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.

<table>
<thead>
<tr>
<th>Instruction fetch</th>
<th>Register fetch</th>
<th>Execute</th>
<th>Memory access</th>
<th>Register write back</th>
</tr>
</thead>
</table>

[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]