COLEGIO DE MUNTINLUPA

DEPARTMENT OF COMPUTER ENGINEERING

COEN 3213 - Microprocessors (Lecture)

CPU General-purpose and Flag Registers Debugging

Assignment No. 1

GRADE

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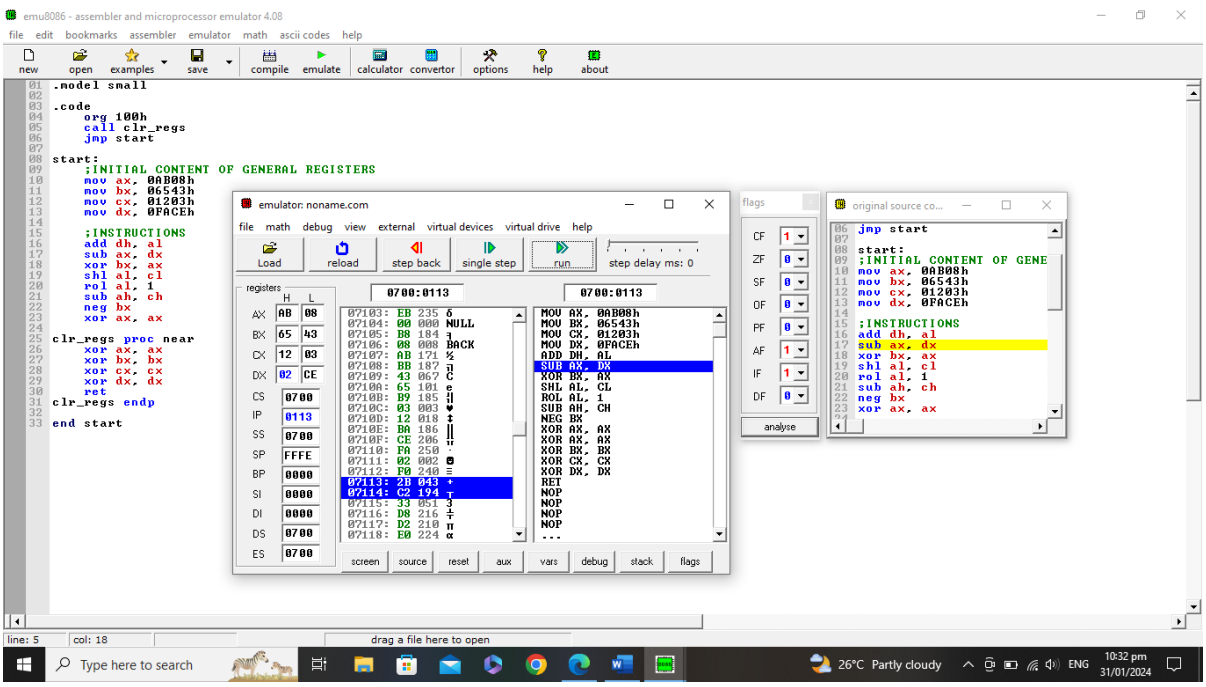
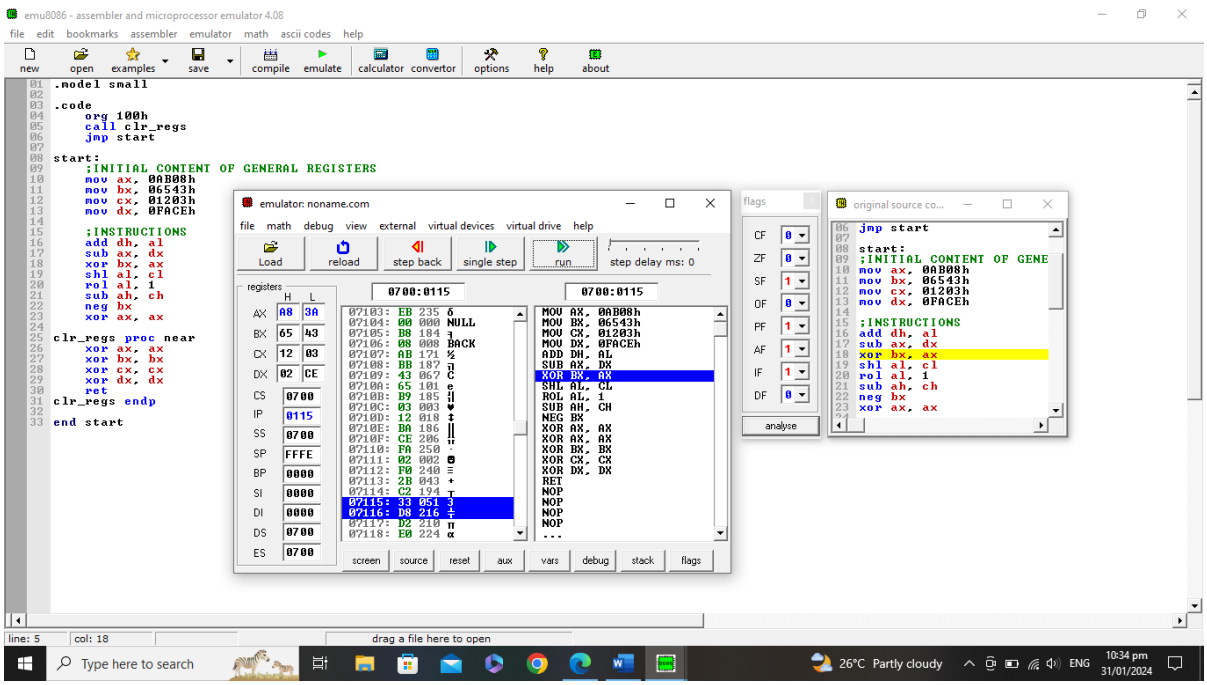
Machine Problem. Using emu8086 emulator software and assume that FLAG registers are cleared (0), and the initial content of AX = AB08h, BX = 6543h, CX = 1203h, DX = FACEh registers, Determine the content of general register and the status of the CPU flag registers. Also provide a summary of discussion/observation about the status or condition of each flag registers.

