MODULE A SYSTEMS ARCHITECTURE · A3

Von Neumann architecture: mark scheme

~25 minutes · 20 marks · J277 spec 1.1.1

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. NE = not enough. Credit any other valid answer that shows the same understanding.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 1.1.1	(In the same) main memory / RAM / memory	**1**	Do not accept: secondary storage, hard drive, ROM, cache, registers.
1(b) J277 1.1.1	The program / instructions are stored in (main) memory (with the data) Instructions are fetched (from memory) and executed by the CPU ... one at a time / in turn / in sequence	**2**	Max 2. Third point depends on the second. "Programs are processed" is NE.
2(a) J277 1.1.1	Row 1: Program counter / PC MAR: holds the address (of the memory location) that is to be read from / written to // holds the address of the data or instruction being fetched MDR: holds the data / instruction that has been fetched from memory // holds data to be written to memory Row 4: Accumulator / ACC	**4**	1 mark per row. MAR: must say address. MDR: must say data or instruction (not "address"). "Holds memory" is NE.
3(a) J277 1.1.1	Program counter / PC MAR / memory address register	**2**	Mark the first two answers only. MDR or accumulator scores 0 for that answer.
4(a) J277 1.1.1	46	**1**	Correct answer only.
4(b)(i) J277 1.1.1	41	**1**	Correct answer only.
4(b)(ii) J277 1.1.1	ADD 46 // the instruction (stored) at address 41	**1**	Do not accept 46 alone or 150.
4(c) J277 1.1.1	An address identifies a (unique) location in memory // says where something is stored Data is the value / contents stored at that location Example from the table, e.g. address 45 holds the data 250	**2**	Max 2. The example can earn a mark on its own if it clearly separates the address from the contents.

QUESTION	ANSWER	MARKS	GUIDANCE
5(a) J277 1.1.1	Row 1: False ... the program counter holds the address of the next instruction (to be fetched) Row 2: True Row 3: False ... the MAR holds the address // the MDR holds the data / instruction (being transferred to or from memory)	**3**	1 mark per row. False rows need a correct rewrite for the mark. Two ticks in a row = 0 for that row.
6(a) J277 1.1.1	The new program is (loaded and) stored in (main) memory Instructions and data are stored in the same memory // instructions are just stored values like data ... so changing the program only changes what is in memory, not the hardware The CPU fetches and executes the (new) instructions from memory ... the PC is set to the address of the first instruction of the new program	**3**	Max 3. Must be applied to the pay machine / its program for full marks; generic answers max 2.

Total: 20 marks