

Homework 5.1 Answer

1. **For N input values**, Number of times thread block synchronize to reduce its portion of an array to a single value = **Log(N)** I,e once after every step.
2. For **N input values**, the reduction tree performs $(1/2)N + (1/4)N + (1/8)N + \dots (1/N)$
 $= (1 - (1/N))N = \mathbf{N-1}$ operations

Number of threads used = $N/2$

Therefore,

For Individual threads -

Maximum number of "real" operations that a thread will perform = **Log N**

Minimum number of "real" operations that a thread will perform = **1**

Average number of "real" operations that a thread will perform = $(\mathbf{N-1})/(N/2)$

OR

If number of inputs are greater than BLOCK SIZE,

Maximum number of "real" operations that a thread will perform = **Log (BLOCK SIZE)**

Minimum number of "real" operations that a thread will perform = **1**

Average number of "real" operations that a thread will perform =

$$(\mathbf{BLOCK\ SIZE-1})/(\mathbf{BLOCK\ SIZE}/2)$$

Additionally,

Maximum number of operations performed is in the first step, I,e = $\mathbf{N/2}$

Minimum number of operations performed is in the last step = **1**

Average number of operations performed = $(\mathbf{N-1})/\mathbf{Log(N)}$