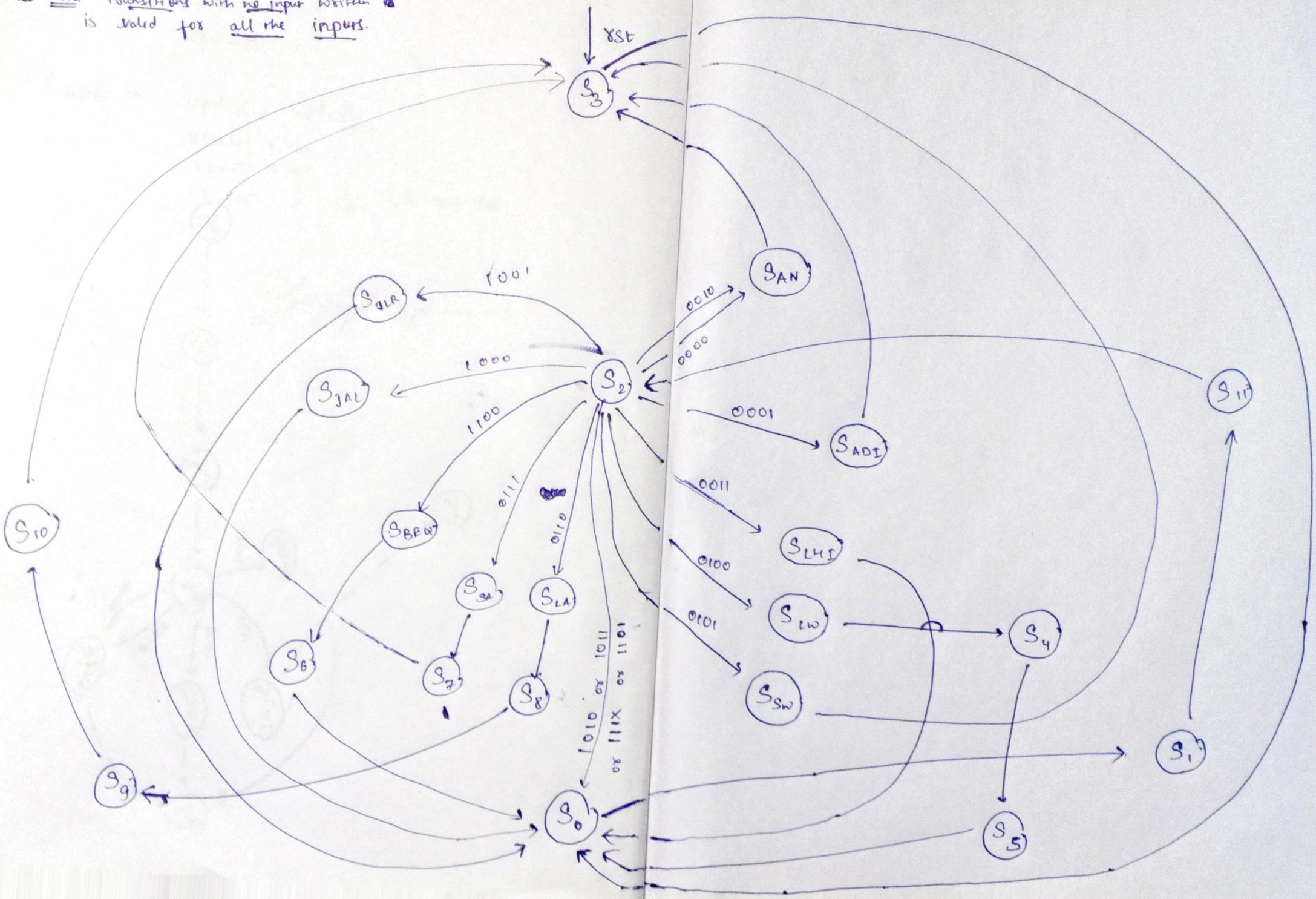
State Diagram

Note: Transitions with no input written is valid for all the inputs.



States in the FSM.

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↳ ADD/ADC/ADZ

S_{ADD} ⇒ upd_c, upd_z — 0000

rf_wc = 10 alu_op

rf_dc = 01

rf_we } if c & z are set.

↳ ADI

S_{ADI} ⇒ upd_c, upd_z — 0001

rf_wc = 01

rf_dc = 01

rf_we

alu_bc = 10

S_3 ⇒ alu_ac = 10

alu_bc = 01

upd_pc

NDU → S_{ND} ⇒ upd_z, rf_we — 0010

NDC

NDZ

rf_wc = 10 alu_op

rf_dc = 01 rf_we.

LHI → S_{LHI} ⇒ rf_dc = 11 alu_ac = 10 — 0011

rf_we alu_bc = 01

upd_pc.

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LW → S_{LW} alu_ac = 01 → S_4 → S_5 → S_0

S_4: m_rac

S_5: alu_ac = 10, alu_bc = 01, upd_pc, rf_wc, rf_we

01000

SW → S_{SW} alu_ac = 01, alu_a = 10, alu_bc = 01, m_wac, m_we, upd_pc

0101

BEQ → S_{BEQ} alu_cin → S_6 → S_0

S_6: alu_ac = 10, upd_pc, if I-imm = 0 → alu_bc = 01, else → alu_bc = 10

1100

JAL → S_{JAL}

rf_dc = 10, rf_we, alu_ac = 10, alu_bc = 11, upd_pc.

1000

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ILR → (S_{ILR}) rf_dc = 10 rf_we
pc_c upd_pc

1001

LA → (S_{LA}) trc = 1

0110

SA → (S_{SA}) trc = 1

0111

PS: → S_{ADD} is equivalent to S_{ND} so we can use S_{AN} as a common state.

→ These states are the extra states added other than those already in the code.

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S_4 m_rac = 1

S_5 rf_we = 1 upd_pc = 1
zc = 1
alu_ac = 10
alu_bc = 01

S_6 alu_pc = 10 alu_bc = { 01 if z_imm = 1 ; 10 else }
upd_pc = 1

S_7 rt_rc = 1 alu_ac = 11
m_we = 1 alu_bc = 01

S_8 m_rac = 1
alu_ac = 11
alu_bc = 01

S_9 m_rac = 1 rt_we = 1
alu_ac = 11 rt_wc = 11
alu_bc = 01

S_{10} rt_we = 1
rt_wc = 11