INSTRUCTION	GENERAL PURPOSE REGISTERS				FLAG STATUS						
	AX	BX	CX	DX	O	I	S	Z	A	P	C
ADD DH, AL	AB08	6543	1203	02CE	0	1	0	0	1	0	1
SUB AX, DX	A83A	6543	1203	02CE	0	1	1	0	1	1	0
XOR BX, AX	A83A	CD79	1203	02CE	0	1	1	0	1	0	0
SHL AL, CL	A8D0	CD79	1203	02CE	0	1	1	0	1	0	1
ROL AL, 1	A8A1	CD79	1203	02CE	0	1	1	0	1	0	1
SUB AH, CH	96A1	CD79	1203	02CE	0	1	1	0	0	1	0
NEG BX	96A1	3287	1203	02CE	0	1	0	0	1	1	1
XOR AX, AX	0000	3287	1203	02CE	0	1	0	1	1	1	0

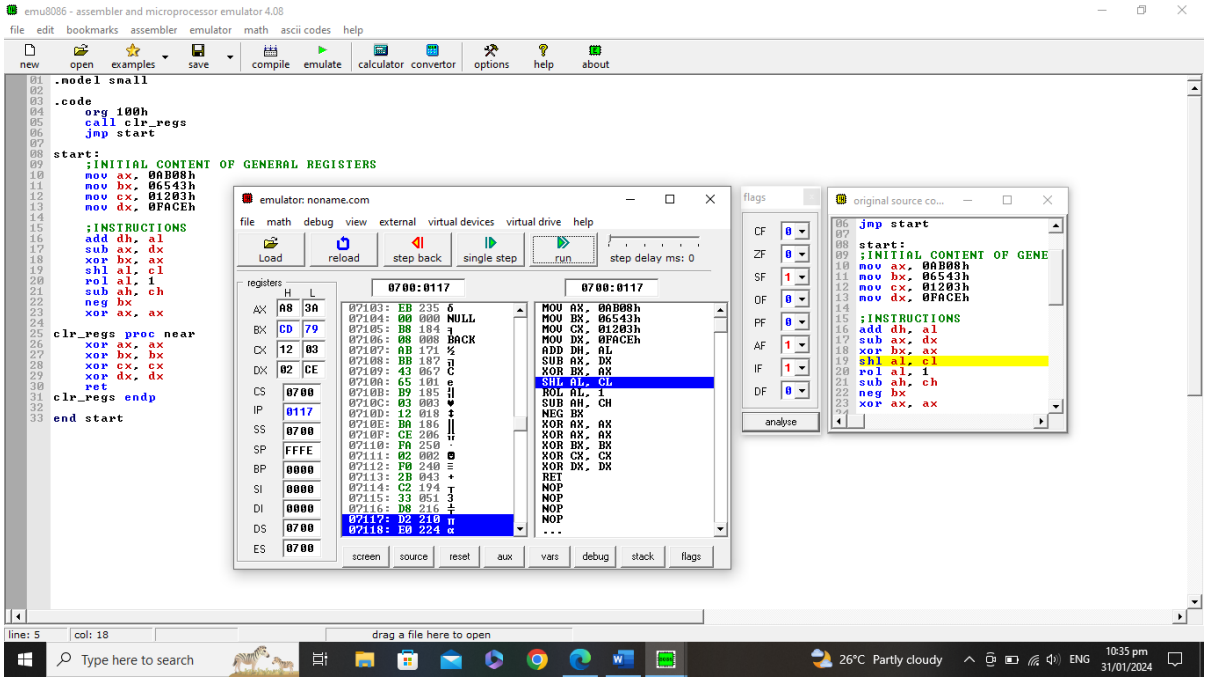
A. Screenshots of each simulation of line code



