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Workshop 1 - SAM Instruction Set Architecture

Discuss and answer the following questions about the SAM Instruction Set Architecture (ISA).

1. List all the elements in the SAM ISA machine state. This is the list of programmer-visible storage elements in the SAM.

PC, MAR, 16B RAM, ACC, OUT, IR, Output Display

2. Write a SAM program to perform and output the calculation ((w+x)-y) where w=123, x=-1, y=3. Give the assembly language for the program along with a symbol table mapping and then give the machine code translation in both hexadecimal and binary in the format shown in the text. Programs must start at location 0 in the SAM. Data should be placed in high memory starting at location 15 and working down, although this is not a requirement.

Assembly language		Machine code translation		
Label	Instr	Loc	Hex	Bin
	Lda x	0	0D	0000 1101
	Add y	1	1E	0001 1110
	Sub z	2	2F	0010 1111
	Out	3	E0	1110 0000
	Hlt	4	F0	1111 0000
X:	Dat 4	13	04	0000 0100
Y:	Dat 7	14	07	0000 0111
Z:	Dat 2	15	02	0000 0010

Symbol Table

Label	Addr	
x	13	0xD
Y	14	0xE
z	15	0xF

3. Give an exection trace for the assembly program in the previous problem.

	Current		Next machine state			
##	PC	instr	PC	ACC	OUT	hex memory contents 16 locations
0			0	-	-	0D 1E 2F E0 F0 -- -- -- -- -- -- -- -- 04 07 02
1	0	Lda	1	04	-	0D 1E 2F E0 F0 -- -- -- -- -- -- -- -- 04 07 02
2	1	Add	2	0B	-	0D 1E 2F E0 F0 -- -- -- -- -- -- -- -- 04 07 02
3	2	Sub	3	09	-	0D 1E 2F E0 F0 -- -- -- -- -- -- -- -- 04 07 02
4	3	Out	4	09	09	0D 1E 2F E0 F0 -- -- -- -- -- -- -- -- 04 07 02
5	4	Hlt	5	09	09	0D 1E 2F E0 F0 -- -- -- -- -- -- -- -- 04 07 02