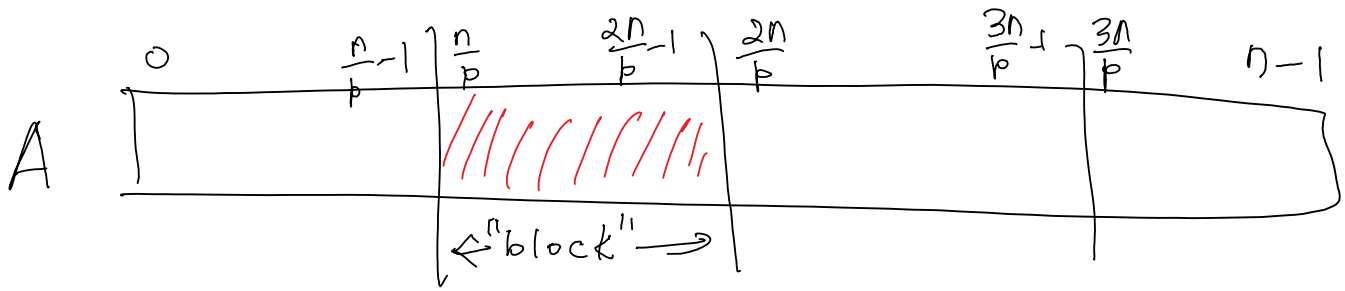


Data Decomposition

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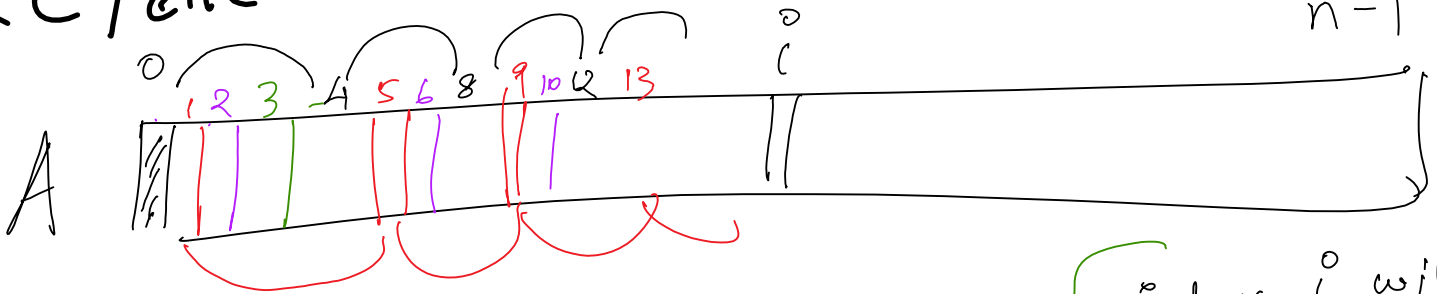
$(n \gg p) \ \& \ n \% p = 0$
 n : input size



(Block Decomposition)

block size = $\frac{n}{p}$
 "block" is a contiguous chunk of A.

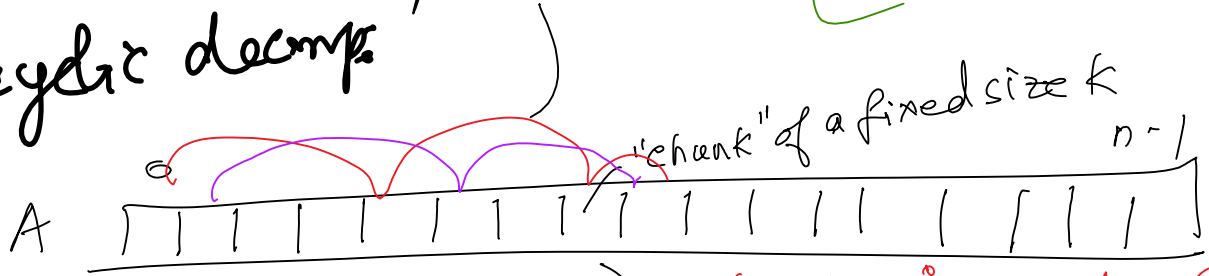
Cyclic decomposition



Every proc. will receive $\frac{n}{p}$ elements.

