Skill Assessment #5

● Graded

Student

HARRY KIM

Total Points

137.5 / 150 pts

Question 1

A1/A2/A3: Digital Circuit Design

75 / 75 pts

✔ **+ 75 pts** Excellent

+ 65 pts Good

+ 57 pts Fair

+ 26.25 pts Poor

+ 0 pts Inadequate

– 2 pts The wrong equation for p0 - needs to be in sum of products form

– 2 pts the wrong equation for p1 - needs to be in sum of products form

– 2 pts Output bits in wrong order

– 5 pts the wrong equations for output bits - they need to be in sum of products form

Question 2

A4/A5: Invert an expression

25 / 25 pts

✔ **+ 25 pts** Correct

– 10 pts A5 - we can create this by writing a product of all the input terms in the truth table where p2 (output bit) is 0. This means there should be 13 terms.

– 10 pts A4 - DeMorgans Law applied incorrectly, leading to incorrect answer

– 5 pts A5 - Number of product terms not stated.

– 1 pt Answer is in the wrong rank

– 1 pt Solved for incorrect output bit

– 2.5 pts Right idea incorrect number of terms

– 1 pt Forget to carry the not in the final answer of A4

Question 3

A6: ALU with Shift Operation

37.5 / 50 pts

+ 50 pts Excellent

✔ + 37.5 pts Good

+ 25 pts Fair

+ 12.5 pts Poor

+ 0 pts Inadequate

– 5 pts Logical Right Shift instead of arithmetic

Shift right is incorrect. The ALU0 would still need the bit from ALU1, and ALU31 would need a31 for it's shift right input for an arithmetic shift.

Question 4

Late Penalty (if appropriate)

0 / 0 pts

✔ + 0 pts Correct

– 15 pts Late

Question assigned to the following page: 1

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A1: Truth table for a circuit that will compute the product *p=x*y*:

x_0	x_1	y_0	y_1	p_3	p_2	p_1	p_0
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	1
0	1	1	0	0	0	1	0
0	1	1	1	0	0	1	1
1	0	0	0	0	0	0	0
1	0	0	1	0	0	1	0
1	0	1	0	0	1	0	0
1	0	1	1	0	1	1	0
1	1	0	0	0	0	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	1	1	0
1	1	1	1	1	0	0	1

A2: The equations for each output are as follows:

$$p_0 = \overline{x_0}x_1\overline{y_0}y_1 + \overline{x_0}x_1y_0y_1 + x_0x_1\overline{y_0}y_1 + x_0x_1y_0y_1$$

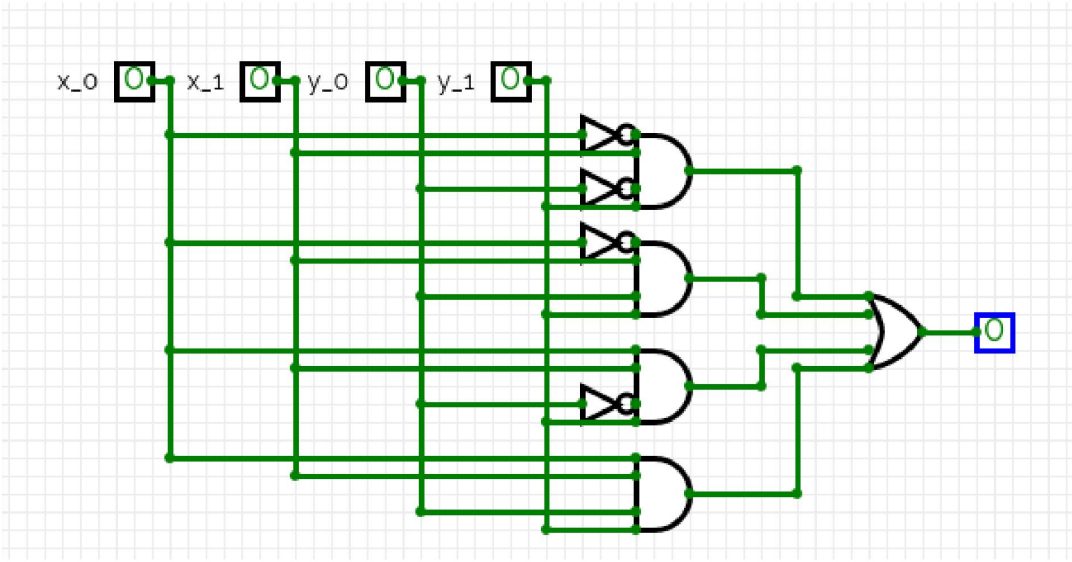
$$p_1 = \overline{x_0}x_1y_0y_1\overline{y_1} + \overline{x_0}x_1y_0y_1 + x_0\overline{x_1}\,\overline{y_0}y_1 + x_0\overline{x_1}y_0y_1 + x_0x_1\overline{y_0}y_1 + x_0x_1y_0\overline{y_1}$$

$$p_2 = x_0\overline{x_1}y_0\overline{y_1} + x_0\overline{x_1}y_0y_1 + x_0x_1y_0\overline{y_1}$$

$$p_3 = x_0x_1y_0y_1$$

Questions assigned to the following page: 1, 2, and 3

A3: Circuit diagram for output p_0:



(drew on https://circuitverse.org/simulator)

A4: The boolean equation for p_3 is as follows:

$$p_3 = x_0 x_1 y_0 y_1$$

Using DeMorgan's law to invert p_3 goes as follows:

$$\overline{p_3} = \overline{(x_0 x_1 y_0 y_1)}$$

$$\overline{p_3} = \overline{x_0} + \overline{x_1} + \overline{y_0} + \overline{y_1}$$

A5: To find the formula for $\overline{p_2}$ by using the truth table, you would need to flip all the zeros to ones and all the ones to zeros in the p_2 column (which would make p_2 to $\overline{p_2}$) then write the boolean equation for $\overline{p_2}$. There will be 13 product terms.

A6: In order to shift each 'a' bit one position to the left, you need to connect a wire from the previous ALU's 'a' input into the current ALU's new multiplexer position (4) with the first bit always being inputted zero for that multiplexer position. In order to shift each 'a' position to the right, you need to connect a wire from the following ALU's 'a' input back into the current ALU's new multiplexer position (5) except for the first ALU which will always input zero in order to preserve ALU's bit for an arithmetic shift.

Question assigned to the following page: 3

Modified ALU diagrams: