MODULE A SYSTEMS ARCHITECTURE · A5

CPU performance: mark scheme

~25 minutes · 20 marks · J277 spec 1.1.2

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative words; **//** separates alternative statements for the same mark. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.1.2	Row 1: clock speed Row 2: number of cores Row 3: cache size	**3**	1 mark per row. 2+ ticks in a row = 0 for that row.
1(b) J277 1.1.2	3.2 billion / 3 200 000 000 / 3200 million (cycles per second)	**1**	Correct answer only. Accept 3.2×10^9.
1(c) J277 1.1.2	More (fetch-execute) cycles (carried out) per second... ...so more instructions are processed/executed per second // so programs run faster / performance improves	**2**	Max 2. Do not accept "the computer is faster" alone (NE). Do not accept "more cycles at the same time" (that describes cores).
1(d) J277 1.1.2	2 500 000 000 // 2.5 billion // 2500 million	**1**	Accept 2.5×10^9. Do not accept 2.5 million or 2 500 000 (wrong prefix).
2(a) J277 1.1.2	Frequently used data / instructions	**1**	Accept "data and instructions that are likely to be needed again". Do not accept "programs" or "files" (NE).
2(b) J277 1.1.2	More (frequently used) data/instructions can be stored in cache... ...so fewer (slower) fetches from RAM / main memory are needed // cache is faster to access than RAM so the CPU spends less time waiting (for data/instructions)	**2**	Max 2. "Bigger cache = faster" alone is NE.
3(a) J277 1.1.2	CPU Q (CPU Q) has a higher clock speed / 3.5 GHz compared with 2.0 GHz... ...so it carries out more cycles / processes more instructions per second (on the one core used) The program uses only one core, so CPU P's extra cores would not be used / give no benefit Cache size is the same (6 MB) so does not affect the choice	**3**	1 mark for CPU Q, then max 2 for justification. CPU P chosen = 0 for the whole part. Justification must be in context.

QUESTION	ANSWER	MARKS	GUIDANCE
3(b) J277 1.1.2	CPU P has more cores / 4 cores compared with 2 Each core can process (its own) instructions at the same time / simultaneously The program can split its tasks across all 4 cores So more instructions are processed in total (per second) even though each core is slower // 4 × 2.0 GHz gives more total cycles per second than 2 × 3.5 GHz	**3**	Max 3. Combination answers credited (J277 1.1.2 "in combination"). Do not accept "4 cores is four times faster". Accept 8 billion vs 7 billion cycles per second in total.
4(a) J277 1.1.2	Row 1: False Row 2: True Row 3: True Row 4: False	**4**	1 mark per row. 2 ticks in a row = 0 for that row.

Total: 20 marks