$1 + a = 1$

$a \cdot \overline{a} = 0$

$c_i + \overline{c_i} = 1$

$c_{i+1} = \overline{x_i \cdot y_i + x_i \cdot c_i + y_i \cdot c_i} =$

$= x_i \cdot y_i \cdot (c_i + \overline{c_i}) + x_i c_i + y_i c_i =$

$= x_i \cdot y_i \cdot \overline{c_i} + x_i \cdot y_i \cdot c_i + x_i \cdot c_i + y_i \cdot c_i = x_i \cdot y_i \cdot \overline{c_i} + x_i \cdot c_i (\underbrace{y_i + 1}_{1}) + y_i c_i =$

$= x_i \cdot y_i \cdot \overline{c_i} + x_i c_i + y_i c_i = \underbrace{x_i y_i}_{g_i} \overline{c_i} + (\underbrace{x_i + y_i}_{p_i}) c_i$

$c_{i+1} = g_i \cdot \overline{c_i} + p_i \cdot c_i$

$\overline{c_{i+1}} = \overline{g_i \cdot \overline{c_i}} \cdot \overline{p_i \cdot c_i} = (\overline{g_i} + c_i)(\overline{p_i} + \overline{c_i}) = \overline{g_i} \cdot \overline{p_i} + \overline{g_i} \cdot \overline{c_i} + \overline{p_i} \cdot c_i + \cancel{c_i \overline{c_i}}$

$= \overline{g_i} \cdot \overline{p_i} \cdot \overline{c_i} + \overline{g_i} \cdot \overline{p_i} \cdot c_i + \overline{g_i}\, \overline{c_i} + \overline{p_i} c_i = \overline{g_i}\, \overline{c_i} (\underbrace{\overline{p_i} + 1}_{1}) + \overline{p_i} c_i (\underbrace{\overline{g_i} + 1}_{1})$

$= \overline{g_i}\, \overline{c_i} + \overline{p_i} c_i$

$\overline{c_{i+1}} = \overline{g_i} \cdot \overline{c_i} + \overline{p_i} \cdot c_i$

2+1bit

$c_i <^0_1$: (z^0, c^0_{i+1}), $c_i = 0$

(z^1, c^1_{i+1}), $c_i = 1$

$z_i = x_i \oplus y_i \oplus c_i$

$a \oplus b = \overline{a} b + a \overline{b}$

$c_0 = 0$

$c_1 = g_0 \cdot \overline{c_0} + \cancel{p_0 \cdot c_0} = g_0$

$c_2 = g_1 \cdot \overline{c_1} + p_1 \cdot c_1$

$c_3 = g_2 \cdot \overline{c_2} + p_2 \cdot c_2$; $\overline{c_3} = \overline{g_2} \cdot \overline{c_2} + \overline{p_2} \cdot c_2$

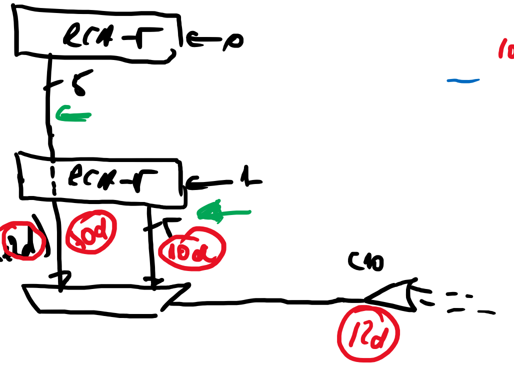
$c_4 = g_3 \cdot \overline{c_3} + p_3 \cdot c_3 = g_3 (\overline{g_2}\, \overline{c_2} + \overline{p_2} c_2) + p_3 (g_2 \overline{c_2} + p_2 \cdot c_2) =$

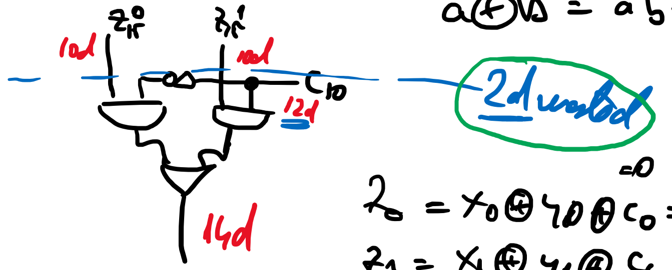
$= (g_3 \overline{g_2} + p_3 g_2) \overline{c_2} + (g_3 \overline{p_2} + p_3 p_2) \cdot c_2$

$D_{ECA}^{z/c_{out}} = 2nd$

$n \to n+1$

D: $2nd \to (n+2d)$





$z_0 = x_0 \oplus y_0 \oplus c_0 = x_0 \oplus y_0$

$z_1 = x_1 \oplus y_1 \oplus c_1 = \overline{x_1 \oplus y_1} \cdot c_1 + (x_1 \oplus y_1) \cdot \overline{c_1}$

$z_2 = x_2 \oplus y_2 \oplus c_2 = \overline{x_2 \oplus y_2} \cdot c_2 + (x_2 \oplus y_2) \cdot \overline{c_2}$

$z_3 = x_3 \oplus y_3 \oplus c_3 = \overline{x_3 \oplus y_3} \cdot c_3 + (x_3 \oplus y_3) \cdot \overline{c_3} = \overline{x_3 \oplus y_3} (g_2 \overline{c_2} + p_2 c_2) + (x_3 \oplus y_3)(\overline{g_2}\, \overline{c_2} + \overline{p_2} \cdot c_2)$

$= (\overline{x_3 \oplus y_3} \cdot g_2 + (x_3 \oplus y_3) \cdot \overline{g_2}) \overline{c_2} + (\overline{x_3 \oplus y_3} \cdot p_2 + (x_3 \oplus y_3) \cdot \overline{p_2}) \cdot c_2$