Concurrent Quicksort

Implementation

The place where this algorithm can be parallelized is the recursive call which happens in two independent different parts of the array [left of pivot and right of pivot].

I parallelize it in two ways:

- creating new processes
- creating new threads

If new processes are created, we need to share the memory [the array] among all processes, so a shared memory region is created.

NOTE

Having a large number of threads under a single process is bad. If I try to sort 10000 numbers using threads, a lot of threads get created and the cpu is overloaded. So, I have kept a cap of 50000 numbers to call the threaded sorting function

Code snippets

```
int p = partition(arr, l, r);
```

Normal:

```
quickSort(arr, l, p - 1);
quickSort(arr, p + 1, r);
```

New processes:

```
int p1 = fork();
int p2;

if(p1 == 0) {
    quickSort(arr, l, p - 1);
    exit(0);
} else {
    p2 = fork();
    if(p2 == 0) {
        quickSort(arr, p + 1, r);
        exit(0);
```

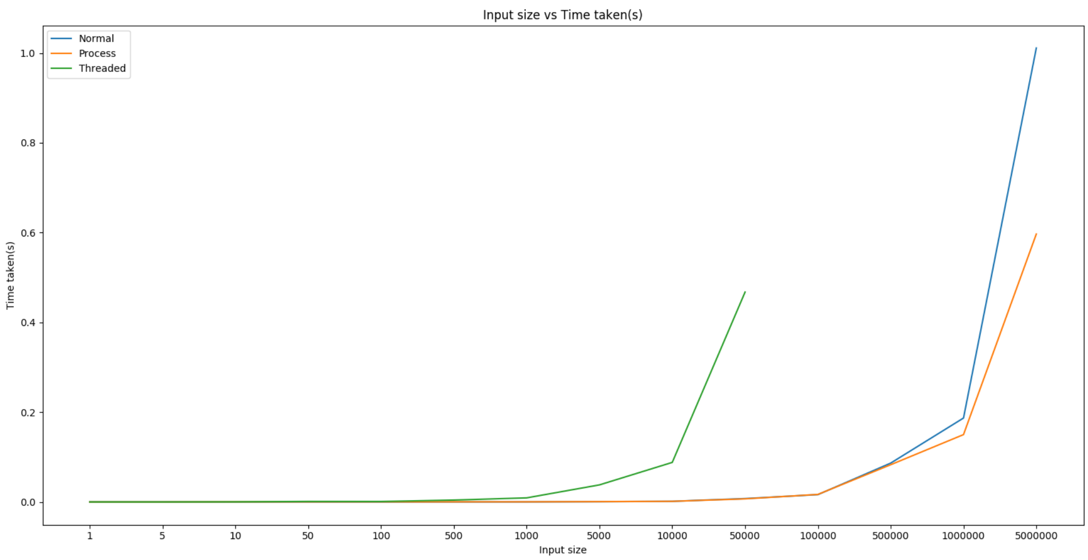
```
    } else {
        waitpid(p1, 0, 0);
        waitpid(p2, 0, 0);
    }
}
```

Threaded:

```
a1.arr = a2.arr = a->arr;

a1.l = a->l;
a1.r = p - 1;

a2.l = p + 1;
a2.r = a->r;

pthread_t t1, t2;
pthread_create(&t1, 0, quickSortThread, &a1);
pthread_create(&t2, 0, quickSortThread, &a2);

pthread_join(t1, 0);
pthread_join(t2, 0);
```

Results

A picture speaks a thousand words



Clearly, it is seen that at first, the parallelizing with process approach is slower than doing the whole thing in a single process, but, as we increase the length of the list, we see that process starts outperforming the single process ones. This starts happening from n = 5*10^5

At n = 5*10^6, process takes almost half the time compared to normal