

Homework 5

Name	State	Register Transfer	Control Lines	Next State
F1	0	[PC] → MAR	opc, imar	1
	1	[[MAR]] → MDR	read, inhibit if not mfc	2 if MFC = 1 1 if MFC = 0
	2	[MDR] → IR	omdr, iir	3
	3	[PC] + 1 → Q	opc, ib, p1, iq	4
	4	[Q] → PC	oq, ipc	5
F2	5	[PC] → MAR	opc, imar	14 if ADD(X) or INC (X) 18 if INC X
	6	6 [[MAR]] → MDR	read inhibit if not mfc	7 if MFC = 1 6 if MFC = 0 15 if JMP
	7	[PC] + 1 → Q	opc, ib, p1, iq	8
	8	[Q] → PC	oq, ipc	9
	9	[MDR] → MAR	omdr, imar	10
S1	10	10 [[MAR]] → MDR	read, inhibit if not mfc	11 if MFC = 1 10 if MFC = 0 12
	11	[MDR] → T1	omdr, it1	16 if INC addr
	12	[T1] + [AC] → Q	oac, ia, ib, iq	13
	13	[Q] → AC	oq, iac	0
	14	[X] → MAR	ox, imar	10
E1	15	[MDR] → PC	omdr, ipc	16 if INC (X)
	16	[T1] + 1 → Q	ia, p1, iq	17
	17	[Q] → [MDR]	oq, imdr, write, Inhibit if not MFC	20 if INC X 0 if MFC = 1 17 if MFC = 0
	18	[X] + 1 → Q	ib, p1, iq	16
	19	[Q] → X	oq, imdr	0

IPC	T4 + T8 + T15
OPC	T0 + T3 + T5 + T7
IMAR	T0 + T5 + T9 + T14
IMDR	T17 + T19
OMDR	T2 + T9 + T11 + T15
Read	T1 + T6 + T10
Write	T17
Inhibit	T1 + T6 + T10 + T17
IIR	T2
IA	T12 + T16
IB	T7 + T18
P1	T3 + T7 + T16 + T18
IT1	T11 + T18
IQ	T3 + T7 + T12 + T16 + T18
OQ	T4 + T8 + T13 + T17 + T19
OX	T14
IAC	T13

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OAC	T12
Preset	$T4 + T6 + T11 + T13 + T14 + T15 + T16 + T17 + T18 + T19$
D4	$T4 \text{ AND } \text{INC } X + T11 + T14 \text{ AND } \text{INC}(X) + T16 + T18$
D3	$T4 \text{ AND } \text{ADD}(X) \text{ or } \text{INC}(X) + T6 + T14$
D2	$T4 \text{ AND } \text{ADD}(X) \text{ or } \text{INC}(X) + T6 + T16$
D1	$T4 \text{ AND } \text{ADD}(X) \text{ or } \text{INC}(X) + T6 + T14 \text{ AND NOT INC}(X)$
D0	T6

Memory	Content
0	b01000001000000000
1	b00000000010000000
2	b00101111000000000
3	b00110001000100100
4	b00001110000000000
5	b01000001000000000
6	b00000000010000000
7	b00110001000100100
8	b00001110000000000
9	b01000111000000000
10	b00000000010000000
11	b11000111000000000
12	b00110010000001100
13	b00010110000000000
14	b01000011000000000
15	b00001111000000000
16	b00110000000101000
17	b10000110100000000
18	b00110000000100100
19	b10000110000000000

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	High Lvl Register Transfers	Name
INC addr	$[[PC]] \rightarrow IR$	F1
	$[PC] + 1 \rightarrow PC$	
	$[[PC]] \rightarrow MDR$	F2
	$[PC] + 1 \rightarrow PC$	
	$[[MDR]] \rightarrow T1$	S1
	$[T1] + 1 \rightarrow Q$	E3
INC (X)	$Q \rightarrow MDR$	
	$[[PC]] \rightarrow IR$	F1
	$[PC] + 1 \rightarrow PC$	
	$[[MDR]] \rightarrow T1$	S1
	$[[X]] \rightarrow T1$	S2
	$[T1] + 1 \rightarrow Q$	E3
	$[Q] \rightarrow MDR$	
INC X		F1
	$[X] \rightarrow T1$	S3
	$[T1] + 1 \rightarrow Q$	E3
	$[Q] \rightarrow X$	E4