1998 Paper 5 Question 2

Computer Design

Early computers (and early microprocessors) were accumulator machines. RISC computers replaced the accumulator with a register file.

(*a*) What is a register file and why is it preferable to an accumulator? Illustrate your answer by writing a loop to calculate factorial of 10 for an accumulator and a RISC processor (you may invent instruction sets and assume that a multiply instruction is available). [12 marks]

(*b*) Why is the Intel x86 processor family often referred to as being an extended accumulator machine? [4 marks]

(*c*) The Intel x86 `LOOP` instruction decrements the `CX` register and, if the result is not zero, jumps to a given label. Why is a compiler likely to find it hard to exploit this instruction, especially for nested loops? [4 marks]