

Chapter 4

Hyper Quick Sort

4.1 Objectives:

At the end of this lecture the learner will be able to:

- Apply Hyper Quick Sort algorithm to sort a given list.

4.2 HyperQuickSort Algorithm

Procedure HyperQuickSort

begin

Create processors P_i where i varies from 1 to n .

Divide the given list among n processors.

Each processor P_i performs a sequential quick sort on the given list.

The processor that is assigned to pick the pivot, computes the median of its list.

Broadcast the list to other processors.

Each processor divides its list into two, where one list contains the elements that are lesser than the median and the other is greater than the median.

Swapping is carried out between the neighbouring processors.

The processors merge the received list and the remaining elements of its own list.

call HyperQuickSort(list lesser than the median).

call HyperQuickSort(list greater than the median).

end.

4.3 Analysis

4.3.1 Computation Complexity

Pivot element selection can be done in $O(1)$ step. Data Splitting can be done in $\log m$ steps where m is the total number of numbers and the numbers are sorted. Merging can be carried out in m steps if the largest list contains m numbers.

4.3.2 Communication Complexity

During pivot broadcast, a pivot element should be broadcast to the processors in a sub cube. The hypercube broadcasting will take $d-i$ steps, where d is the dimension and i is the phase number.

Therefore Number of steps = $\sum_{i=0}^{d-1} (d-i) = d(d-1)/2$.

$\text{Time}_{\text{Communication during pivot broadcast}} = d(d-1)/2 (\text{Time}_{\text{Start}} + \text{Time}_{\text{data}})$

During data split, $\text{Time}_{\text{Communication}} = \text{Time}_{\text{Start}} + m/2 \text{ Time}_{\text{data}}$.

Chapter 5

References

1. Parallel Computing, Theory and Practice, M.J.Quinn, McGraw Hill Publications,2002.
2. Introduction to Parallel Computing, Grama, Gupta, Kumar, Karypis, Addison Wesley, ISBN:0-201-64865-2, 2003.
3. Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, Barry Wilkinson and Michael Allen, Prentice-Hall, 2nd edition, 2005.