.other_Allowances

    employee.total_deductions = employee.Income_Tax +
    employee.Employee_Provident_Fund + employee.Professional_Tax

    employee.net_Salary = employee.gross_salary - employee.
                                              total deductions
```

→ linear algorithm

```
function minmax ( arr[] )  {
// searches for maximum and minimum salary value
// from every given array by using iterative approach
// ie by comparing every element present in array.
// input : an array arr[] containing the salaries of
//             the employees
// output : maximum and minimum values of the
//             employee's salary

        max_salary = arr[0]
        min_salary = arr[0]
        for (int i=1 ; i < arr.size ; i++) {
            if (a[i] > max_salary)
                max_salary = a[i];
            if (a[i] < min_salary)
                min_salary = a[i];

        return min_salary, max_salary;  }
```

Time Complexity: (Linear approach)

base case is only 1 element present in array ie. O(1)

$\sum_{i=0}^{n} 1 = (n-1)+1$

$= O(n)$

1) Algorithm (Divide-and-conquer Approach)

```
function findminmax (int arr[], low, high) {

//searches for maximum and minimum salary value
//from arr[] by using recursive divide and conquer
//input : an array arr[] and indices high, low
//output : The maximum and minimum value present
//         at that particular index.
int low = 0
int high = arr.size() - 1
if (low == high) {
     return {arr[low], arr[low]};
}
else if (high == low + 1) {
    if (arr [low] < arr[high]) {
       return {arr [low], arr[high]};
    } else {
       return {arr [high], arr[low]};
    }
}
else {
   int mid = low + (high - low) / 2 ;
   leftResult = findminmax ( arr [], low, mid);
   rightResult = findminmax ( arr [], mid+1, high);

   minimum = min( leftResult.min , rightResult.min);
   maximum = max (leftResult.max , rightResult.max);

   return minimum, maximum;
}
}
```

Date ____
Page ____

For divide-and-conquer

Time complexity using masters theorem

$T(n) = 2T(\frac{n}{2}) + O(1)$ {O(1) is the base case i.e. only one element present in array}

a = 2 {since we are using the recursive call of the function twice}

b = 2 {since we are using divide and conquer recursively each time f" is called the array is split into half by using this method}

general formula: $T(n) = aT(\frac{n}{b}) + f(n)$

$n^k = 1 \Rightarrow k = 0$

$a > b^k$
$2 > 2^0$
$2 > 1$
} This satisfies one of the master theorem's case

hence we use this formula: $n^{\log_b a}$

$\log_b a = \log_2 2 = 1$

$n^1 = n$

Thus the time complexity of the algorithm is O(n)

#6 Conclusion : Hence we have learnt the basics of Visual Studio Code and code editing and its extensions. We created a csv file having salary information of 2000 employees and found maximum and minimum salary by lineal method having time complexity O(n) and Divide and conquer using merge sort having time complexity of O(n log n)