index i will be assigned to rank $(i \% p)$

(block cyclic decomp)



chunk k i goes to rank $(i \% p)$

Data Decomposition

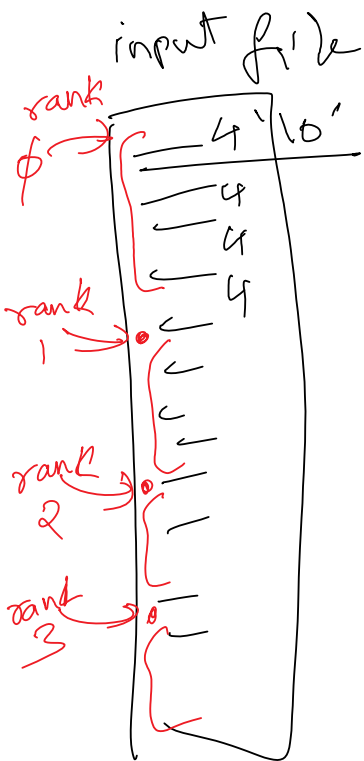
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Sum problem: (reduce)



Q) How to distribute the input?

0
 ϕ 0
 1 0
 2 0
 3



$$fsize() = \frac{N \text{ bytes}}{\# \text{ bytes per line } k}$$

rank i will read from $(i \times \frac{N}{k}) \times k$ byte offset.

Reduction of n numbers

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Sum of n numbers on p procs:

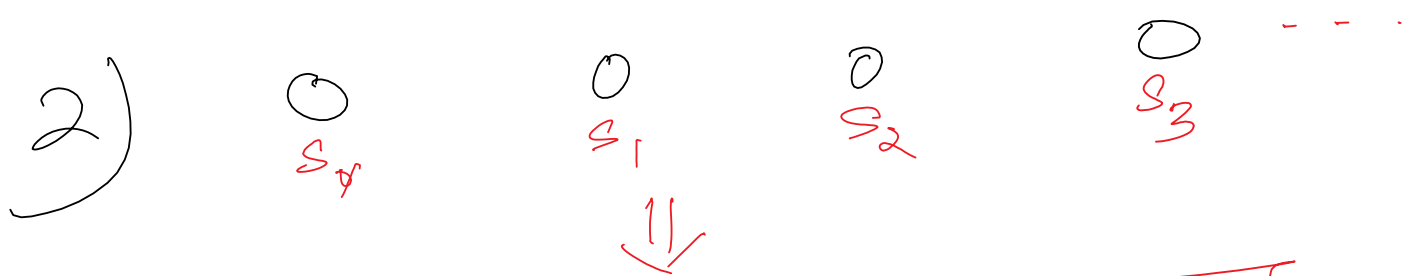


$\Theta\left(\frac{n}{p}\right)$ comp.

Input reading (block decomposition)
 Rank i has A_i (with $\frac{n}{p}$ elements)
 $A_i = A\left[\frac{i \cdot n}{p} \dots \frac{(i+1)n}{p} - 1\right]$

$\Theta\left(\frac{n}{p}\right)$ comp.

Rank i computes its local sum
 $S_i = \sum_{j=0}^{\frac{n}{p}-1} A_i[j]$ // serial code



$\Theta((c+n) \lg p)$ comm. MPL Reduce / Allreduce

add p numbers on p procs

$$T(n, p) = \underbrace{\Theta\left(\frac{n}{p}\right)}_{\text{comp.}} + \underbrace{\Theta((c+n) \lg p)}_{\text{comm.}}$$

should dominate.