Report

Memory instructions

T_0: $AR \leftarrow PC$

T_1: $IR \leftarrow M[AR]$, $PC \leftarrow PC + 1$

T_2: $D_0, \ldots, D_7 \leftarrow$ Decode $IR(12–14)$, $AR \leftarrow IR(0–11)$, $I \leftarrow IR(15)$

(T_0, T_1 and T_2 are common signals between all instructions)

LDA

$$D_2T_4: DR \leftarrow M[AR]$$
$$D_2T_5: AC \leftarrow DR, SC \leftarrow 0$$

ADD

$$D_1T_4: DR \leftarrow M[AR]$$
$$D_1T_5: AC \leftarrow AC + DR, E \leftarrow C_{out}, SC \leftarrow 0$$

AND

$$D_0T_4: \quad DR \leftarrow M[AR]$$
$$D_0T_5: \quad AC \leftarrow AC \wedge DR, \quad SC \leftarrow 0$$

STA

$$D_3T_4: \quad M[AR] \leftarrow AC, \quad SC \leftarrow 0$$

SUB

$D_5T_4: \quad DR \leftarrow M[AR]$

$D_5T_5: \quad AC \leftarrow DR, \ DR \leftarrow AC$

$D_5T_6: \quad AC \leftarrow DR-AC, \ E \leftarrow C_{out}, \ SC \leftarrow 0$

SZA

$D_7T_3B_2 : if(AC=0) \ then \ PC \leftarrow PC+1, \ SC \leftarrow 0$

INC

$D_7T_3B_5: DR \leftarrow AC$

$D_7T_4B_5: AC \leftarrow DR+1, \ SC \leftarrow 0$

control signals

en AR

$$T_0+T_2$$

en TR

$$0$$

en DR

$$D_2T_4+D_1T_4+D_5T_4+D_5T_5+D_7T_3B_5+D_0T_4=$$
$$D_5(T_4+T_5)+D_2T_4+D_1T_4+D_7T_3B_5+D_0T_4$$

en AC

$$D_2T_5+D_1T_5+D_5T_5+D_5T_6+D_7T_4B_5+D_0T_5=$$
$$D_2T_5+D_1T_5+D_5(T_5+T_6)+D_7T_4B_5+D_0T_5$$

en PC

$$D4T4$$

inc PC

$$T_1+D_7T_3B_2(OR(AC(0\text{-}15))')$$

en IR

T1

Clr SC

$D_2T_5 + D_1T_5 + D_5T_6 + D_7T_3B_2 + D_4T_4$

$+ D_7T_4B_5 + D_0T_5 + D_3T_4 =$

$T_5(D_0 + D_{1+}D_2) + T_4(D_3 + D_4) +$
$+ D_5T_6 + D_7T_3B_2 + D_7T_4B_5$

en Write(Memory)

D_3T_4

en Read(Memory)

$T_1 + D_2T_4 + D_1T_4 + D_5T_4 + D_0T_4 =$

$T_1 + T_4(D_2 + D_1 + D_5 + D_0)$

ALU Selection lines signal

000	0
001 (SUM)	$D_1 T_5$
010 (SUB)	$D_5 T_6$
011(Transfer)	$D_2 T_5 + D_5 T_5 = T_5 \left(D_5 + D_2 \right)$
100 (AND)	$D_0 T_5$
101 (OR)	0
110 (XOR)	0
111 (Increment by 1)	$D_7 T_4 B_5$

BUS Selection lines signal

000 (Mem)	$T_1 + T_4 (D_2 + D_1 + D_5 + D_0) = $ en Read
001 (AR)	$D_4 T_4$
010 (TR)	0
011 (DR)	0
100 (AC)	$D_7 T_4 B_5 + D_3 T_4 + D_5 T_5$
101 (PC)	T_0
110 (IR)	T_2
111 (Nothing)	---