**Lab 2 Manipulation Instruction**

The add, sub, addc, subc, and, or, not, SHRAand ROTR are implemented in this lab. The bit code for this class is 1. Harvard and 12 bits are utilized in this lab. Everything works fine when tested with MIF file as shown below. First four MSB are opcode, the second four MSB are Ri and the last four bits are Rj for the manipulation instructions.

0 : 110; % SUB R1, R0; R1 = 0 %

1 : 010; % ADD R1, R0; R1 = 0 %

2 : 223; % ADDC R2, #0x3; R2 = 0x3 %

3 : 222; % ADDC R2, #0x2; R2 = 0x5 %

4 : 032; % ADD R3, R2; R3 = 0x5 %

5 : 420; % NOT R2; R2 = 0xFFFA %

6 : 632; % OR R3, R2; R3 = 0xFFFF %

7 : 532; % AND R3, R2; R3 = R2 = 0xFFFA %

8 : 731; % SHRA R3, #0x1; R3 = 0xFFFD %

9 : 821; % ROTR R2, #0x1 %