Addressing Modes

Addressing Mode. The way in which an operand is specified is called its *addressing mode*.

- **Immediate** – The datum is either 8 bits or 16 bits long and is part of the instruction.

- **Direct** – The 16-bit effective address of the datum is part of the instruction.

- **Register** – The datum is in the register that is specified by the instruction. For a 16-bit operand, a register may be AX, BX, CX, DX, SI, DI, SP, or BP, and for an 8-bit operand a register may be AL, AH, BL, BH, CL, CH, DL, or DH.

- **Register Indirect** – The effective address of the datum is in the base register BX or an index register that is specified by the instruction, i.e.,

$$\text{EA} = \left\{ \begin{array}{c} \text{(BX)} \\ \text{(DI)} \\ \text{(SI)} \end{array} \right\}$$

- **Register Relative** – The effective address is the sum of an 8- or 16-bit displacement and the contents of a base register or and index register, i.e.,

$$\text{EA} = \left\{ \begin{array}{c} \text{(BX)} \\ \text{(BP)} \\ \text{(SI)} \\ \text{(DI)} \end{array} \right\} + \left\{ \begin{array}{c} \text{8-bit displacement} \\ \text{16-bit displacement} \end{array} \right\}$$

- **Based Indexed** – The effective address is the sum of a base register and an index register, both of which are specified by the instruction, i.e.,

$$\text{EA} = \left\{ \begin{array}{c} \text{(BX)} \\ \text{(BP)} \end{array} \right\} + \left\{ \begin{array}{c} \text{(SI)} \\ \text{(DI)} \end{array} \right\}$$

- **Relative Based Indexed** – The effective address is the sum of an 8- or 16-bit displacement and a based indexed address, i.e.,

$$\text{EA} = \left\{ \begin{array}{c} \text{(BX)} \\ \text{(BP)} \end{array} \right\} + \left\{ \begin{array}{c} \text{(SI)} \\ \text{(DI)} \end{array} \right\} + \left\{ \begin{array}{c} \text{8-bit displacement} \\ \text{16-bit displacement} \end{array} \right\}$$

Example. If $\text{(BX)} = 0158$, $\text{(DI)} = 10A5$, $\text{Displacement} = 1B57$, $\text{(DS)} = 2100$ and DS is used as the segment register, then what are the effective and physical addresses produced by these quantities?

A portion of a memory map for a 80286 (16-bit word) machine (a little-endian machine which orders bytes in a word from *right to left*), and the contents of the registers are depicted as follow (addresses and contents are represented in hex):

E102	ABCD	(DS)	= 0E10
E104	9413	(BX)	= 000A
E106	5354	(DI)	= 0010
E108	9394		
E10A	000B		
E10C	0008		
E10E	0001		
E110	0007		
E112	0001		
E114	0204		
E116	3536		

1. What are the memory contents of E103 and E104?
   (E103) =
   (E104) =

2. What is the content of AL after the instruction MOV AL, [BX]?
   (AL) =

3. What is the content of AX after the instruction MOV AX, [BX+04H]?
   (AX) =

4. What are the contents of SI and AX after the following sequence of instructions:
   (1) MOV SI, [DI]; (2) MOV AX, [BX+SI+01H]?
   (SI) =
   (AX) =

5. What are the contents of SI and AL after the following sequence of instructions:
   (1) MOV SI, [BX]; (2) MOV AL, [BX][SI]?
   (SI) =
   (AL) =