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Experiment No. 2

Aim – Experiment based on divide and conquer approach.

Details – Divide and conquer algorithm is a strategy of solving a large problem by breaking the problem into smaller sub-problems. The divide-and-conquer strategy solves a problem by:

Quicksort– It picks an element called as pivot, and then it partitions the given array around the picked pivot element. It then arranges the entire array in two sub-array such that one array holds values that are smaller than the specified value (Pivot), and another array holds the values that are greater than the pivot.The Divide and Conquer steps of Quicksort perform following functions.

Divide: In Divide, first pick a pivot element. After that, partition or rearrange the array into two sub-arrays such that each element in the left sub-array is less than or equal to the pivot element and each element in the right sub-array is larger than the pivot element.
Conquer: Recursively, sort two subarrays with Quicksort
Combine: Combine the already sorted array.

Merge sort– Merge sort is similar to the quick sort algorithm as it uses the divide and conquer approach to sort the elements. It divides the given list into two equal halves, calls itself for the two halves and then merges the two sorted halves. We have to define the merge() function to perform the merging.The sub-lists are divided again and again into halves until the list cannot be divided further. Then we combine the pair of one element lists into two-element lists, sorting them in the process. The sorted two-element pairs is merged into the four-element lists, and so on until we get the sorted list.

Problem Definition & Assumptions – For this experiment, you need to implement two sorting algorithms namely Quicksort and Merge sort methods. Compare these algorithms based on time and space complexity. Time required for sorting algorithms can be performed using high_resolution_clock::now() under namespace std::chrono. You have to generate 1,00,000 integer numbers using C/C++ Rand function and save them in a text file. Both the sorting algorithms uses these 1,00,000 integer numbers as input as follows. Each sorting algorithm sorts a block of 100,200,300,...,100000 integer numbers with array indexes numbers A[0..99], A[100..199], A[200..299],..., A[99900..99999]. You need to use high_resolution_clock::now() function to find the time required for 100, 200, 300…. 100000 integer numbers. Finally, compare two algorithms namely Quicksort and Merge sort by plotting the time required to sort integers using LibreOffice Calc/MS Excel. The x-axis of 2-D plot represents the block no. of 1000 blocks. The y-axis of 2-D plot represents the tunning time to sort 1000 blocks of 100,200,300,...,100000 integer numbers.

Note – You have to use C/C++ file processing functions for reading and writing randomly generated 100000 integer numbers.

Important Links:

1. C/C++ Rand function Online library
   https://cplusplus.com/reference/cstdlib/rand/
2. Time required calculation Online library-
   https://en.cppreference.com/w/cpp/chrono/high_resolution_clock/now

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Input –

1) Each student have to generate random 100000 numbers using rand() function and use this input as 1000 blocks of 100,200,300,...,100000 integer numbers to Quicksort and Merge sorting algorithms.

Output –

1) Store the randomly generated 100000 integer numbers to a text file.
2) Draw a 2D plot of both sorting algorithms such that the x-axis of 2-D plot represents the block no. of 1000 blocks. The y-axis of 2-D plot represents the running time to sort 1000 blocks of 100,200,300,...,100000 integer numbers.
3) Comment on Space complexity for two sorting algorithms.