**INSTRUCTIONS: (i) Create a folder, rename it to your IDNO. (ii) Rename the project with your IDNO (iii) Write your IDNO and name in .v file. Write all modules in a single .v file**

Q. Implement a digital circuit which encrypts a given 4 bit number and stores it at a location in memory as per the following details:

➔ The 4 bit number to be encrypted is stored in a 4 bit register named REG1
➔The number is read from REG1 and rotated right by two bits
➔The rotated number is then multiplied by a fixed 4 bit number (KEY)
➔The resultant encrypted 8 bit number is then stored in a memory of size (16x8) at an address same as the original unencrypted number itself. (Please refer diagram below)
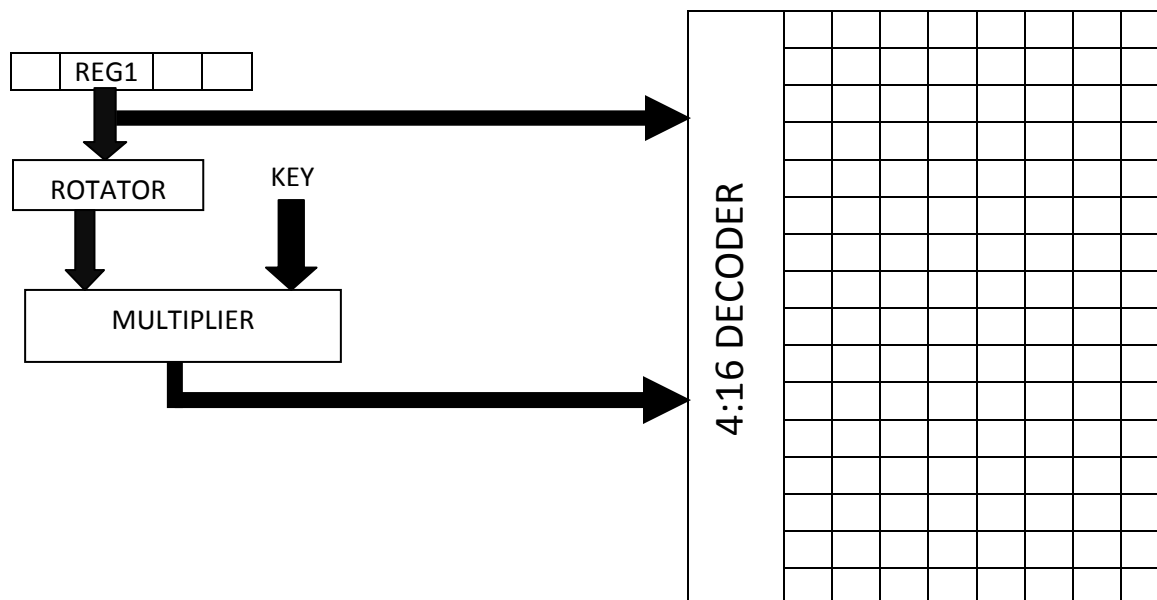
Implement the circuit in different modules stated as follows (implement all modules in Behavioral modeling):

1. REG1 (clk, EN, numin, numout) : This module is a 4 bit register which stores the 4 bit value (parallel load) numin at a positive clock edge when EN signal is asserted. The output is available as numout thereafter.

2. ROTATOR (clk, Enable, numo, numrotated): This module right rotates the input four bit number by 2 bit positions on two positive clock edges when Enable is asserted.

3. MULTIPLIER(op1, op2, product): This module multiplies two 4 bit numbers. Flow chart for implementation of this module is given below
4. DECODER (sel, out1) : This module is a 4:16 decoder
5. MEMORY(WE, datatowrite, regsel, readdata): This is the memory module where the encrypted value is stored
6. DATAPATH (num, key, storedvalue): This is a wrapper module which connects all the previous modules.
7. TESTBENCH: Write the testbench module to show the output for a given input. Instantiate a module DATAPATH which takes the number to be encrypted and key as input and gives the desired output. Test the circuit for the following combinations:
   a. Num= 1000, KEY= 1000
   b. Num= 1001, KEY= 1000
   c. Num= 1100, KEY= 1010
   d. Num= 1011, KEY= 1110

DETAILED FLOWCHART OF MULTIPLY MODULE