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Homework 1

Problem 1:

A) GPUs have been rapidly increasing in processing power. They are increasing at a faster rate than conventional CPUs. GPUs outperform CPUs in floating point operations and also require less power to do so. Adding more cores would improve both the latency and throughput because they are simple chips.

B) This tells us the GPU is best used for very large computations.

C) How will the improvement on GPUs help use increase of knowledge of machine learning?

Problem 2:

A) One feature of ARM/LEGv8 to RISC ISA is its fixed width instruction set.

B) CPU1 = 1.7 * .6 GHz = 1.02

CPU2 = 1.5 * 1.66 GHz = 2.44

CPU1 is 2.44 times slower than CPU2

C) $\frac{1}{1-.37\frac{.37}{2}}=\frac{1}{.63\frac{.37}{2}}=\frac{1}{.815}=1.227$

The improved bwaves would have a 1.227 speedup over the old bwaves.

D) The ARMv8 processor will perform th benchmark faster than the i7.

Problem 3:

A)

Known:

It will take 100 seconds on 1 core

up to 50 seconds of this can be parallelized with a perfect linear sped up

Splitting it onto two cores will reduce it by 25 seconds

For 2 cores:

100 seconds – 25 seconds = 75 seconds.

We then need to adjust this time for the difference in clock speed

$$75\,seconds-\frac{3.06\,GHz}{3.20\,Ghz}\approx 71.72\,seconds$$

For 4 cores:

Since we know that it will take 25 seconds when it is split onto two cores, we must divide this number again by two when we split it onto four cores.

$\frac{25\,seconds}{2}=12.5\,seconds$ Then we add it to the 50 seconds for it to be parallelized.

$$50\,seconds+12.5\,seconds=62.5\,seconds$$

Finally, we must adjust for the clock speed

$$62.5\,seconds\;x\,\frac{2.26\,hz}{3.20\,GHz}\approx 44.14\,seconds$$

B) To find the power that is used we must used the question Power= Static+ dynamic.

4 cores = 18 w + 42w = 60w

2 cores = 20w + 59.14w = 79.14w

1 core = 23w + 142.89w = 155.89w

C) To find the total energy used we must use the following formula: Energy = (static + dynamic) * time.

1 core = 155.89w x 100 seconds = 15,589 Joules

2 cores = 79.12 w x 71.72 seconds = 5,674.49 Joules

4 cores = 60w x 44.14 seconds = 2,648.4 Joules

D) Since the rest of the computer uses a static amount of power, the most efficient configuration will not change when the whole system's static power is accounted for.