AbdelRahman Adel 17012296

NOTES

Sheet 1

① $n = 2048$

PE adding 2 numbers = 1 millisecond
PE sending m numbers = $2 + \frac{m}{1024}$ milliseconds

PE from 1 to 1024, Power of 2

PE = 1 :-

Adding numbers time = $n - 1$
$= \underline{\underline{2047}}$

Step 1 :- Transfer to other PES
Step 2: Summation of numbers
Step 3 :- Send once add once until Reaching first PE

$\boxed{PE=1}$ Time = 2047 milliseconds

$\boxed{PE=2}$ step 1 :- 1024 from P.E#to ~~PE~~#1

$2 + \frac{m}{1024} = 2 + \frac{1024}{1024} = 3$

step 2 :- 1024

Step 3 :- $\underbrace{2 + \frac{1}{1024}}_{\text{Transfer}} + \underbrace{1}_{\text{adding}}$

1

~~general rule: 3.9 1024~~

~~Data Distribution:~~

PE = 4:

Step 1: $2+\frac{1024}{1024}=3$ PE#0 → PE#2

Step 2: $2+\frac{512}{1024}=2.5$ PE#0 → #2 PE#1 → #3

Step 3:

Addition: ~~3~~ 511

#0 ← #2 #1 ← #3

Step 4: $2+\frac{1}{1024}\approx 2.001$ #2 #3

Step 5: Add 1

Step 6: $2+\frac{1}{1024}\approx 2.001$

Step 7: 1

Total = 522.502

<u>General formula:</u> $p = 2^q \quad , n = 2^k = 2048 = 2^{11}$ NOTES

- Data Distribution: $\sum_{n=1}^{q} 2 + \frac{2^{k-n}}{1024} = \sum_{n=1}^{q} 2 + 2^{k-n-10}$

- Addition: $n/p - 1 = 2^{k-q} - 1$

- Collecting & Adding: $q\left(2 + \frac{1}{1024} + 1\right)$

Total $= \sum_{n=1}^{q}\left(2 + 2^{k-n-10}\right) + 2^{11-q} - 1 + q\left(2 + \frac{1}{1024} + 1\right)$

q	PE	$\Sigma(2+2^{k-n-10})$	Total	Speedup	Efficiency
0	1	//	2047	1	100%
1	2	3	1029	1.989	99.45%
2	4	5.5	522.5	3.918	97.95%
3	8	7.75	271.75	7.533	94.9875%
4	16	9.875	148.88	13.75	85.9375%
5	32	11.9375	89.94	22.76	71.125%
6	64	13.96875	62.97	32.50	50.78125%
7	128	15.984375	51.99	39.37	30.75%
8	256	17.9921875	49	41.78	16.32%
9	512	19.99609375	50	40.94	7.99%
10	1024	21.99804688	53	38.62	3.77%

NOTES.

2) ⓐ Every Processor only computes the slot of Histogram offered to it but there will be redundant pixels that will not be counted per slot

ⓑ The image will be processed faster but there will be a chance of racing conditions to access & write in the Histogram.

③ Strong Scalability: Number of cores is changing but input is fixed

Weak Scalability: Both cores & input are changing

④ Distributed Memory:- Each Node ~~ff~~ have it's own private memory and only communicate explictly by sending across a network

Shared Memory:- All cores access a common memory space through shared bus + local cache for each core.

Nile STATIONERIES

4)

5 Typical Considerations

- Partitioning:- Decomposing the problem into pieces. like Data parallelism, task parallelism, model parallelism

- Communication:- Depending on the partitioning scheme, the amount of communication & the type of communication is ~~deter~~ determined

- Synchronization:- In order to operate in an appropriate way, threads or processes may need to be synchronized

- Load Balancing:- Work needs to be equally divided among threads or processes in order to balance the ~~acto~~ load and minimize idle times.