Faculteit Wiskunde & Informatica
Vrije Universiteit

Tentamen Computerorganisatie
3 juni 1998

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Every correctly answered question is good for a maximum of 10 points.
The final grade is the sum of these points (0 to 100) divided by 10.

1. Please explain the following terms in your own words:
   a. microprogram
   b. opcode
   c. track
   d. thread
   e. page fault

2. Consider a computer with identical interpreters at levels 1, 2, and 3. It takes an interpreter n instructions to fetch and execute an instruction one level down. A level 1 instruction takes 5 nsec. How long do instructions take at levels 2, 3, and 4 in nsec?

3. A pipelined computer fetches a new instruction every 10 nsec. The pipeline has k stages. How many MIPS does this computer have?

4. A character code consists of the following code points:

   00001 00011 00100 00101 01000 01001 01111 10000 10010 11000

   What is the Hamming distance of this code? Can it detect all single-bit errors?

5. Draw a circuit for a 1-bit latch built up of only NOR gates.

6. Which IJVM instruction does the following Mac-1 code sequence implement. What does it do?

```
MAR = SP - 1; rd
MAR = SP
H = MDR; wr
MDR = TOS
MAR = SP -1; wr
TOS = H; goto main1
```

7. Many computers have four condition code bits. What are they called and what does each one do.

8. A page table looks like this:

Virtual page	Physical page
0	5
1	4
2	8
3	0

   Pages are 4096 bytes. What is the physical address for virtual address 8200?

9. What is the main difference between a multiprocessor and a multicomputer?

10. On the NUMA-Q multiprocessor, can a cache block be present in the cache of two machines at the same time? If not, why not? If so, how does the system keep track of which nodes contain the block?