COEN 346 - LAB ASSIGNMENT 1

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OBJECTIVES:

This programming assignment had an objective to implement a merge-sort using multithreading. The program was to take an input file called input.txt, which contained a list of integer values and sort them using the merge-sort. The output was to be printed in a file called output.txt. The output is a list of the operations made during the merge-sort; this includes the starting and stopping of each thread as well as the sorted sub-list at the end of each thread.

PROGRAM OVERVIEW:

Go over each function and what it does

void run():
The *run* function is an override method created inside the thread.

void merge(int array[], int left, int mid, int right) :
The *merge* function takes four parameters which are integer array[], integer left, integer mid, integer right. It virtually separates the entire array by half and compares each element between two sections and sorts the array. It has n log n performances in the worst, best, and average.

void sort(int array[], int left, int right, FileWriter fileWriter):
The *sort* function takes integer array[], integer left, integer right, FileWriter *fileWriter*. It recursively cuts the array by half until reaching the breakpoint, and then calls the merge method repeatedly. This method sorts the array elements from input.txt as ascending order and writes the results in the output.txt. Meanwhile, thread is created inside this method so as to create multi threads in the recursive way.

List<String> readInputFile(string fileName):
The *readInputFile* function takes a string type of *fileName*. It is used to read a text file. It uses a relative path and expects the file to be found in the same directory.

List<Integer> convertStringListToIntList(List<String> stringList):
The *convertStringListToIntList* function takes a list type of string, stringList. It is used to convert a list of strings to a list of integers.

void printArray(int arr[]):
The *printArray* function takes an integer type of array and prints an array of integers to the console.

PROGRAM FLOW:

1. Fetching the input values

   The program is contained in the *main()* function. From the *main()* the other functions are called. The program starts by reading the input.txt file. To do so, the *readInputFile*function is called and returns a *List* of *Strings*. This list is converted to *Integers* and then to an array of type int, as the wrapper is not needed in the sorting functions.

2. Sorting

   After transforming the input into an int array, the *sort* function (recursive) is called to start the sorting process. This recursive method also utilizes the *merge* function to implement the merge-sort.

3. Output the sorted values to a text file

   As the array is split, merged and sorted, the output file records the operations, threads and sub-arrays of sorted ints. At the end of the sorting operations, the output file is closed and the program ends.

EXAMPLE SUGGESTION:

1. There are many multithreaded applications we are using in life, such as all the popular social media apps and chatting apps : twitter, facebook, wechat, Whatsapp….All of these apps apply multi thread techniques.
2. Balancing the each thread responding time in a multi threaded application is essentially important.

CONCLUSION:

Students learned how to implement a merge sort using multithreading. Students used 5 different functions which are *merge(), sort(), readInputFile()*, *convertStringListToIntList(), printArray()* to implement this project. The program ran successfully as was expected. Also, students used *run()* as multithreading, thus it was faster than using a single thread.