Course Name: A Level (1ˢᵗ Sem)   **Subject: CO**
Topic: Address Modes   **Date: 27-05-20**

Address Modes: As we know that an instruction is composed of many fields. One most important field is the Address field. There are multiple ways that a computer uses to access the operands. Sometimes the operands are in memory, sometimes in registers. Along with that, sometimes operands are to be accessed in random fashion while sometimes to be accessed in a particular order. Keeping all these things in mind, several addressing modes are designed. The most important modes are as follows:

1. Immediate Mode   **2.** Implied Mode
3. Direct Mode   **4.** Indirect Mode
5. Register Mode   **6.** Register Indirect Mode
7. Auto Increment/Auto Decrement Mode   **8.** Indexed Mode
**9.** Relative Mode

Immediate Mode: In this mode the address field doesn't store an address. Instead, the operand itself is provided implicitly in that field of instruction register.
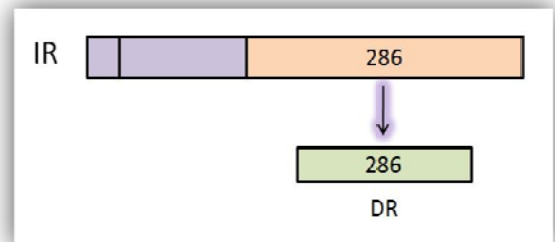

Implied Mode: This mode is peculiar in such a way that it also has no any address information. Instead it has a message for the control unit to listen to and perform accordingly. Usually the message is for AC like, Complement AC, Increment AC, Shift Right AC etc.
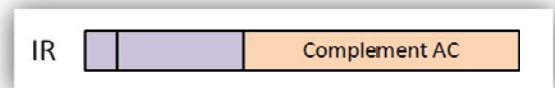

Direct Mode: An address of certain memory location is given in the address field. The address is transferred to AR and the appropriate memory location is sought after for getting the operand.
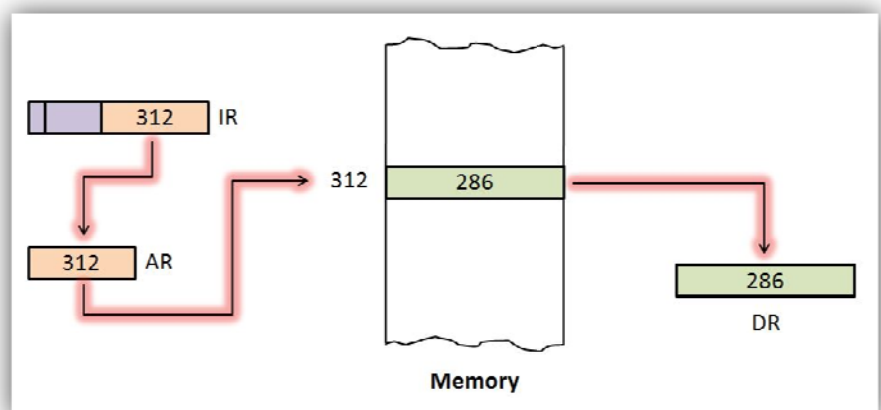

