SYSC 3006 Lab 6 (Fall 2016) Version 2

Control FSM Output LO Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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)**  **00** | **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** | **24023801** |
| **(F1)**  **01** | **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** | **1B100602** |
| **(F2)**  **02** | **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** | **40C20003** |
| **(D)**  **03** | **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** | **0** | **0** | **0** | **20022100** |
| **(E0)**  **04** | **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** | **0002B805** |
| **(E1)**  **05** | **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** | **00047606** |
| **(E2)**  **06** | **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** | **00032100** |
| **07** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **1** | **0** | **1** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0004B206** |
| **08** | **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** | **1** | **0** | **0** | **1** | **0002B809** |
| **09** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **00040606** |
| **0A** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **00032000** |
| **0B** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **00040206** |
| **0C** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **1** | **0402B00D** |

Control FSM Output LO Table (continued … if needed)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **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** |
| **0D** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **1** | **0** | **0123300E** |
| **0E** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **028A0000** |
| **0F** | **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** | **1** | **0** | **0** | **0** | **0** | **0002B810** |
| **10** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **1** | **08000611** |
| **11** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **1** | **0402040D** |
| **12** | **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** | **0** | **0** | **0** | **0** |
| **13** | **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** | **0** | **0** | **0** | **0** |
| **14** | **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** | **0** | **0** | **0** | **0** |
| **15** | **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** | **0** | **0** | **0** | **0** |
| **16** | **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** | **0** | **0** | **0** | **0** |
| **17** | **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** | **0** | **0** | **0** | **0** |
| **18** | **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** | **0** | **0** | **0** | **0** |
| **19** | **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** | **0** | **0** | **0** | **0** |
| **1A** | **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** | **0** | **0** | **0** | **0** |
| **1B** | **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** | **0** | **0** | **0** | **0** |

Control FSM Output HI Table Control FSM Output HI Table (continued… if needed)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| bit : | 3 | 2 | 1 | 0 | Hex |
| (State)  hex | **IRS20** | **IRS16** | **IRU20** | **IRU16** |  |
| (F0)  00 |  |  |  |  | **0** |
| (F1)  01 |  |  |  |  | **0** |
| (F2)  02 |  |  |  |  | **0** |
| (D)  03 |  |  |  |  | **0** |
| (E0)  04 |  |  |  |  | **0** |
| (E1)  05 |  |  |  |  | **0** |
| (E2)  06 |  |  |  |  | **0** |
| 07 |  |  |  |  | **0** |
| 08 | **0** | **0** | **0** | **0** | **0** |
| 09 | **0** | **0** | **0** | **1** | **1** |
| 0A | **0** | **0** | **1** | **0** | **2** |
| 0B | **0** | **0** | **1** | **0** | **2** |
| 0C |  |  |  |  | **0** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| bit : | 3 | 2 | 1 | 0 | Hex |
| (State)  hex | **IRS20** | **IRS16** | **IRU20** | **IRU16** |  |
| 1A |  |  |  |  | **0** |
| 1B |  |  |  |  | **0** |
| 1C |  |  |  |  | **0** |
| 1D |  |  |  |  | **0** |
| 1E |  |  |  |  | **0** |
| 1F |  |  |  |  | **0** |
| 20 |  |  |  |  | **0** |
| 21 |  |  |  |  | **0** |
| 22 |  |  |  |  | **0** |
| 23 |  |  |  |  | **0** |
| 24 |  |  |  |  | **0** |
| 25 |  |  |  |  | **0** |
| 26 |  |  |  |  | **0** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| bit : | 3 | 2 | 1 | 0 | Hex |
| (State)  hex | **IRS20** | **IRS16** | **IRU20** | **IRU16** |  |
| 0D |  |  |  |  | **0** |
| 0E |  |  |  |  | **0** |
| 0F |  |  |  |  | **0** |
| 10 | **0** | **1** | **0** | **0** | **4** |
| 11 |  |  |  |  | **0** |
| 12 |  |  |  |  | **0** |
| 13 |  |  |  |  | **0** |
| 14 |  |  |  |  | **0** |
| 15 |  |  |  |  | **0** |
| 16 |  |  |  |  | **0** |
| 17 |  |  |  |  | **0** |
| 18 |  |  |  |  | **0** |
| 19 |  |  |  |  | **0** |

Decode ROM Table Main Memory (Test Program)

|  |  |  |
| --- | --- | --- |
| Instruction | Address  (hex) | Contents  (hex) |
| NOP (Form 3) | 00 | **00** |
| ADD (Form1) | 01 | **04** |
| SUB (Form 1) | 02 | **04** |
| MOV (Form 2) | 03 | **07** |
| AND (Form 1) | 04 | **04** |
| OR (Form 1) | 05 | **04** |
| XOR (Form 1) | 06 | **04** |
| NOT (Form 2) | 07 | **07** |
| ADD (Form 4) | 21 |  |
| SUB (Form 4) | 22 |  |
| MOV (Form 5) | 23 | **0A** |
| AND (Form 4) | 24 |  |
| OR (Form 4) | 25 |  |
| XOR (Form 4) | 26 | **08** |
| MVN (Form 5) | 27 | **0B** |
| LDR (Form 2) | 30 |  |
| LDR (Form 4) | 31 |  |
| STR ( Form 2) | 34 | **0C** |
| STR (Form 4) | 35 | **0F** |

|  |  |  |  |
| --- | --- | --- | --- |
| Address  (hex) | Contents  (hex) | Instruction  (hex) | Result of Execution  Not marked! Only for practice. |
| 0 | **0x 26FF0005** | **XOR R15, R15, #0x05** | R15 = 5 |
| 1 | **------- Do not initialize ------** | **variable X** | - |
| 2 | **------- Do not initialize ------** | **variable Y** | - |
| 3 | **0x 07440F00** | **variable Z** | - |
| 4 | **0x 23500001** | **MOV R5, #1** | R5 = 1 |
| 5 | **0x 23600003** | **MOV R6, #3** | R6 = 3 |
| 6 | **0x 01456000** | **ADD R4, R5, R6** | R4 = 4 |
| 7 | **0x 34450000** | **STR R4, [ R5 ]** | MMem[1] = 4 |
| 8 | **0x 27400007** | **MVN R4, #7** | R4 = 7 |
| 9 | **0x 3546FFFF** | **STR R4, [R6, #–1 ]** | MMem[2] = 4 |
| ------- | **OPTIONAL FROM HERE ON !!** | **-----------------------------** |  |
| A |  | **LDR R6, [ R5, #2 ]** |  |
| B |  | **SUB R6, R6, 0x0F00** |  |
| C |  | **STR R6, [ R5, #0xC ]** |  |
| D | **0x ABCD ABCD** | **mystery instruction** |  |
| E |  | **MOV R15, #0** |  |