

COMPUTER SCIENCE TRIPOS Part IB – 2020 – Paper 5

2 Computer Design (swm11)

- (a) In computer architecture, why do we aim to make the common case fast? [3 marks]
- (b) If we have a new hardware divider that speeds up division by $2\times$ but results in a 2% drop in processor clock frequency, how frequently does divide need to be used to improve overall performance by 10%? [3 marks]
- (c) What properties are used to cache data efficiently? [3 marks]
- (d) What is the difference between direct-mapped, fully-associative and set-associative caches? [3 marks]
- (e) What cache-line replacement policies are typical for direct-mapped and set-associative caches? [3 marks]
- (f) Why are multi-level caches typically used? [2 marks]
- (g) What hardware is typically used to make virtual memory efficient? [3 marks]