COMPUTER SCIENCE TRIPOS Part II – 2025 – Paper 8

1   Advanced Computer Architecture (rdm34)

(a) Why might it be reasonable to estimate the performance of a high-performance
     processor as being proportional to the square root of the area of the core?

                                                                          [4 marks]

(b) It has become increasingly difficult to boost the performance of high-performance
     superscalar processors. This has raised concerns within industry that only very
     modest gains might be possible in the future.

     (i)   Should we be concerned about the stagnation of single-thread performance?
            Provide one argument in favour and one against.   [6 marks]

     (ii)   Some suggest that industry should explore radically different processor
            designs to boost single-thread performance. Why have developments in
            Instruction Set Architectures (ISAs) and microarchitectures historically
            been more incremental in nature?   [3 marks]

     (iii) One potential avenue for innovation involves enhancing the information
            shared between the compiler and hardware. This would be achieved by
            modifying the Instruction Set Architecture (ISA). What are the possible
            benefits of this approach, and what challenges might arise in practice?
                                                                          [4 marks]

(c) A chiplet is a small, modular integrated circuit that can be combined with
     other chiplets to create a complex system within a single package. What are
     the benefits of this approach when compared to designing and manufacturing a
     single die?   [3 marks]