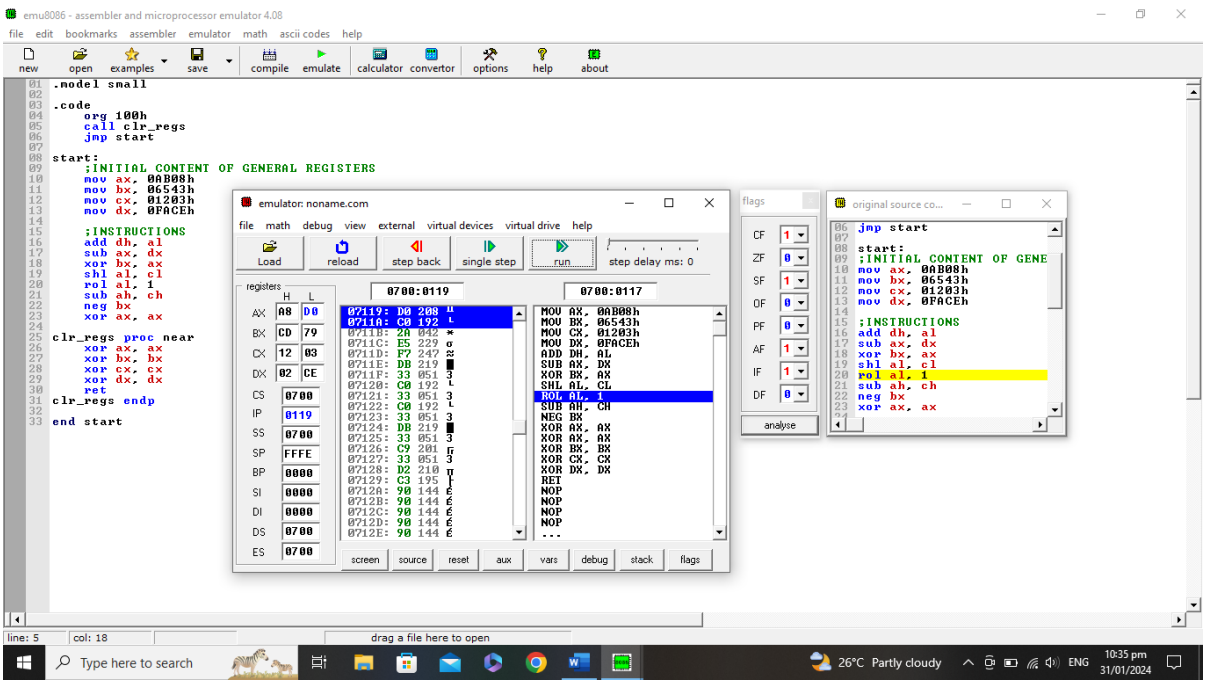
Instruction 1 - `ADD DH, AL`



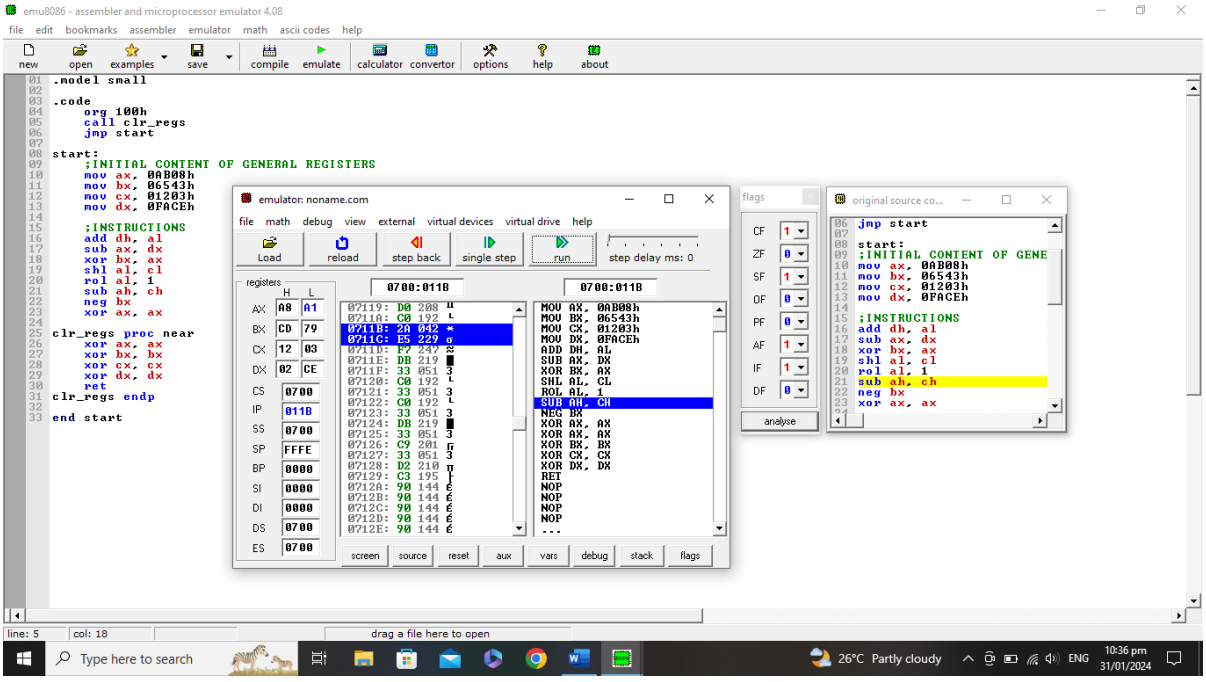
Instruction 2 - `SUB AX, DX`



