1. Explain why in MARIE, the MAR is only 12 bits wide while the AC is 16 bits wide. Hint: Consider the difference between data and addresses

Ans.

MARIE can handle 16-bit data, so the AC must be 16 bits wide. However, MARIE's memory is limited to 4096 address locations, so the MAR only needs to be 12 bits wide to hold the largest address.

2. Explain the steps of the fetch-decode-execute cycle. Your explanation should include what is happening in the various registers.

Ans.

Fetch: Load the PC into the MAR; fetch the instruction and place it into the IR; increment PC by 1;

Decode: Decode the instruction using IR[15-12]; if necessary, place IR[11-0] into MAR and fetch operand, placing result into MBR;

Execute: Execute instruction

3. Draw the timing diagram for MARIE's Load instruction using the format of Figure 4.16.

Ans LOAD