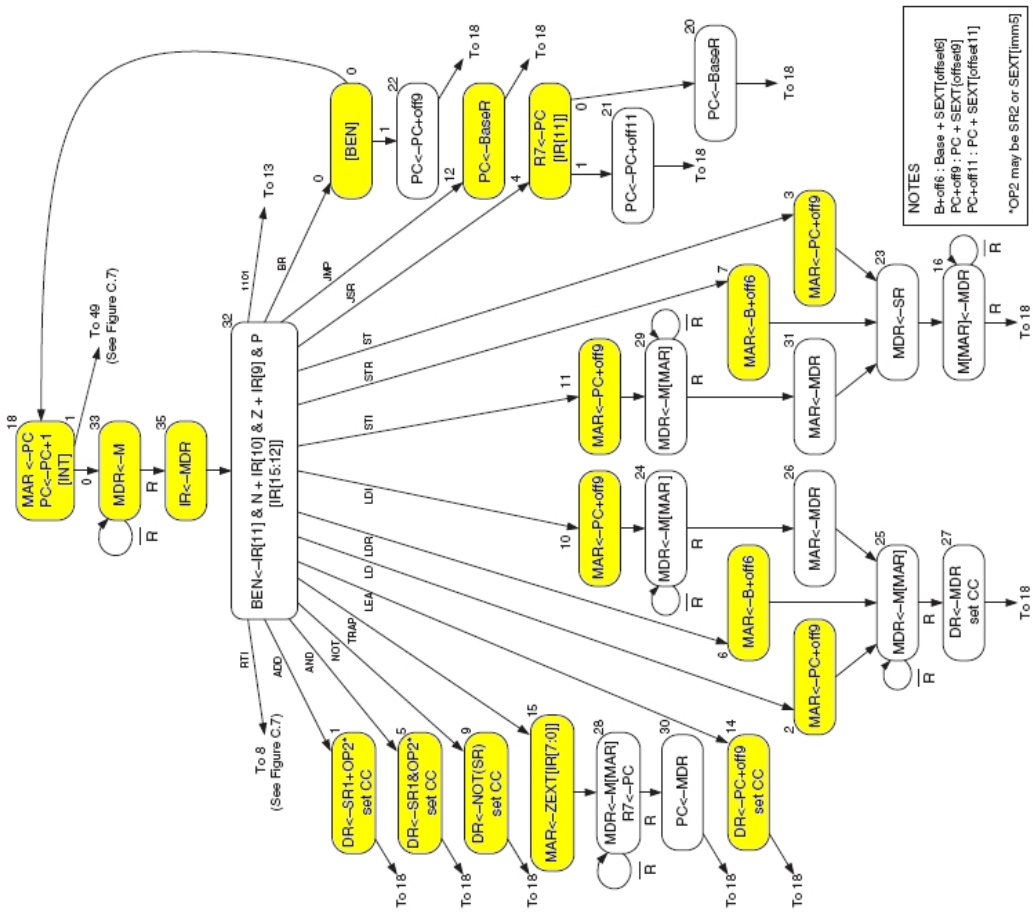
LC-3 FSM

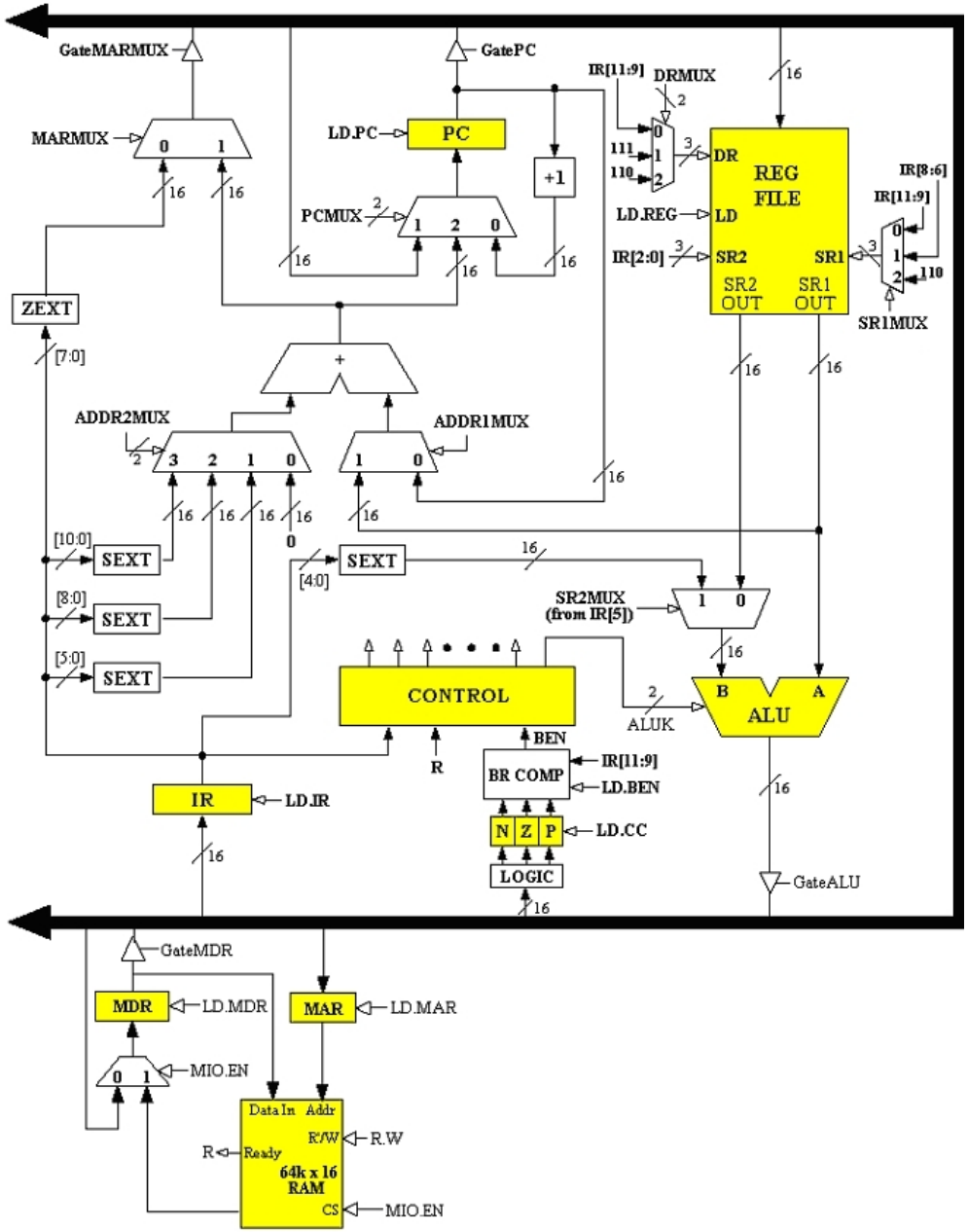


LC-3 Instructions

NOTES: RTL corresponds to execution (after fetch!); JSRR not shown

ADD	0001 DR SR1 0 00 SR2	ADD DR, SR1, SR2	DR ← SR1 + SR2, Setcc
ADD	0001 DR SR1 1 imm5	ADD DR, SR1, *imm5*	DR ← SR1 + SEXT(imm5), Setcc
AND	0101 DR SR1 0 00 SR2	AND DR, SR1, SR2	DR ← SR1 AND SR2, Setcc
AND	0101 DR SR1 1 imm5	AND DR, SR1, *imm5*	DR ← SR1 AND SEXT(imm5), Setcc
BR	0000 n z p PCoffset9	BR{nzp} *PCoffset9*	((n AND N) OR (z AND Z) OR (p AND P)): PC ← PC + SEXT(PCoffset9)
JMP	1100 000 BaseR 000000	JMP BaseR	PC ← BaseR
JSR	0100 1 PCoffset11	JSR *PCoffset11*	R7 ← PC, PC ← PC + SEXT(PCoffset11)
TRAP	1111 0000 trapvect8	TRAP *trapvect8*	R7 ← PC, PC ← M[ZEXT(trapvect8)]
LD	0010 DR PCoffset9	LD DR, *PCoffset9*	DR ← M[PC + SEXT(PCoffset9)], Setcc
LDI	1010 DR PCoffset9	LDI DR, *PCoffset9*	DR ← M[M[PC + SEXT(PCoffset9)]], Setcc
LDR	0110 DR BaseR offset6	LDR DR, BaseR, *offset6*	DR ← M[BaseR + SEXT(offset6)], Setcc
LEA	1110 DR PCoffset9	LEA DR, *PCoffset9*	DR ← PC + SEXT(PCoffset9), Setcc
NOT	1001 DR SR 111111	NOT DR, SR	DR ← NOT SR, Setcc
ST	0011 SR PCoffset9	ST SR, *PCoffset9*	M[PC + SEXT(PCoffset9)] ← SR
STI	1011 SR PCoffset9	STI SR, *PCoffset9*	M[M[PC + SEXT(PCoffset9)]] ← SR