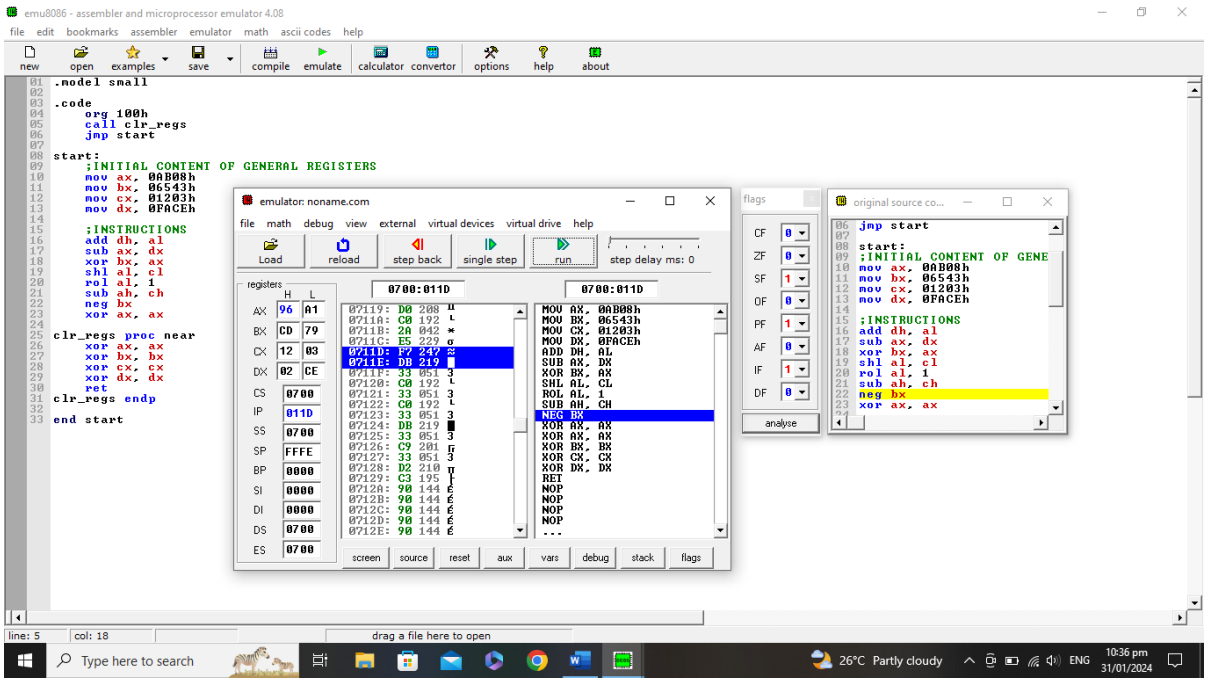
Instruction 3 - `XOR BX, AX`



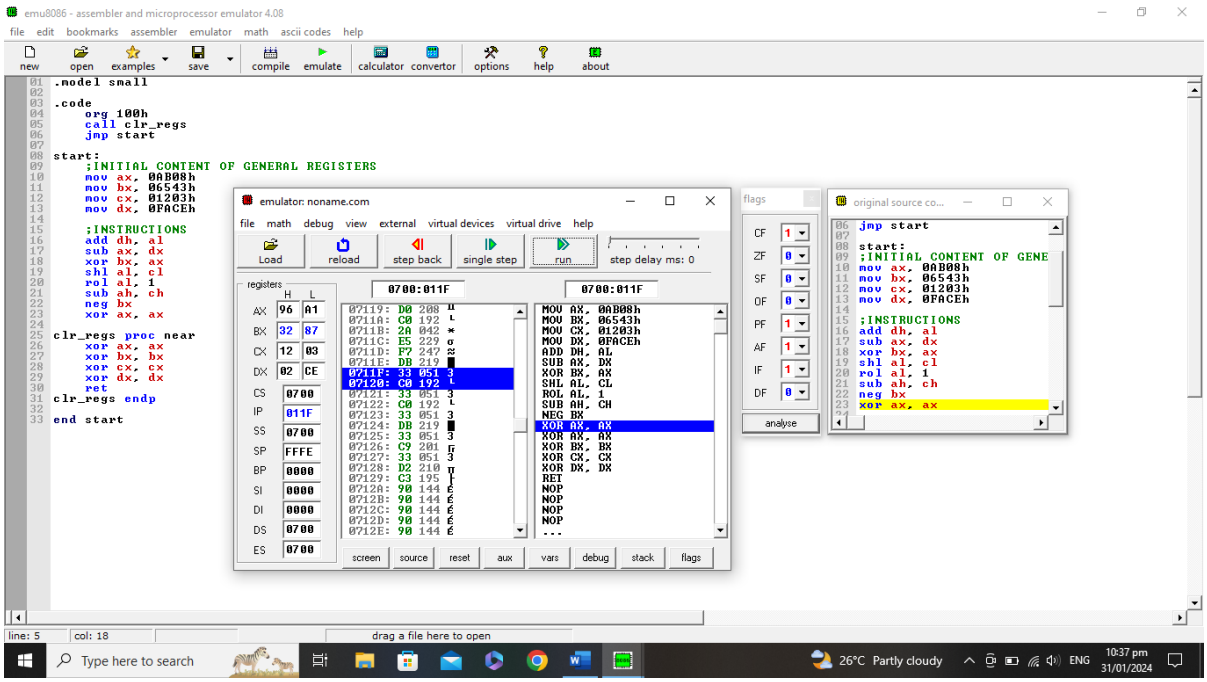
Instruction 4 – `SHL AL, CL`



