INF2270, exercise in combinational logic two's complement arithmetic: example solution

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Task 1

Figure 1 shows a cascade of half adders that increment a 9-bit signed integer by 1. ISE notation is used for the busses and the XOR and AND gate represent 9 gates in parallel. The first half adder receives a constant 1 as carry in bit and thus, 1 is added to the the input a(8:0) and the result S is equal to a+1.

Task 2

11011	=	27-32	=	-5
1110111	=	119-128	=	-9
1010101	=	85-128	=	-43
100000001	=	257-512	=	-255
111111111	=	511-512	=	-1

What is the corresponding 8 bit two's complement number for:

-31	$\hat{=}$	-31+256=225	=	11100001
-32	$\hat{=}$	-32+256=224	=	11100000
-127	$\hat{=}$	-127+256=129	=	10000001
-128	$\hat{=}$	-128+256=128	=	10000000
-77	$\hat{=}$	-77+256=179	=	10110011
22	$\hat{=}$	22	=	00001010

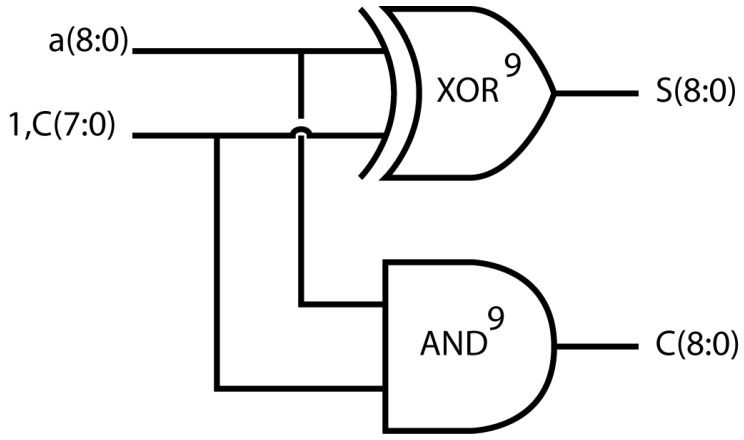

Figure 1: A circuit that increments a 9-bit integer by 1