University of California, Davis
Department of Computer Science

ECS-154B Computer Architecture

Professor Farrens

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Test 1

Cheating on exams is prohibited by the Academic Code of Conduct. I understand that if I am caught cheating on this exam my scores will be negated and I will receive no credit on the exam. Persons caught cheating will also face University disciplinary actions.

Name: _____

Signature: _____

Student ID number: _____

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[4] What are the two main ways to define performance?

[4] What is leakage current?

[4] 20 years ago, dynamic power consumption was more than an order of magnitude larger than leakage consumption. **Approximately** what percentage of power consumption is due to leakage now?

[4] Advances in technology allow us to make both transistors and wires smaller and smaller. If everything else is held constant, what happens to the power density as things shrink?

[6] What is Amdahl's law? (In words, not the equation)

[6] Area on the die used to be the most critical design constraint. That is no longer true - what is the most critical factor now? Why?

[6] What is the 3-term CPU time equation?

[6] Over the years, clock rates have grown by a factor of 1000 while power consumed has only grown by a factor of 30. (a) How was this accomplished without melting the chip? (b) Why is this technique no longer effective?

[4] According to the book, what will enhance performance better than optimizing the rare case?

[4] In class we talked about MFLOPS being a way to report performance. What does MFLOPS stand for?

[6] In class we talked about the 4 types of benchmarks. Synthetic was the first - what were the other 3?

[4] What is a benchmark program?

[6] Do benchmark programs remain valid indefinitely? Why or why not?

[4] Why are there multiple dies per silicon wafer? Why not just fabricate one huge die per wafer?

[6] It is difficult for the internal processing elements on a CMOS chip to cross the chip boundary and communicate with things that are on other chips. Explain why that is.

[8] Processor A requires 400 instructions to execute a given program, uses 3 cycle per instruction, and has a cycle time of 2 ns. Processor B requires 5 cycles per instruction, but only requires 120 instructions to do the same program. What must the cycle time of Processor B be in order to give the same CPU time as Processor A? (Show your work)

[8] An important program spends 80% of its time doing Integer operations, and 20% of its time doing floating point arithmetic. By redesigning the hardware you can make the Integer unit 30% faster (take 70% as long), or you can make the Floating Point unit 99% faster (take 1% as long). Which should you do, and why? (Show your work).

[10] In an MOS device, there is a gate, drain, and source. Briefly explain how this device works. Drawing a picture is highly recommended.