FullAdder

Input			Output	
A	B	C_in	Sum	C_out
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

$$Sum = \bar{A}\bar{B}C_{in} + \bar{A}B\overline{C_{in}} + A\bar{B}\overline{C_{in}} + ABC_{in}$$

$$= \bar{A}(\bar{B}C_{in} + B\overline{C_{in}}) + A(\overline{\bar{B}C_{in}} + BC_{in})$$

$$= \bar{A}(B \text{ xor } C_{in}) + A\overline{(B \text{ xor } C_{in})}$$

$$= A \text{ xor } (B \text{ xor } C_{in})$$

$$C\text{-}out = \bar{A}BC_{in} + A\bar{B}C_{in} + AB\overline{C_{in}} + ABC_{in}$$

$$= AB + C_{in}(\bar{A}B + A\bar{B})$$

$$= AB + C_{in}(A \text{ xor } B)$$