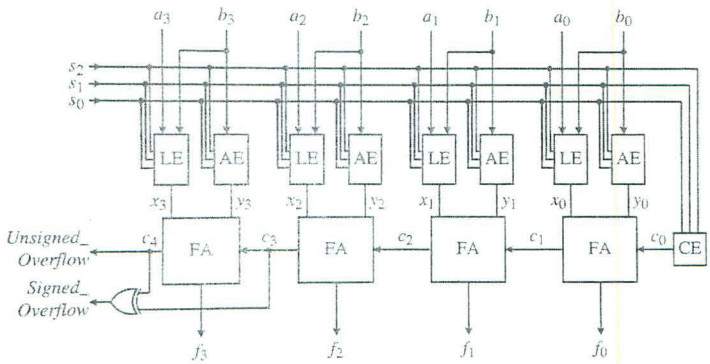
Name Answers

CE-1901-11 – Dr. Durant – Quiz 8
Fall 2016, Week 9 Quiz

1. (6 points) ALUs



a. (2 points) ***Complete*** the following table for a 4-operation ALU (an 8-operation ALU is shown for reference):

S	Operation	Expression	LE (FA:a)	AE (FA:b)	CE (FA0:c_i)
0	Decrement	--A	A	~~0~~ 1	~~1~~ 0
1	XOR	A ⊕ B	A⊕B	0	0
2	Subtract	A – B	A	$\bar{B}$	1
3	Add	A + B	A	B	0

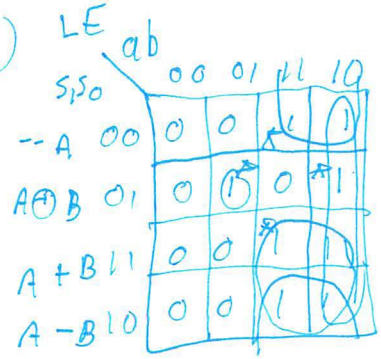
b. (2 points) ***Explain*** why the given extender values for decrement are correct. ***Provide*** an example where the input A = 1010.

c. (2 points) ***Design*** the LE using a K-map.

(b)

~~1010~~ 1010 ← LE → passes A
~~0000~~ + 1111 ← AE → b_i = 1 ⇒ B = −1
1001 = 9 = 10 − 1 ✓

(c)



$LE = \bar{s}_1 s_0 \bar{a} b + s_1 a + \bar{s}_0 a + a\bar{b}$ ← answer

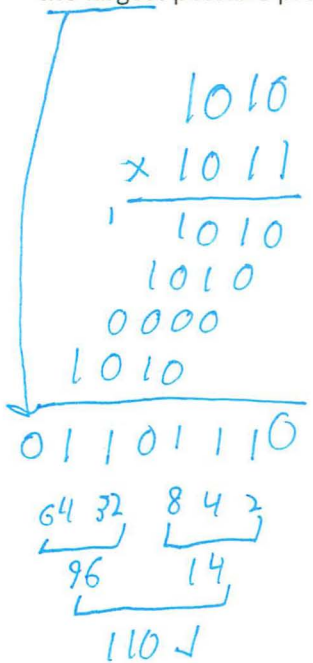
$= \bar{s}_1 s_0 \bar{a} b + a(s_1 + \bar{s}_0 + \bar{b})$

$= \bar{s}_1 s_0 \bar{a} b + a\,\overline{\bar{s}_1 s_0 b}$ (factor $\bar{a}$ from term 1 to reveal XOR)

$= a \oplus (\bar{s}_1 s_0 b)$

Challenge question: Why is this answer expected given the LE column (hint: 3 rows output just A)?

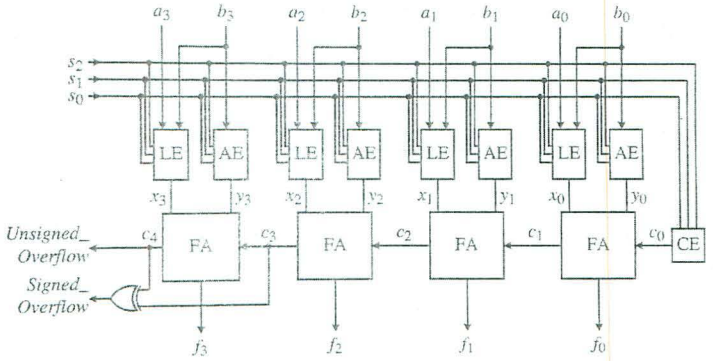
2. (4 points) In binary, multiply A=1010 by B=1011, showing all 4 properly shifted intermediate products. Calculate the overall sum, showing the correct number of output bits needed to handle the largest possible product. In decimal, confirm whether your results agree with 10×11 = 110



Name Answers

CE-1901-12 – Dr. Durant – Quiz 8
Fall 2016, Week 9 Quiz

1. (6 points) ALUs



a. (2 points) ***Complete*** the following table for a 4-operation ALU (an 8-operation ALU is shown for reference):

S	Operation	Expression	LE (FA:a)	AE (FA:b)	CE (FA0:c_i)
0	NOR	(A OR B)'	$\overline{A+B}$	0	0
1	XOR	A ⊕ B	$A \oplus B$	0	0
2	Subtract	A – B	A	B'	1
3	NAND	(AB)'	$\overline{AB}$	0	0

b. (2 points) ***Explain*** why the given extender values for subtract are correct. ***Provide*** an example where the input A = 1010 and B = 0111.

c. (2 points) ***Design*** the LE using a K-map.

(b) $A - B \Rightarrow A + \overline{B} + 1$ ← 2's comp. gives $-B$

1 1 ← CE ⇒ $c_0 = 1$
1010 ← A
+ 1000 ← $\overline{B}$
0011 ← 3 = 10 − 7 ✓

(c)

LE, $s_1 s_0$ \ ab	00	01	11	10
NOR 00	1*	0	0	0
XOR 01	0	1*	0	1*
NAND 11	1	1	0	1
SUB 10	0	0	1	1*

$LE = \bar{s}_1 \bar{s}_0 \bar{a}\bar{b} + s_1 s_0 \bar{a} + s_0 \bar{a} b + s_0 a \bar{b} + s_1 \bar{s}_0 a$

add this one; there are 2 correct options

2. (4 points) In binary, multiply A=0110 by B=1001, showing all 4 properly shifted intermediate products. Calculate the overall sum, showing the correct number of output bits needed to handle the largest possible product. In decimal, confirm whether your results agree with 6×9 = 45.

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