EE 337: Microprocessors Laboratory (Spring 2021)
Section: S1 (Second year UG)
Indian Institute of Technology Bombay

Lab 2: 20 points Date: January 25, 2021

1. [10 points] Write a program to calculate the decimal representation of an unsigned 8-bit integer stored at memory location `50H`. The unsigned integer belongs to the set $\{0, 1, 2, \ldots, 255\}$. The decimal representation will have 1 or 2 or 3 digits. Each decimal digit can be represented by 4 bits (also called a nibble). Store the digits at memory locations `52H` and `53H` as follows:

   - The ones place decimal digit occupies the least significant 4 bits at location `53H`.
   - The tens place decimal digit occupies the most significant 4 bits at location `53H`.
   - The hundreds place decimal digit occupies the least significant 4 bits at location `52H`.
   - If the integer at memory location `50H` has only 1 decimal digit, the tens and hundreds place nibbles should have zero. Similarly, if the integer has only two decimal digits, the hundreds place nibble should have zero.

   Example: If the byte at memory location `50H` is `FEH`, then the contents of locations `52H` and `53H` should be `02H` and `54H`, respectively.

2. [10 points] Write a program to check if a given $m \times m$ matrix $\mathbf{M}$ is symmetric, i.e., $\mathbf{M} = \mathbf{M}^T$. The matrix dimension m is stored in `60H` and the memory location corresponding to the 1st element of the matrix is `61H`. If the given matrix is symmetric then set the user definable bit in program status word (PSW) i.e., set $PSW.5$ to 1 else set it to 0. The matrix dimension m can be 2, 3, or 4. Assume the matrix $\mathbf{M}$ to be stored in row-major form, i.e., element $M(1,1)$ is in the 1st location, $M(1,2)$ is in the 2nd location, ..., $M(m, m-1)$ is in the $(m-1)m$-th location and $M(m,m)$ in the m^2-th location.

   Example: If the value stored in `60H` is 3 and values stored in `61H`, `62H`, ..., `69H` are $1, 4, 3, 4, 1, 2, 3, 2, 1$, respectively, then set $PSW.5$ to 1.

TA Checkpoints

1. For question 1, ask the student to load a byte into location `50H`. Check the result of running the program is correctly stored in locations `52H` and `53H`.

2. For question 2, ask the student to store 3 in `60H` and load a symmetric 3×3 matrix and check that `PSW.5` is 1. Next load an asymmetric 3×3 matrix and check that `PSW.5` is 0.