

Parallel quicksort

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Sequential quicksort

- Quicksort (Array, start, end)
 - If (start < end)
 - middle = partition (Array, start, end)
 - quicksort(Array, start, middle)
 - quicksort(Array, middle+1, end)

Sequential quicksort

- Partition (Array, start, end)

X = Array [start]

I = start - 1

J = end + 1

while TRUE

 repeat J = J - 1 until Array [J] <= X

 repeat I = I + 1 until Array [I] >= X

 if I < J swap (Array [I], Array [J])

 else return J

Sequential quicksort – complexity analysis

- Pessimistic complexity
 - $O(n^2)$
- Average complexity
 - $O(n \log n)$

Parallel quicksort

Parallel quicksort



Parallel quicksort

- How a single processor makes QuickSort (Array, start, end)
 - $J = \text{Partition}(\text{Array}, \text{start}, \text{end})$
 - Start a new thread on another processor : $\text{QuickSort}(\text{Array}, \text{start}, J)$
 - Start a new thread on another processor : $\text{QuickSort}(\text{Array}, J+1, \text{end})$
 - Wait for both threads to complete
 - Notice your parent that your task is finished

Parallel quicksort

- OR :
 - $J = \text{Partition}(\text{Array}, \text{start}, \text{end})$
 - Start a new thread on another processor :
`QuickSort(Array, start, J)`
 - Execute `QuickSort(Array, J+1, end)`
 - Wait for the thread to complete
 - Notice your parent that your task is finished

Parallel quicksort

- In case no processor can take thread, the thread is put into a queue for later processing.
- After a processor has done its task, it checks whether the queue contains any waiting threads. If so, it removes the first task from the queue and processes it.

Parallel quicksort

- Methods of choosing the split key
 - First element
 - Average of : first, last and medium element
 - Median (the median of a sample is expected to be the median of the whole array)

Parallel quicksort

- A new thread is created only if the length of the array to sort is no less than `MIN_ARRAY_SIZE` constant
- If the length of the array to sort is less than `MIN_QUICKSORT_SIZE`, the array is sorted using a simple algorithm (eg. Insertionsort or Selectionsort), which require no new threads.
- `MIN_QUICKSORT_SIZE <= MIN_ARRAY_SIZE`