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(Voor Nederlands, Z.O.Z.)

All questions count equally. Final grade = max(midterm, Part 1 of the exam) + Part 2 of the exam

WRITE NEATLY PLEASE.

Part 1

1. The PDP-8 was the first computer with a bus. Earlier computers, from Von Neumann's IAS computer to the IBM 360 did not have buses. What was the architecture of the "pre-bus" computers? Make a drawing of a "bus-" and a "pre-bus" computer.

2. A word with 32 data bits is expanded for greater reliability by using a Hamming code. What is the efficiency of the result (that is, data bits/total bits x 100%)?

3. A computer with a 32-bit word and a 32-bit wide data bus uses 4 MB x 1 memory chips. How big is the smallest possible memory for this machine?

4. By using a drawing, explain how daisy chaining works in the context of bus arbitration (i.e., which device may grab the bus next).

5. Practically all CPUs these days are pipelined. Is the principle of pipelining also applicable on a bus? If so, how does that work? If not, why not?

Part 2

6. Give the optimal IJVM code for the following Java statement:
   I = 2 * (J + K + 3)

7. Name three addressing modes and explain how they work.

8. Pipelines are getting longer. Is branch prediction becoming more important or less important as a result of this development? Explain.

9. An assembly language has both machine instructions and pseudoinstructions. What is the difference between these two concepts?

10. On a multiprocessor system, two CPUs try to grab the bus at EXACTLY the same moment. What happens?