

# CS-206 - HW4

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## 1 Question 1

Consider the following code for an in-place merge-sort:

```
void mergeSort(int[] A, int lo, int hi) {
    if (hi - lo > 1) {
        int mid = lo + (hi - lo)/2;
        executor.submit(new mergeSort(A, lo, mid));
        executor.submit(new mergeSort(A, mid, hi));
        awaitTermination();
        merge(A, lo, mid, hi);
    }
}
```

Assume that the merge method has no internal parallelism, and  $hi = 128$ ,  $lo = 0$ . Give the work (amount of tasks), critical path length, and parallelism of this algorithm.

## 2 Question 2

You may assume that the actual running time of a parallel program on a dedicated  $P$ -processor machine is

$$T_P = T_1/P + T_\infty.$$

Your research group has produced two chess programs, a simple one and an optimized one. The simple one has  $T_1 = 2048$  seconds and  $T_\infty = 1$  second. When you run it on your 32-processor machine, sure enough, the running time is 65 seconds. Your students then produce an "optimized" version with  $T_1 = 1024$  seconds and  $T_\infty = 8$  seconds. Why is it optimized? When you run it on your 32-processor machine, the running time is 40 seconds, as predicted by our formula. Which program will scale better to a 512-processor machine?

## 3 Question 3

Write a class, `ArraySum` that provides a method

```
static public int sum(int[] a)
```

that uses divide-and-conquer to sum the elements of the array argument in parallel. Write the pseudo code and use the Java future class.

## 4 Submission

Deadline: 12.05.2015

Please make a PDF file of your answer and upload it in the moodle using related box. Do not forget to write your Name and Sciper number.

Please write clearly and concisely.