Indirect Mode: This mode is very similar to the Direct mode but with one level of indirection. The address given in IR is sought after in the memory and what we get is not an operand, it is another address. Now this address is effective address and moving on to this address, we get our operand.
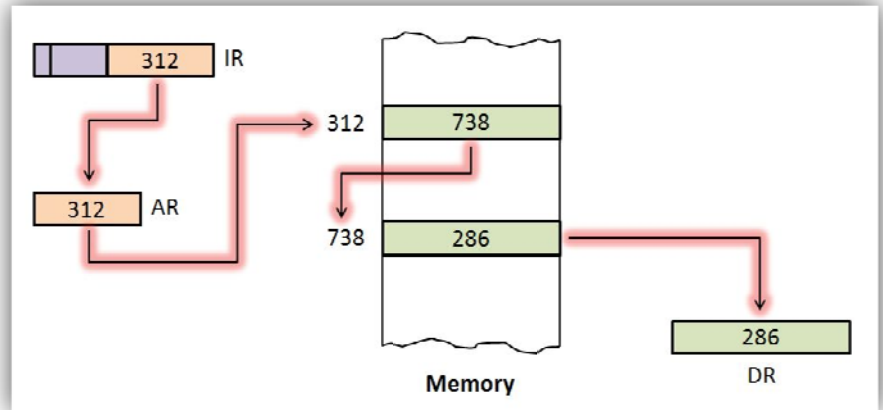
Register Mode: The address given in IR is not a memory address. Instead, it is a register code which refers to a particular register. A k bit register code can refer a single register from a group of 2^k registers. The operand is found in the referred register.
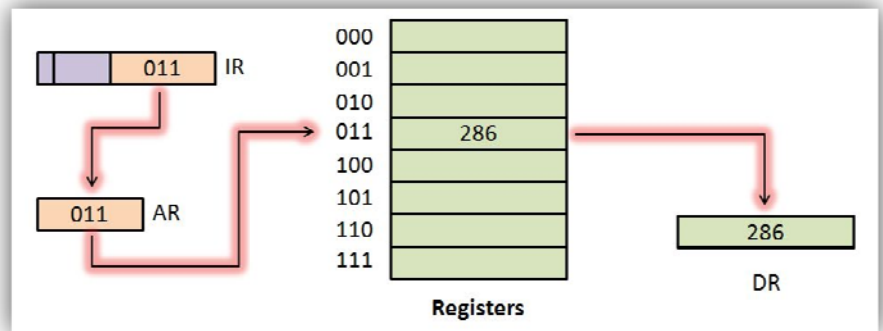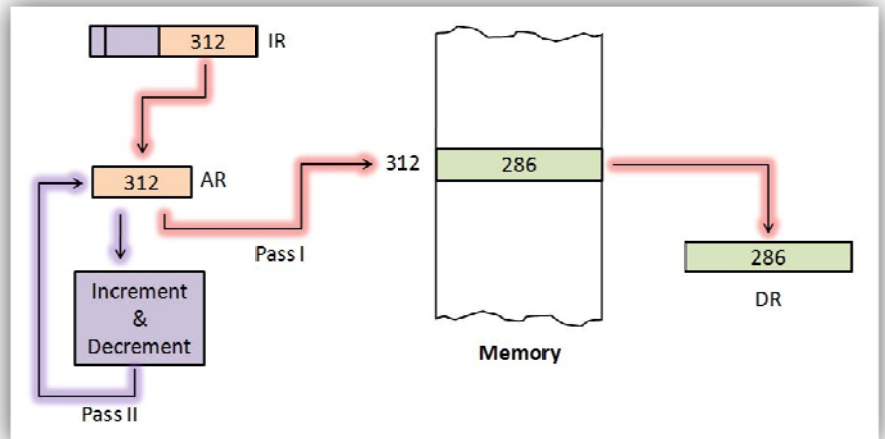

Register Indirect Mode: It is basically a combination of Register mode and Indirect Mode. The address found in IR is a register code which points to a register. The appropriate register now provides the effective address which is the address of a memory location. The operand is found finally in the memory.
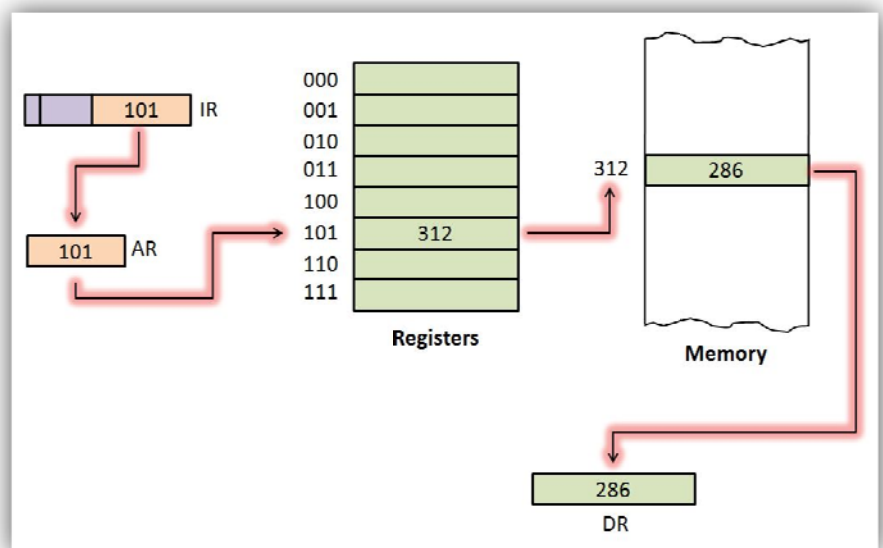
Auto Increment/Auto Decrement Mode: The address found in IR is transferred to AR and from here, the address goes in two different ways- the one is to refer the memory and find the operand while other is to go through an Increment or Decrement circuit. Increment or Decrement is just to increase or decrease the address so that it can refer one next or one previous memory location back to back. This mode is preferable when many operands are to be fetched for just one instruction and all are stored one contiguous memory locations.

