

CE-1901 - Dr. Durant - Quiz 8
Fall 2015, Week 8 Quiz

1. (8 points) ALUs

a. (4 points) **Complete** the following table for a 4-operation ALU:

S	Operation	Expression	LE (FA:a)	AE (FA:b)	CE (FA0:c _i)
0	Subtract	A - B	a_i	$\overline{b_i}$	1
1	Decrement	--A	a_i	1	0
2	Increment	++A	a_i	0	1
3	Nor	A nor B	$\overline{a_i + b_i}$	0	0

b. (2 points) **Explain** why the given extender values for decrement are correct. **Provide** an example where the input A = 1010.

c. (2 points) **Design** the AE using a K-map $\left(\frac{-1}{4}\right)$ did LE only, correctly $\left(\frac{-1}{4}\right)$ 4 var. OR NOT OR don't use a_i

(b) $A = 1010 = 10_{10} = (-6 \text{ if signed})$ - in both cases result is less than input
 $B = 1111 \downarrow = 9_{10} = (-7 \text{ if signed})$ - adding $-1 = 1111_2$

(c) $y = \overline{b} \overline{s_1} + \overline{s_1} s_0 = \overline{s_1} (\overline{b} + s_0)$ either POS or SOP is acceptable

(not asked for :) LE

$$x = s_1 s_0 \overline{a} \overline{b} + \overline{s_1} a + \overline{s_0} a$$

$$= s_1 s_0 \overline{a + b} + (\overline{s_1 s_0}) a$$

2. (2 points) Express $G = -12$ as a 6-bit number. Use this value of G as the starting point for each calculation below.

- Arithmetic right shift by 2 bits (binary and decimal)
- Logical right shift by 2 bits (binary and decimal)
- Rotate left by 1 bit

$$\begin{array}{r} 12: 001100 \\ \sim 110011 \\ ++ \boxed{110100} \end{array}$$

(a) $\frac{111101}{\uparrow \text{negate MSB}} \sim 000010 \xrightarrow{++} 000011$
 $3 \dots -3 = (-12)/4$

(b) $\frac{001101}{\text{0 fill}} = 13_{10}$

(c) $\frac{101001}{\text{0 fill}} = 41_{10} \stackrel{\text{or}}{=} -23_{10}$

(-1/4) reverse a+b