Uzochi Dimkpa
Flops/Iops
ITCS 5182-001
High Performance Computing
Prof. Erik Saule
September 11, 2023

Formulas:

$$\#cores \ \cdot clock\ speed \cdot \frac{FMA}{cycle} \cdot \# \frac{flops}{FMA}$$

FLOPs

$$\#cores \cdot clock\ speed \cdot \frac{VPADDB}{cycle} \cdot \frac{iops}{VPADDB}$$

IOPs

Use the VFMADD132PS instruction: Fused Multiply Add, $c \leftarrow a \cdot b + c$, used on AVX register

$\frac{FMA}{cycle} = 2$, the number comes from the reciprocal (inverse) throughput column, which reads 0.5, and inversing this value gives you $\frac{1}{\frac{1}{2}}$, which comes out to 2 FMA instructions per cycle

$\frac{flops}{FMA} = 16$, 256-bit registers in AVX2, floats are single-precision, meaning 32 bits, so 8 floats per AVX2 register, but FMA instruction is multiply & add, each of which require 8 floats, so # floating point operations adds up to 16 in total

Use the VPADDB instruction

$\frac{VPADDB}{cycle} = 3$, comes from reciprocal (inverse) throughput column value which reads 0.33

$\frac{iops}{VPADDB} = 32$, 256-bit registers in AVX2, integers are stored as 8 bits long, so 32 integers per AVX2 register, which means # integer operations comes up to 32 in total

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1. My laptop computer contains an AMD Ryzen 7 4800H CPU based on AMD's Zen 2 architecture

2. $\left(\frac{Flops}{sec}\right)_{calc} = 8\,cores \cdot 2.9 \times 10^9 \cdot 2 \cdot 16 = \boxed{742.4 \times 10^9}\ \mathrm{Flops_{calc}}$,
$\left(\frac{Flops}{sec}\right)_{exp} \approx \boxed{7.10192 \times 10^{11}}\ \mathrm{Flops_{exp}}$,
$\text{efficiency} = \frac{\left(\frac{Flops}{sec}\right)_{exp}}{\left(\frac{Flops}{\mathrm{sec}}\right)_{calc}} = \frac{7.10192\times10^{11}}{742.4\times10^{9}} = 0.95661 \approx \boxed{96\%}$

3. $\left(\frac{Iops}{sec}\right)_{calc} = 8\,cores \cdot 2.9 \times 10^9 \cdot 3 \cdot 32 = \boxed{2227.2 \times 10^9}\ \mathrm{Iops_{calc}}$,
$\left(\frac{Iops}{\mathrm{sec}}\right)_{exp} \approx \boxed{9.89807 \times 10^{11}}\ \mathrm{Iops_{exp}}$,
$\text{efficiency} = \frac{\left(\frac{Iops}{sec}\right)_{exp}}{\left(\frac{Iops}{\mathrm{sec}}\right)_{calc}} = \frac{9.89807\times10^{11}}{2227.2\times10^{9}} = 0.44441 \approx \boxed{44\%}$