COMPUTER SCIENCE TRIPOS Part II – 2024 – Paper 9

1 Advanced Computer Architecture (tmj32)

Many high-performance microprocessors support multithreading in hardware.

(*a*) In coarse-grained multithreading, threads switch following specific events.

    (*i*) What hardware support is required for coarse-grained multithreading?

           [3 marks]

    (*ii*) What hardware can be provided to reduce the cost of thread switching in coarse-grained multithreading and how does it help? [3 marks]

(*b*) In fine-grained multithreading, a new thread is selected to be fetched on each clock cycle.

    (*i*) How can fine-grained multithreading reduce the hardware requirements of a simple in-order processor in some circumstances? [3 marks]

    (*ii*) What is the impact on performance of fine-grained multithreading and how can it be improved? [3 marks]

(*c*) In simultaneous multithreading, threads co-exist within a core.

    (*i*) Describe a scenario where overall performance will improve, and another where it will get worse, with simultaneous multithreading. [4 marks]

    (*ii*) What factors need to be considered when deciding whether to duplicate, partition or share a core resource? [4 marks]