Chapter 5 - Exercise 2 - Individual

•We develop a parallel algorithm that uses 8 processors.
    •For input of size n, each processor does n/8 computations.
    •Additionally, each processor incurs a communication overhead cost of log(n) computations.
•We then try the algorithm using 16 processors.
    •For input of size n, each processor does n/12 computations.
    •Additionally, each processor incurs a communication overhead cost of 4*log(n) computations.
1. Why might the communication overhead have increased?
2. Why might the number of computations not decreased in a linear rate?

Grading Rubric
_____ (2 Points) Correct explanation for #1
_____ (2 Points) Correct explanation for #2

Answer:

1. Why might the communication overhead have increased?

As the number of processors increases, the complexity of communication between them also increases. This is because more processors mean more connections and coordination required to ensure that data is shared correctly. In this case, using 16 processors increases the overhead to 4 * log(n), as there are more communication paths and synchronization steps needed compared to 8 processors. The increased communication overhead reflects the additional effort required to manage data transfer and ensure consistency across more processors.

2. Why might the number of computations not decreased in a linear rate?

The number of computations doesn't decrease linearly because of the diminishing returns in dividing tasks among processors. When using 16 processors, each processor performs n / 12 computations instead of n / 16. This is because certain tasks can't be perfectly split, leading to inefficiencies and overlapping work. Additionally, there might be dependencies between computations, causing some processors to wait for others to complete their tasks, further preventing a linear reduction in workload. Thus, increasing processors doesn't always result in a proportional decrease in individual workload due to these factors.