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Digital Logic : Asn 7

Problem Set:
Chapter 7: 1-6, 9-11

D) ((X+Y)-Z) is what this program does, the data for X, Y, Z is 4, 7, 2 respectively:

((4+7)-2)
(11-2)
9 is the output from this program

2) w+(X-Y)-Z
where: w=3
X=-1
Y=8
Z=-113

symbol label	table addr
W:	12
X:	13
Y:	14
Z:	15

Assembly Language Label	Instr	Machine code Loc	Hex	BIN	
	Lda ~~X~~	0	0D	0000	~~1101~~ 1101
	Sub Y	1	2E	0010	1110
	Add W	2	1C	0001	1100
	sub Z	3	2F	0010	1111
	Out	4	E0	1110	0000
	Hlt	5	F0	1111	0000
W	dat 3	12	03	0000	0011
X	dat -1	13	0F	0000	1111
Y	dat 8	14	08	0000	1000
Z	dat -113	15	0	0000	0000 1111

Final output is 107_{10}

3) ?

4) Virtual Space 16 x larger

$2^{16} = 65{,}536$

65,536 more bits in the virtual space than a physical address

5)

Current			Next Machine State								
##	PC	Instr	PC	Acc	Out	Hex Memory for 16 lines					
0			0	-	-	0E	1F	~~E0~~ 3E	E0		0101
1	0	Lda	1	1	1						
2	1	Add	2	2	2						
3	2	?	3	3	3						
4	3	Add	4	4	4						

6) $X := 2 \cdot X - Y$

X = 75

Y = 30

Lda X : 75] 45

Sub Y : 30

Sta Z :

Add Z to Z = 90

This program should compute 120

Our Machine does not have a multiplication function, so to get 2 * X we have to just add X to itself, also, we have defined X twice which may cause the machine to not work.

Symbol

label	loc
X	14
Y	15

9)

##	Current PC	Instr	Next Machine State PC	Acc	Out	Hex Memory										
0			0	-	-	OE	1E	2F	3E	EO	FO	XX	XX	XX	XX	XX	XX	XX	48	1E
1	0	Lda	1	75	-					same										
2	1	Add	2	150	-					Same										
3	2	Sub	3	120	-					Same										
4	3	Sta	4	120	-	OE	1E	2F	3E	EO	FO								78	1E
5	4	Out	5	120	120					Same										
6	5	Hlt	6	120	120					Same										

10) Symbol table

Label	loc
X data	157
Y data	15

1. Lda X : 55
   Sub Y
   Out
   Sta X
   Sub Y
   out
   Sta X
   Sub Y
   out
   ⋮
   out
   Hlt

10)

Symbol	label
label	loc
x dat10	14
y dat5	15

#	#	PC	Instr	PC	Acc	Out	Hex Memory
0				0			0E E0 2F 3E 0E E0 2F 3E 0E E0 04 05
1	0		Lda	1	10	~~10~~	
2	1		out	2	10	10	
3	2		Sta	3	10	10	
4	3		Lda	4	5	-	
5	4		out	5	5	5	
6	5		Sta	6	5	5	
7	6		Lda	7	5	-	

11)

Symbol	label
label	loc
x dat10	14
y dat5	15

#	#	PC	Instr	PC	Acc	Out	Hex Memory
0				0			0E E0 2F 3E 0E E0 2F 3E 0E E0 04 05
1	0		Lda	1	10		Same
2	1		out	2	10	10	Same
3	2		Sub	3	5		Same
4	3		Sta	4	5		0E E0 2F 3E 0E E0 2F 3E 0E E0 05 05
5	4		Lda	5	5		Same
6	5		out	5	5	5	Same
7	6		Sub	6	0		Same
8	7		Sta	7	0		0E E0 2F 3E 0E E0 2F 3E 0E E0 00 05
9	8		Lda	8	0		Same
10	9		out	9	0	0	Same