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Project 4 Design Document

- The project is done using Java. The program first reads in the set of unordered input data as an ArrayList and the sema init file.
- The ParallelSort class implements Runnable interface and the sorting will happen in the run() method of each thread instance.
- The PThread class maintains the thread ID of each thread and the size which is equal to N (taken from input file).
- The ParallelSort constructor is parameterized and takes one instance of PThread class and initializes it to the member variable psThread which holds the thread ID and size for each thread instance. This constructor is used while creating new Threads which will be used for sorting.
- An individual semaphore (semaOne) and another array of two semaphores are created. The array of semaphores phb[i] is initialized as 0 where i is either 0 or 1, and it makes sure that it keeps thread waiting unless it receives a signal.
- semaOne is a binary semaphore and so it is initialized to 1. These semaphores are independent of the length of input data.
- The binary semaphore keeps track of the thread count by increasing and comparing with overall no of threads. When thread reaches the binary semaphore semaOne, it will increase the thread count value by 1 and check with total no of threads. If count is not equal to overall threads, the incoming thread will then wait at the semaphore array phb[i]. However, if thread count and total no of threads are equal, after parallel sorting the thread will arrive at the end, meanwhile the other threads would be waiting at phb[i] sema array.
- The semaphore.acquire() makes the thread wait until the permit condition is reached. semaphore.release() releases the waiting threads one at a time.
- If thread count and total no of threads are equal then it will signal the phb[i] semaphore array so that the threads that were waiting could now enter the next phase. Moreover, the current thread will reset the thread count value to either 0 or 1 and leave.
- Finally based on the mode entered -o or -r the printList method prints the sorted list at each phase.