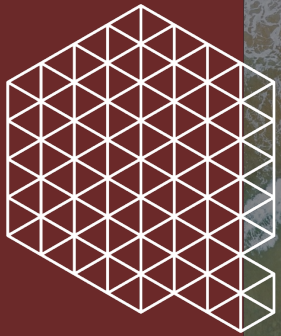
Microsoft



Resource estimation and verification in Q♯

Mathias Soeken

October 13, 2020

Majority-of-three $f = \langle x_1 x_2 x_3 \rangle = [x_1 + x_2 + x_3 \geq 2]$

Task: Implement Q# operation that maps $|x_1 x_2 x_3\rangle|y\rangle \mapsto |x_1 x_2 x_3\rangle|y \oplus f\rangle$

Truth table

i	x_3	x_2	x_1	f
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	1
7	1	1	1	1

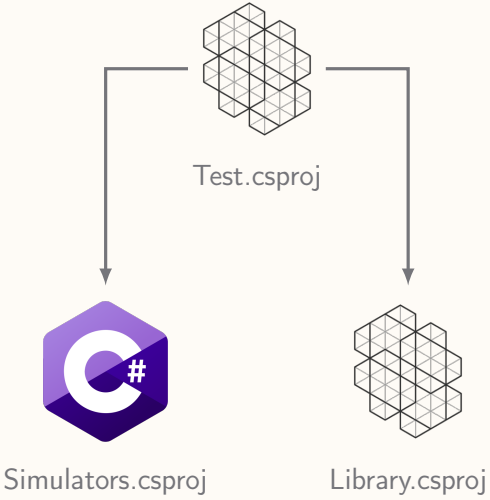
Boolean expression

$f = x_1 x_2 \oplus x_1 x_3 \oplus x_2 x_3$

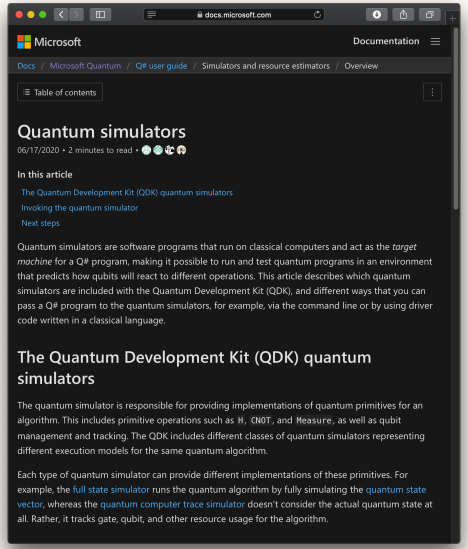
Alternative Boolean expression

$f = (x_1 \oplus x_2)(x_2 \oplus x_3) \oplus x_2$

Project organization



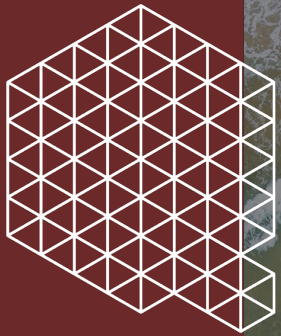
QDK simulators



Resource estimation

Implementation	CNOT	Clifford	T	T Depth	Qubits
Ints	120	30	84	56	5
CCNOTs	30	6	21	15	4
TruthTable	14	3	8	6	4
CNOTTransformation	15	2	7	5	4

Microsoft



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