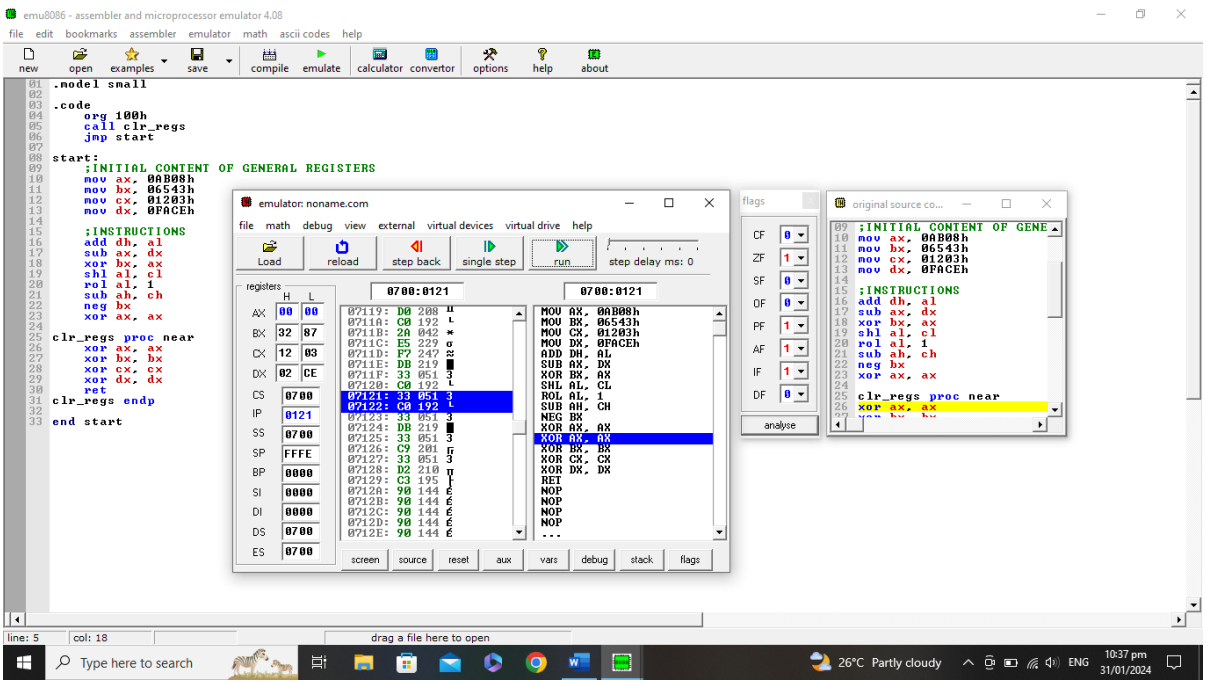
Instruction 5 – `ROL AL, 1`



Instruction 6 – `SUB AH, CH`



Instruction 7 – `NEG BX`



Instruction 8 – `XOR AX, AX`

B. Discussion or observation about the condition or status of each FLAG registers

ADD DH, AL:

Overflow (O): Cleared.

