

COMPUTER SCIENCE TRIPOS Part IB – 2021 – Paper 5

2 Computer Design (swm11)

- (a) How are forwarding paths used in processor pipelines? What pipeline hazards can they mitigate and what are the limitations of the mitigations? Provide one or more examples to illustrate the challenges. [8 marks]
- (b) For a pipelined processor implementing the RISC-V instruction set, why might branches cause bubbles in the pipeline, why are they needed and what can be done to mitigate them? Provide one or more examples. [6 marks]
- (c) In detail, describe the hardware mechanisms that are required to support virtual memory for a pipelined processor implementing the 32-bit RISC-V ISA. [6 marks]