Parity bit

10110010 Ok

10100010 → Not acceptable

10110001

Redundancy

0 $0_L = 000$]

1 $1_L = 111$]

Majority vote

101 → 111
→ 1

$$|+\rangle \frac{|0\rangle + |1\rangle}{\sqrt{2}} = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\1\end{pmatrix}$$

$$|\psi'\rangle = \frac{|0\rangle + e^{i\alpha}|1\rangle}{\sqrt{2}} = \frac{1}{\sqrt{2}}\begin{pmatrix}1\\e^{i\alpha}\end{pmatrix}.$$

$$= \frac{1}{\sqrt{2}} e^{i\alpha/2}\begin{pmatrix}e^{-i\alpha/2}\\ e^{i\alpha/2}.\end{pmatrix}$$

$$P_{+1} = |+\rangle\langle+| = \frac{1}{2}\begin{pmatrix}1\\1\end{pmatrix}\begin{pmatrix}1 & 1\end{pmatrix}$$

$$= \frac{1}{2}\begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix}$$

$$P_+|\psi'\rangle = \frac{1}{\sqrt{2}}\begin{pmatrix}\cos\frac{\alpha}{2}\\ \cos\frac{\alpha}{2}\end{pmatrix}$$

$\cos^2\frac{\alpha}{2}$.