Indexed Mode: Indexed mode uses a sum of address in IR and the value of an Index register to produce the effective address. The value of Index register is regularly changed to produce different memory addresses while retaining the address in IR the same.
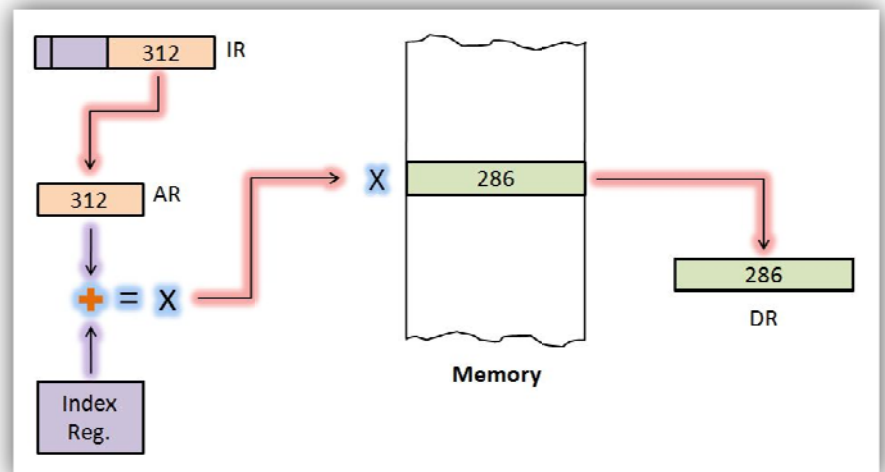
Relative Mode: It is very similar to the Indexed mode. The address in IR is summed up with the value in Program Counter (PC) to produce the effective address. Using this address the operand is accessed from memory.
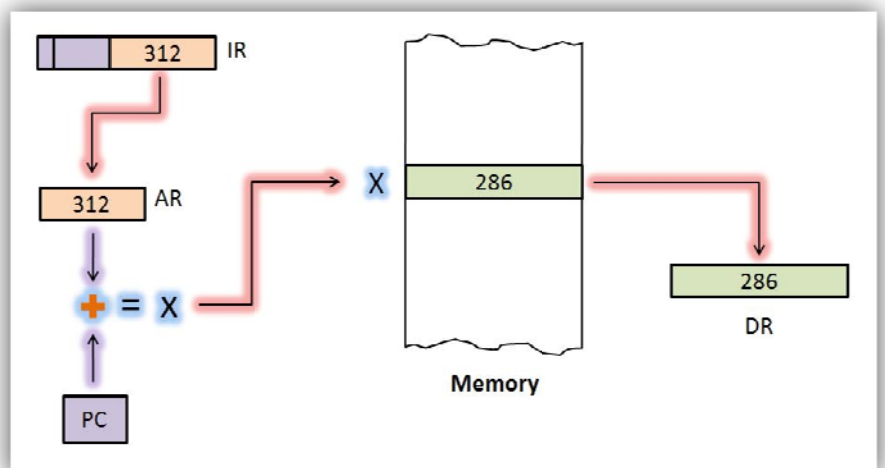
Assignment:

1. What is an address mode? List at least 6 of the address modes.
2. Differentiate between Register Mode and Register Indirect Mode.