

7 The following table shows part of the instruction set for a processor. The processor has two registers, the Accumulator (ACC) and the Index Register (IX).

Instruction		Explanation
Opcode	Operand	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
ADD	#n/Bn/&n	Add the number n to the ACC
ADD	<address>	Add the contents of the given address to the ACC
SUB	#n/Bn/&n	Subtract the number n from the ACC
SUB	<address>	Subtract the contents of the given address from the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX)

<address> can be an absolute or a symbolic address
 # denotes a denary number, e.g. #123
 B denotes a binary number, e.g. B01001010
 & denotes a hexadecimal number, e.g. &4A

(a) The current contents of memory are shown:

Address	Data
50	54
51	55
52	50
53	52
54	100
55	25
56	50

The current contents of the ACC and IX are shown:

ACC	50
IX	45

Complete the table by writing the content of the ACC after each program has run.

	Instructions	ACC content
1	LDD 50 ADD #4 ADD 54	
2	LDI 53 DEC ACC ADD 56	
3	LDM #55 SUB #5	

[3]

(b) The instruction set also includes these bit manipulation instructions:

Instruction		Explanation
Opcode	Operand	
AND	#n/Bn/&n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n/Bn/&n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n/Bn/&n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>

<address> can be an absolute or a symbolic address
 # denotes a denary number, e.g. #123
 B denotes a binary number, e.g. B01001010
 & denotes a hexadecimal number, e.g. &4A

Explain how bit manipulation can be used to clear the data in an 8-bit register.

Write the bit manipulation instruction that will be used.

Explanation

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Instruction

[3]