STR	0111 SR BaseR offset6	STR SR, BaseR, *offset6*	M[BaseR + SEXT(offset6)] ← SR

LC-3 Datapath



LC-3 Datapath Control Signals

Signal	Description
LD.MAR	= 1, MAR is loaded
LD.MDR	= 1, MDR is loaded
LD.IR	= 1, IR is loaded
LD.PC	= 1, PC is loaded
LD.REG	= 1, register file is loaded
LD.BEN	= 1, updates Branch Enable (BEN) bit
LD.CC	= 1, updates status bits from system bus
GateMARMUX	= 1, MARMUX output is put onto system bus
GateMDR	= 1, MDR contents are put onto system bus
GateALU	= 1, ALU output is put onto system bus
GatePC	= 1, PC contents are put onto system bus

Signal	Description
MARMUX	= 0, chooses ZEXT IR[7:0] = 1, chooses address adder output
MIO.EN	= 1, Enables memory, chooses memory output for MDR input = 0, Disables memory, chooses system bus for MDR input
ADDR1MUX	= 0, chooses PC = 1, chooses reg file SR1 OUT
R.W	= 1, M[MAR]<-MDR when MIO.EN = 1 = 0, MDR<-M[MAR] when MIO.EN = 1
ADDR2MUX	= 00, chooses "0...00" = 01, chooses SEXT IR[5:0] = 10, chooses SEXT IR[8:0] = 11, chooses SEXT IR[10:0]
ALUK	= 00, ADD = 01, AND = 10, NOT A = 11, PASS A
PCMUX	= 00, chooses PC + 1 = 01, chooses system bus = 10, chooses address adder output
DRMUX	= 00, chooses IR[11:9] = 01, chooses "111" = 10, chooses "110"
SR1MUX	= 00, chooses IR[11:9] = 01, chooses IR[8:6] = 10, chooses "110"