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CS 472 HW 6

(6.1) There are many criteria for judging computer performance. These include efficiency, throughput, latency, relative performance, and time and rate. Performance is difficult to define because of the different criteria, and also because different people are concerned with different performance criteria.

(6.4) Efficiency = bits of data words / total bits sent = 16384 / 16608 = 98.65

(6.7) a. Cycle 1, 2, and 3 would all take 50 ns so 150 ns total.

b. Cycle 1, 2, and 3 would all take 40 ns so 120 ns total.

c. Cycles 1 and 2 would take 30 ns. Cycle 3 would still take 32 ns, so 92 ns total.

d. Cycle 1 would take 20 ns, but cycle 2 would take 25 ns and cycle 3 would take 32 ns. 77 ns total.

e. Cycle 1 would take 10 ns, but cycle 2 and 3 would take 25 and 32 ns. 67 ns total.

(6.11) Some operations are not scalable, and it is difficult to alter the clock rate dynamically from clock pulse to clock pulse. Due to this, computers may become unstable if you try to overclock them.

(6.13) Arithmetic/logical instructions, CPI = .65

Register load operations, CPI = .50

Register store operations, CPI = .10

Conditional branch instructions, CPI = 1.6

Total CPI = 2.85

Need to increase to 3.42, or by .57

CPI for conditional branch instructions needs to be 2.17

2.17 / .2 = 11 cycles

(6.16) Assuming the CPU has a large cache, I would go with option b. If the cache is large enough, data from the hard drive would be loaded into the cache, then a fast CPU would be able to access the data fast.

(6.18) Speedup ratio = p / (p*fs + 1 - fs), where fs = .10

It would not be worth adding cores until the speedup ratio increases by less than 5

At 32 processors, this point will be reached. The speedup ratio for 31 processors is 7.75 and 7.80 for 32 processors.

(6.25) No, the formula is not applied correctly. p refers to the number of processors, and f_s refers to the fraction of the program that can run only on one processor. The part of the program spent not accessing the hard drive can not necessarily be run on multiple processors, which the problem assumes. The same incorrect assumption is made for the floating point operations.

(6.31) $(\sqrt{x} - \sqrt{y})^2 \geq 0$

$x - 2\sqrt{xy} + y \geq 0$

$x + y \geq 2\sqrt{xy}$

$\frac{x+y}{2} \geq \sqrt{xy}$