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CSF - Digital Logic
HW6

1. Consider a 212 x 64 bit memory. What is the range of signed integer values that can be stored in this memory? How many bits are needed to address every location in this memory?

-2^63 to 2^63 - 1
212

2. Consider the SAM Instruction Fetch with Data Read and Store combined datapath shown in Section 6.6 .
(a) How many bits is the program counter? 4
(b) How many bits is the memory address register? 4
(c) How many bits is the accumulator register? 8
(d) How many bits is the instruction register? 8

3. How many address bits are needed for a 4 gibibyte address space? A gibibyte is the accepted standard term for 1024^3 bytes. You might want to look up the term gibibyte because 1024^3 bytes is often called a gigabyte, but giga is properly a metric prefix for 1000^3.

log2 (8 * 4 * 1024^3) = 35

4. Using the SAM Instruction Fetch with Data Read and Store combined datapath shown in Section 6.6, create a four-cycle combined register transfer sequence table for an instruction fetch followed immediately by a memory read.

Control Code						Action
Inc	Amux	Mar	Mst	Ir	Acc	f(src) -> dst
1	0	1	0	0	0	PC -> MAR; inc(PC)
0	-	0	0	1	0	Mem(MAR) -> IR
0	1	1	0	0	0	IR -> MAR
0	-	0	0	0	1	Mem(MAR) -> ACC

5. Repeat the previous problem for an instruction fetch immediately followed by memory write operation.

Control Code						Action
Inc	Amux	Mar	Mst	Ir	Acc	f(src) -> dst
1	0	1	0	0	0	PC -> MAR; inc(PC)
0	-	0	0	1	0	Mem(MAR) -> IR
0	1	1	0	0	0	IR -> MAR
0	-	-	1	-	-	ACC -> Mem[MAR]