

1999 Paper 9 Question 7

Optimising Compilers

Explain the term *instruction scheduling* understood as part of the compilation process. Describe what effects it might have on compile-time or run-time performance when performed by a compiler. [4 marks]

For a plausible, but not necessarily implemented, machine architecture of your choice give an algorithm which performs instruction scheduling. Note carefully what information on instructions is liable to be needed and the unit of code over which scheduling is done. [10 marks]

Discuss the following statements:

- (a) “An instruction scheduling phase cannot do as well as an assembly code programmer because

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ld.w   r0,a
st.w   r0,b
ld.w   r0,c
st.w   r0,d
```

cannot be interleaved.” [3 marks]

- (b) “My fast new special-purpose processor has 4 Kbyte of on-chip register-speed memory and hence has no *load delays*. It is not pipelined but instead its execution unit executes simultaneously the four 32-bit instructions found starting at (PC). The provided compiler works by placing instructions one-by-one in such a group of four and starting a new group of four (by completing any current group of four with no-ops if necessary) if the current instruction reads a value written by another of the current group of four. Hence there is no need for instruction scheduling.” [3 marks]