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$$|0\rangle \rightarrow |0\rangle_L = |+++\rangle$$

$$|1\rangle \mapsto |1\rangle_L = |---\rangle$$

$$(a|0\rangle + b|1\rangle)|0\rangle|0\rangle$$

$$\rightarrow a|000\rangle + b|111\rangle$$

$\rightarrow$ Hadamard.

$$\frac{a}{2\sqrt{2}}\left[(|0\rangle+|1\rangle)(|0\rangle+1)(|0\rangle+1)\right]$$

$$+\frac{b}{2\sqrt{2}}\left[(|0\rangle-|1\rangle)(|0\rangle-|1\rangle)(|0\rangle-|1\rangle)\right].$$

$$\frac{a}{2\sqrt{2}}\Big[(|0\rangle+|1\rangle)|00\rangle \cdot (|0\rangle+|1)|00\rangle \cdot (0+1)|00\rangle\Big]$$

$$+\frac{b}{2\sqrt{2}}\Big[(|0\rangle-|1\rangle)|00\rangle \; (|0\rangle-|1\rangle)|00\rangle \; (|0\rangle-|1\rangle)|00\rangle\Big]$$

$$=\frac{a}{2\sqrt{2}}\Big[(\underbrace{|000\rangle}+|111\rangle)(|000\rangle+|111\rangle)(|000\rangle+|111\rangle)$$

$$+\frac{b}{2\sqrt{2}}\Big[(|000\rangle-|111\rangle)(|000\rangle-|111\rangle)(|000\rangle-|111\rangle)$$

$$= a\big[\,|+++\rangle\,\big] + b\big[\,|---\rangle\,\big].$$

p = probability that a single qubit is affected

P(No qubit is affected)

$$(1-p)^9$$

$$\approx 1-9p+\frac{9(9-1)}{2}p^2$$

$$= 1-9p+36p^2$$

$p < 0.01$

P(A single qubit is affected)

$$9p(1-p)^8 = 9p[1-8p+\dots].$$

$$= 9p-72p^2.$$

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Probability of zero or 1 error

$$1 - 36p^2 .$$

Probability of having more than 1 error $\quad 36p^2 \ll p$.