Interrupt Enable (I): Set (enabled).

Sign (S): Cleared.

Zero (Z): Cleared.

Auxiliary Carry (A): Set (indicating a carry-out from the low nibble).

Parity (P): Cleared.

Carry (C): Set (indicating a carry-out from the operation).

Observation: The ADD operation results in a carry-out from the high nibble, affecting the Carry and Auxiliary Carry flags. The Overflow, Sign, and Zero flags are not directly affected.

SUB AX, DX:

Overflow (O): Set (indicating a signed overflow).

Interrupt Enable (I): Set (enabled).

Sign (S): Set (due to the negative result).

Zero (Z): Cleared.

Auxiliary Carry (A): Set (indicating a borrow from the low nibble).

Parity (P): Set.

Carry (C): Cleared.

Observation: The SUB operation results in a borrow from the low nibble, affecting the Carry and Auxiliary Carry flags. The Overflow, Sign, Zero, and Parity flags are influenced by the signed result.

XOR BX, AX:

Overflow (O): Set (indicating a signed overflow).

Interrupt Enable (I): Set (enabled).

Sign (S): Set (due to the negative result).

Zero (Z): Cleared.

Auxiliary Carry (A): Cleared.

Parity (P): Cleared.

Carry (C): Cleared.

Observation: The XOR operation doesn't affect the Carry or Auxiliary Carry flags. The Overflow, Sign, Zero, and Parity flags are influenced by the signed result.

SHL AL, CL:

Overflow (O): Set (indicating a signed overflow).

Interrupt Enable (I): Set (enabled).

Sign (S): Set (due to the negative result).

Zero (Z): Cleared.

Auxiliary Carry (A): Cleared.

Parity (P): Set.

Carry (C): Set (indicating a carry-out from the most significant bit).

Observation: The SHL operation affects the Carry flag due to a shift-out from the most significant bit. Overflow, Sign, Zero, and Parity flags are influenced by the signed result.

ROL AL, 1:

Overflow (O): Set (indicating a signed overflow).

Interrupt Enable (I): Set (enabled).

Sign (S): Set (due to the negative result).

Zero (Z): Cleared.

Auxiliary Carry (A): Cleared.

Parity (P): Set.

Carry (C): Set (indicating a carry-out from the most significant bit).

Observation: The ROL operation, like SHL, affects the Carry flag due to a shift-out from the most significant bit. Overflow, Sign, Zero, and Parity flags are influenced by the signed result.

SUB AH, CH:

Overflow (O): Set (indicating a signed overflow).

Interrupt Enable (I): Set (enabled).

Sign (S): Set (due to the negative result).

Zero (Z): Cleared.

Auxiliary Carry (A): Set (indicating a borrow from the low nibble).

Parity (P): Cleared.

Carry (C): Set (indicating a borrow from the operation).

Observation: Like the SUB AX, DX instruction, the SUB AH, CH operation affects the Carry and Auxiliary Carry flags. Overflow, Sign, Zero, and Parity flags are influenced by the signed result.

NEG BX:

Overflow (O): Cleared.

Interrupt Enable (I): Set (enabled).

Sign (S): Cleared (since the result is positive).

Zero (Z): Cleared (since the result is not zero).

Auxiliary Carry (A): Set (indicating a borrow from the low nibble).

Parity (P): Set.

Carry (C): Set (indicating a borrow from the operation).

Observation: The NEG instruction affects the Carry, Auxiliary Carry, Sign, Zero, and Parity flags. Overflow is not affected.

XOR AX, AX:

Overflow (O): Set (indicating a signed overflow).

Interrupt Enable (I): Set (enabled).

Sign (S): Set (due to the negative result).

Zero (Z): Set.

Auxiliary Carry (A): Set (indicating a carry-out from the low nibble).

Parity (P): Set.

Carry (C): Cleared.

Observation: The XOR operation with AX and itself results in zero, affecting the Zero flag. The Overflow, Sign, Auxiliary Carry, Parity, and Carry flags are all set accordingly.