Homework: Introduction

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1 Smartphone Analysis

For this analysis, we've chosen the *Apple iPhone 14* as our focal point.

1.1 Processor Specifications

Powering the *Apple iPhone 14* is the Apple A15 Bionic processor, detailed by GSMArena [1]. With 6 cores and 6 threads, it operates at a clock speed ranging from 2.02 to 3.23 GHz. This processor is built on a 5nm architecture, with an ARM design, and includes 15800 million transistors [2].

1.2 Memory

The A15 Bionic is equipped with 6 GB of LPDDR4X main memory, complemented by 32MB of L3 and 16MB of L2 cache, as outlined by AnandTech [3].

1.3 GPU

The Graphics Processing Unit (GPU) accompanying the Apple A15 Bionic has 5 GPU cores, each running at 1.34 GHz. Significantly, it supports hardware-level decoding and encoding across various video formats, including HEVC, H.264, MPEG-4 Part 2, and ProRes [4].

1.4 CPU Performance

The CPU within the *Apple iPhone 14* has a speed of 15.8 TFlops for FP16 operations, as reported in the Machine Learning Research blog. [5].

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2 Performance

2.1 Comparison between computers A and B

Computer A performs 2 instructions per cycle and takes 1 ns (10^{-9}s) for each cycle.

$$\frac{2\ instructions}{1\ cycle} \times \frac{1\ cycle}{10^{-9}\ seconds} = 2 \times 10^9\ instructions/sec$$

Computer B performs 1.25 instructions per cycle and takes 600 ps (10^{-12}s) for each cycle.

$$\frac{1.25\ instructions}{1\ cycle} \times \frac{1\ cycle}{600 \times 10^{-12}\ seconds} = 2.08 \times 10^9\ instructions/sec$$

Thus computer B is the fastest for this program since it performs more instructions per second.

2.2 If Computer B required 10% more instructions

Let's denote n as the number of instructions required by Computer A, and $1.1 \times n$ as the number of instructions required by Computer B. The program will take $\frac{n}{2\times10^9}$ seconds on Computer A and $\frac{1.1\times n}{2.08\times10^9} = \frac{n}{1.89\times10^9}$ seconds on Computer B. Consequently, Computer A completes the program faster. [6]

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3 Efficiency

3.1 GFlops/s achieved

The application attained:

$$\frac{15\ TFlops/s}{3600\ sec} = 4.17 GFlops/s$$

3.2 Achieved Efficiency

The achieved efficiency is:

$$\frac{4.17\ GFlops/s}{8\ GFlops/s} = 52\%$$

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4 Parallel Efficiency

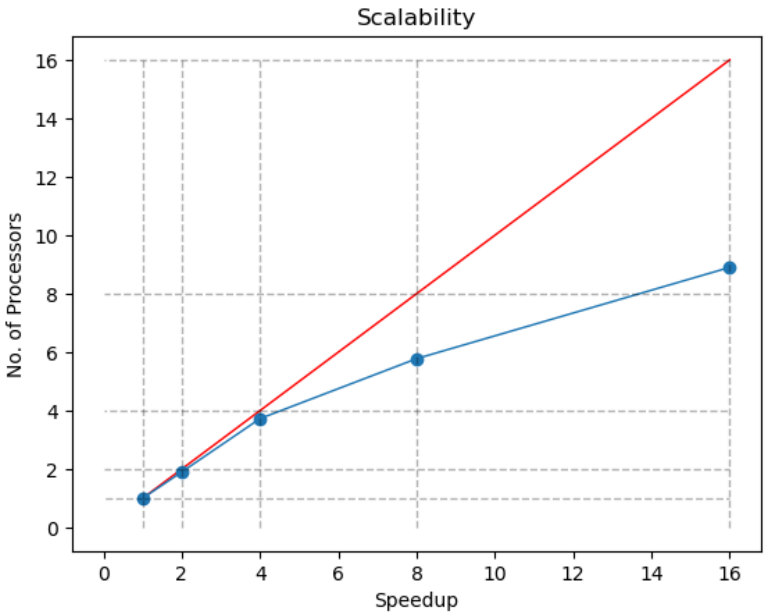
Processors	**GFlops/s**
1	4.0
2	7.6
4	14.9
8	23.1
16	35.0

Table 1: Performance in GFlops/s for Different Numbers of Processors

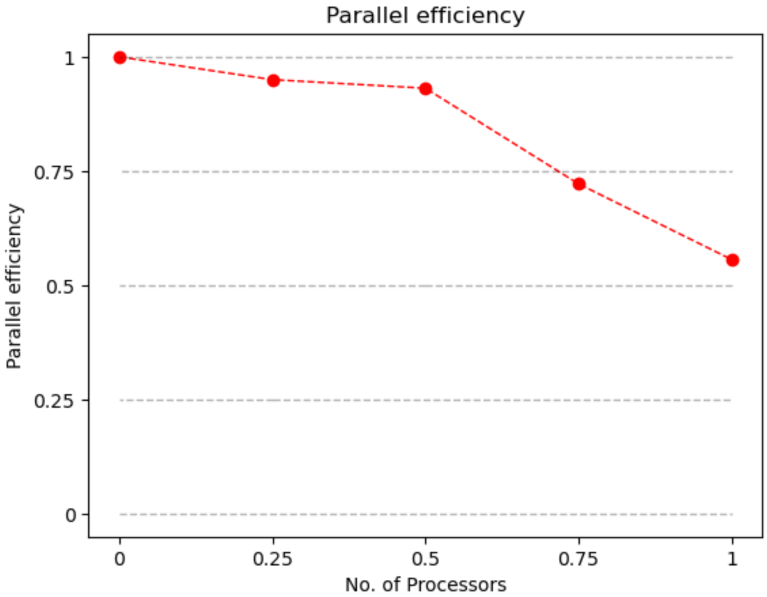
4.1 Scalability

Processors	**Best seq.(1)**	**2**	**4**	**8**	**16**
Speedup	1	1.9	3.725	5.775	8.9
Par. Eff.	1	0.95	0.93	0.72	0.56

Table 2: Speedup and Parallel Efficiency for Different Numbers of Processors



4.2 Parallel efficiency



References

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