Class Exercise—Building a 2-bit Lookahead Adder

10/26/15

Recall: The i-th binary adder has inputs x_i, y_i, c_i
For $i > 1$, instead of waiting for c_i to propagate, we would like to compute it ahead of time.
We have the following formulas:

$$g_i = x_i y_i$$
$$p_i = x_i + y_i$$
$$c_{i+1} = g_i + p_i c_i$$

Finally, $s_i = \mathrm{c_i} \oplus x_i \oplus y_i$

1. Draw the circuits for computing s_0, s_1, p_0, g_0.

2. Draw the circuit for computing c_1 given inputs wires corresponding to p_0, g_0, c_0.

3. Draw the circuit diagram for the 2-bit lookahead adder by combining 1 and 2.

Class Exercise—Building a 3-bit Lookahead Adder

10/26/15

Recall: The i-th binary adder has inputs x_i, y_i, c_i
For $i > 1$, instead of waiting for c_i to propagate, we would like to compute it ahead of time.
We have the following formulas:

$$g_i = x_i y_i$$
$$p_i = x_i + y_i$$
$$c_{i+1} = g_i + p_i c_i$$

Finally, $s_i = \mathrm{c_i} \oplus x_i \oplus y_i$

1. Draw the circuits for computing $s_2, \mathrm{p}_1, \mathrm{g}_1$

2. Draw the circuit for computing c_2 given input wires corresponding to p_0, g_0, p_1, g_1, c_0.

3. Draw the circuit diagram for the 3-bit lookahead adder by combining 1 and 2 and the 2-bit lookahead adder (you can add on to your diagram from the previous page).

4. How many time steps does it take to compute the final 4-bit sum?