

## 1998 Paper 3 Question 7

### Computer Design

How can a pipeline be used to improve processor performance? [5 marks]

Explain, with reference to the 5-stage pipeline diagram below, how feed-forwarding (also called bypassing) can be used to reduce the effects of load delays but cannot eliminate them.

instruction fetch	register fetch	execute	memory access	register write back
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[10 marks]

Most instructions in old accumulator machines read an operand from memory which is then combined with the accumulator. The only exception is usually the **store** instruction which writes the accumulator (without modification) to the memory. If you were to pipeline an accumulator machine, where would the memory access stage go? [5 marks]