

ALU, CU, MAR, MDR, PC, ACC

5. Describe what happens during the 'Fetch' stage of the Fetch-Decode-Execute cycle.

You should refer to the use of specific registers in your answer.

In the fetch stage, the address held in the program counter (PC) is copied into the MAR. ^{PC just storage} memory address register (MAR). A memory read signal is sent down the control bus so the address stored in the MAR can travel down the address bus, and the address data stored in the address in MAR is sent down the data bus and copied into the memory data register (MDR); the value in the PC is incremented by 1 to point to the address of the next instruction to be fetched. ^{Data copied from MDR to CIR} 4 [4]

RAM copies data from the location specified by address bus onto data bus

6. Describe how the accumulator is used during the Fetch-Decode-Execute cycle.

An accumulator ~~is~~ stores the intermediary result of an ^{arithmetic} calculation or logical operation performed in the Arithmetic Logic Unit (ALU). ^{holds all input/output} ^{checks for conditional branching} ^{stores data which has come from memory} [2]

7. Explain which registers and buses are used, and the values they store/carry, when the line LDA first in the LMC program below is executed (after it has been fetched and decoded). You should assume the address first refers to memory location 4.

Code: LDA first, ADD second, OUT, HLT. Memory: first DAT 15, second DAT 23. ^{Value from memory copied to MDR into the ACC (first location)} ^{value from memory ("second") copied to MDR and into ACC then into ALU where process occurs}

The value ^{held in} from ^{data} memory location 4 is copied into the memory data register via the data bus after a memory read control signal has been sent across the control bus. This data containing 15 - ^{copied from opcode copied to CIR and decoded} is then loaded into the accumulator. The value held in memory location 5 is then sent along the address bus into the Memory data register. The value 15 in the accumulator is copied into the Arithmetic Logic Unit and the value 23 is copied into the Accumulator and ALU. ^{NAQ} The "ADD" is an instruction hence the ~~operand and opcode~~ instruction is copied into the Current Instruction Register and decoded ~~as v~~. The value 15 in ACC is copied into Arithmetic Logic unit and value 23 is copied into ACC and ALU, where the two values are added. The value is loaded back into the ACC and into the MDR ^{for} Memory write ~~later~~ control signal across control bus and the value 39 is sent along data bus to be stored in memory location 6. [6]

Students engage with feedback and correct answer in green

Verbal feedback on topic misconceptions, or exam technique issues, are provided during lessons.