

Assembly Language and 8088 Processor Q&A

1. How the processor uses the address bus, the data bus, and the control bus to communicate with the system memory?

The address bus is used by the processor to send the memory address it wants to access, the data bus carries the actual data to and from the memory, and the control bus sends control signals to specify whether the operation is a read or write, and to synchronize other tasks.

2. Which of the following are unidirectional and which are bidirectional?

- a. Address Bus: Unidirectional
- b. Data Bus: Bidirectional
- c. Control Bus: Depends on specific signals, but often bidirectional.

3. What are registers and what are the specific features of the accumulator, index registers, program counter, and program status word?

Registers are small, fast storage locations inside the CPU used to store and manipulate data. The accumulator is used for arithmetic and logic operations, index registers help with array and memory indexing, the program counter holds the address of the next instruction, and the program status word stores flags for the state of the CPU.

4. What is the size of the accumulator of a 64-bit processor?

The accumulator (AX in x86) is typically 64 bits in size for a 64-bit processor.

5. What is the difference between an instruction mnemonic and its opcode?

The mnemonic is the human-readable form of the instruction, like MOV or ADD, while the opcode is the binary code that the processor executes.

6. How are instructions classified into groups?

Instructions are grouped based on their function, such as data movement (MOV), arithmetic operations (ADD, SUB), logic operations (AND, OR), control flow (JMP, CALL), etc.

7. A combination of 8 bits is called a byte. What is the name for 4 bits and for 16 bits?

4 bits are called a nibble, and 16 bits are called a word.

8. What is the maximum memory 8088 can access?

The 8088 can access a maximum of 1MB of memory using a 20-bit address bus.

9. List down the 14 registers of the 8088 architecture and briefly describe their uses.

AX, BX, CX, DX: General-purpose registers

SP: Stack Pointer

BP: Base Pointer

SI, DI: Index registers

CS, DS, SS, ES: Segment registers

IP: Instruction Pointer

FLAGS: Status flags

10. What flags are defined in the 8088 FLAGS register? Describe the function of the zero flag, the carry flag, the sign flag, and the overflow flag.

Zero Flag (ZF): Set if the result of an operation is zero.

Carry Flag (CF): Set if an arithmetic operation results in a carry out.

Sign Flag (SF): Reflects the sign of the result (negative or positive).

Overflow Flag (OF): Set if an arithmetic operation overflows the sign bit.

11. Give the value of the zero flag, the carry flag, the sign flag, and the overflow flag after each of the following instructions if AX is initialized with 0x1254 and BX is initialized with 0x0FFF.

a. add ax, 0xEDAB: SF=1, OF=1, CF=0

b. add ax, bx: ZF=0, SF=0, CF=0

c. add bx, 0xF001: SF=1, OF=0, CF=1

12. What is the difference between little endian and big endian formats? Which format is used by the Intel 8088 microprocessor?

Little endian stores the least significant byte first, while big endian stores the most significant byte first. The Intel 8088 uses the little endian format.

13. For each of the following words identify the byte that is stored at lower memory address and the byte that is stored at higher memory address in a little endian computer.

- a. 1234: Low=34, High=12
- b. ABFC: Low=FC, High=AB
- c. B100: Low=00, High=B1
- d. B800: Low=00, High=B8

14. What are the contents of memory locations 200, 201, 202, and 203 if the word 1234 is stored at offset 200 and the word 5678 is stored at offset 202?

Memory contents:

200=34, 201=12, 202=78, 203=56

15. What is the offset at which the first executable instruction of a COM file must be placed?

The first executable instruction must be placed at offset 0x0100.

16. Why was segmentation originally introduced in 8088 architecture?

Segmentation was introduced to extend memory beyond 64KB while maintaining backward compatibility with older processors like the 8080 and 8085.

17. Why a segment cannot start from the physical address 55555?

Segments must start at paragraph boundaries, which means they must be aligned to 16-byte addresses. 55555 is not aligned to a 16-byte boundary.

18. Calculate the physical memory address generated by the following segment-offset pairs.

- a. 1DDD:0436 = 1E166
- b. 1234:7920 = 19C60
- c. 74F0:2123 = 77013
- d. 0000:6727 = 6727
- e. FFFF:4336 = 103315
- f. 1080:0100 = 10900
- g. AB01:FFFF = AC00F

19. What are the first and the last physical memory addresses accessible using the following segment values?

- a. 1000: First=10000, Last=1FFFF
- b. 0FFF: First=0FFF0, Last=1FFEF
- c. 1002: First=10020, Last=2001F
- d. 0001: First=0010, Last=100F
- e. E000: First=E0000, Last=FFFFFF

20. Write instructions that perform the following operations.

- a. Copy BL into CL: MOV CL, BL
- b. Copy DX into AX: MOV AX, DX
- c. Store 0x12 into AL: MOV AL, 0x12
- d. Store 0x1234 into AX: MOV AX, 0x1234
- e. Store 0xFFFF into AX: MOV AX, 0xFFFF

21. Write a program in assembly language that calculates the square of six by adding six to the accumulator six times.

MOV AX, 0

MOV CX, 6

ADD_LOOP: ADD AX, 6

DEC CX

JNZ ADD_LOOP