CSE369 Practice Problems (lec 4)

Unsigned Binary Representation

Convert the following 8-bit binary numbers into unsigned decimal:

1.1] `0 1 1 0 1 0 1 1`

1.2] `1 0 0 0 0 0 1 1`

1.3] `0 0 0 0 1 0 0 0`

Signed Binary Representation

Convert the following 8-bit binary numbers into *signed* decimal assuming two's complement encoding:

2.1] `1 1 1 0 0 0 1 1`

2.2] `0 0 0 0 0 1 1 1`

2.3] `1 1 0 1 0 1 0 0`

Arithmetic and Overflow

Add the following four-bit numbers together. Complete their unsigned and signed representations. Report whether there was signed overflow and unsigned overflow.

3.1]

Binary	Signed	Unsigned
`  0 0 0 1 1` `+ 1 0 1 0 0`	_____	_____
	Overflow? [ ] yes [ ] no	Overflow? [ ] yes [ ] no

3.2]

Binary	Signed	Unsigned
`  1 1 1 0 0` `+ 0 0 1 0 0`	_____	_____
	Overflow? [ ] yes [ ] no	Overflow? [ ] yes [ ] no

3.3]

Binary	Signed	Unsigned
`  1 0 0 0 1` `+ 1 0 0 0 1`	_____	_____
	Overflow? [ ] yes [ ] no	Overflow? [ ] yes [ ] no

Sequential Design

4.1] Draw a block diagram for a circuit that cycles through outputting the following four 8-bit numbers over and over again: 67, 65, 75, 69

4.2] Draw a block diagram for a circuit that counts up from 0 to parameter N

Hint: This will look very similar to the "perpetual timer" example from class, but it'll need another mux and a block to compare if two numbers are equal. You can treat this comparator as a "black box" whose implementation we take for granted (but you know enough to design that too, if you wanted to 😉)

4.3] Design a circuit that counts up from 0 to N and then starts over again, with N starting at 1 and increasing every time the sequence repeats. (eg: 0, 1, 0, 1, 2, 0, 1, 2, 3, 0, 1, 2, 3, 4, 0, 1, 2, 3, 4, 5, 0, 1, 2, 3, 4, 5, 6, 0, 1, 2, 3, 4, 5, 6, 7…)

4.4] Complete this timing diagram to show how the labelled signals in the circuit below change after reset. Assume no propagation delay.



