Divisie W&I, FEW
Vrije Universiteit

Computer organisation exam
20 december 2000

Every properly answered question is worth a maximum of 1 point.

Final grade = max(midterm, part of of exam) + part 2 of exam

Part 1
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1. According to Moore's law, the number of transistors on a chip doubles every 18 months. A state-of-the-art chip now has 20 million transistors with a 0.1 micro diameter. How large is the diameter of a transistor in 3 years?

2. A computer bus transfers blocks of 16 bytes. To improve the reliability, Hamming bytes (note: BYTES, not BITS) are added. Every Hamming byte takes part in 8 different Hamming codes, one bit for bit 0 in all the bytes, one bit for bit 1 in the all bits, etc. In other words, a kind of parallel Hamming code system on 8 data streams at once. On the receiving side, all 8 Hamming codes are computed.
   (a) What is the efficiency of this system (true data/total bits)?
   (b) How many errors can be corrected at most?

3. RAID level 0 for 4 disks breaks a 512-byte block into 4 pieces of 128 bytes each. The 4 pieces are written onto four disk drives. What is the advantage of this system for
   (a) Performance?
   (b) Reliability?

4. A modem converts digital data to analog data for transmission. Mdulation is used to make the data suitable for the telephone system. Using a drawing, explain the three most important modulation systems.

5. Draw a shift circuit with a 4-bit input and a 4-bit output and 1 control bit, C. If C = 0, no shifting occurs. If C = 1, the input is shifted one bit to the right.

Part 2
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6. The Mic-1 microarchitecture has 10 registers (see attached figure). What is the function of MAR, MDR, PC, and MBR?

7. The Intel IA-64 uses the concept of 'predication.' Explain predication.

8. What is the difference between internal and external fragmentation. What can be done to alleviate the problems associated with each one?

9. A linker (like the UNIX ld program) takes a collection of object files and builds an executable program from them. What are the two most important tasks of the linker?

10. Some multiprocessors use snooping to do their work.
    (a) Explain how snooping works.
    (b) When is snooping NOT used on a multiprocessor?