**SYSC 3006 - Lab 5 Support Tables (Fall 2016)**

Control FSM Output ROM Table: **Fetch, Decode, and Execution States for opcodes 0x01 (ADD) through 0x07 (NOT)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **3 1** | **3 0** | **2 9** | **2 8** | **2 7** | **2 6** | **2 5** | **2 4** | **2 3** | **2 2** | **2 1** | **2 0** | **1 9** | **1 8** | **1 7** | **1 6** | **1 5** | **1 4** | **1 3** | **1 2** | **1 1** | **1 0** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |  |
| **State**  **Hex encoding** | **Unused (0)** | **IRCE** | **PCOE** | **C1OE** | **AADD** | **MARCE** | **MAROE** | **MDRCE** | **MDROE** | **MDRget** | **MDRput** | **IBRead** | **IBWrite** | **AOP** | **ANOP** | **DR** | **SXR** | **SYR** | **RegSEL** | **RegLD** | **T1CE** | **T1OE** | **T2CE** | **T2OE** | **Q7+** | **Q6+** | **Q5+** | **Q4+** | **Q3+** | **Q2+** | **Q1+** | **Q0+** | **Hex**  **Encoding** |
| **F0**  **0** | **0** | **0** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **1** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **2402 3801** |
| **F1**  **1** | **0** | **0** | **0** | **1** | **1** | **0** | **1** | **1** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1B10 0602** |
| **F2**  **2** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **40C2 0003** |
| **Decode**  **3** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **1** | **2002 2107** |
| **E0**  **4** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **1** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **0002 B805** |
| **E1**  **5** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **1** | **1** | **1** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0004 7606** |
| **E2**  **6** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0003 2100** |
| **Dead**  **7** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **1** | **0000 0007** |

**FSM Decode ROM Table:** **Main Memory Table (this is the Test Program)**

|  |  |  |
| --- | --- | --- |
| Instruction | Address  (hex) | Contents  (hex) |
| NOP | 00 | **08** |
| ADD | 01 | **04** |
| SUB | 02 | **04** |
| MOV | 03 | **05** |
| AND | 04 | **04** |
| OR | 05 | **04** |
| XOR | 06 | **04** |
| NOT | 07 | **05** |
| NEG | 17 | **0A** |

|  |  |  |  |
| --- | --- | --- | --- |
| Address  (hex) | Instruction | Encoding  (hex) | Results |
| 0 | MOV  R2 🡨 [ R15 ] | **0320F000** | **R2 = 1** |
| 1 | NOT  R11 🡨 NOT [ R2 ] | **07B02000** | **R11 = -2** |
| 2 | MOV  R10 🡨 [ R15 ] | **03A0F000** | **R10 = 3** |
| 3 | SUB  R15 🡨[ R10 ] – [ R11 ] | **02FAB000** | **R15 = 5** |
| 4 | FFFF FFFF | Illegal instruction | **---** |
| 5 | NOP | **00000000** | **---** |
| 6 | NEG  R11 🡨 – [ R11 ] | **17B00000** | **R11 = 2** |

Control FSM Output ROM Table: **NOP Instruction Execution States**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **3 1** | **3 0** | **2 9** | **2 8** | **2 7** | **2 6** | **2 5** | **2 4** | **2 3** | **2 2** | **2 1** | **2 0** | **1 9** | **1 8** | **1 7** | **1 6** | **1 5** | **1 4** | **1 3** | **1 2** | **1 1** | **1 0** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |  |
| **State**  **Hex encoding** | **Unused (0)** | **IRCE** | **PCOE** | **C1OE** | **AADD** | **MARCE** | **MAROE** | **MDRCE** | **MDROE** | **MDRget** | **MDRput** | **IBRead** | **IBWrite** | **AOP** | **ANOP** | **DR** | **SXR** | **SYR** | **RegSEL** | **RegLD** | **T1CE** | **T1OE** | **T2CE** | **T2OE** | **Q7+** | **Q6+** | **Q5+** | **Q4+** | **Q3+** | **Q2+** | **Q1+** | **Q0+** | **Hex**  **Encoding** |
| **E3**  8 | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0002 0008** |
| **E4**  9 | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0002 0000** |

Control FSM Output ROM Table: **NEG Instruction Execution States** (can it be done in less than 5 execution states?)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **3 1** | **3 0** | **2 9** | **2 8** | **2 7** | **2 6** | **2 5** | **2 4** | **2 3** | **2 2** | **2 1** | **2 0** | **1 9** | **1 8** | **1 7** | **1 6** | **1 5** | **1 4** | **1 3** | **1 2** | **1 1** | **1 0** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |  |
| **State**  **Hex encoding** | **Unused (0)** | **IRCE** | **PCOE** | **C1OE** | **AADD** | **MARCE** | **MAROE** | **MDRCE** | **MDROE** | **MDRget** | **MDRput** | **MMRead** | **MMWrite** | **AOP** | **ANOP** | **DR** | **SXR** | **SYR** | **RegSEL** | **RegLD** | **T1CE** | **T1OE** | **T2CE** | **T2OE** | **Q7+** | **Q6+** | **Q5+** | **Q4+** | **Q3+** | **Q2+** | **Q1+** | **Q0+** | **Hex**  **Encoding** |
| **E5**  A | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **1** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **1** | **0005 320B** |
| **E6**  **B** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0002 090C** |
| **E7**  **C** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **1** | **1800 060D** |
| **E8**  **D** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0003 2100** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |