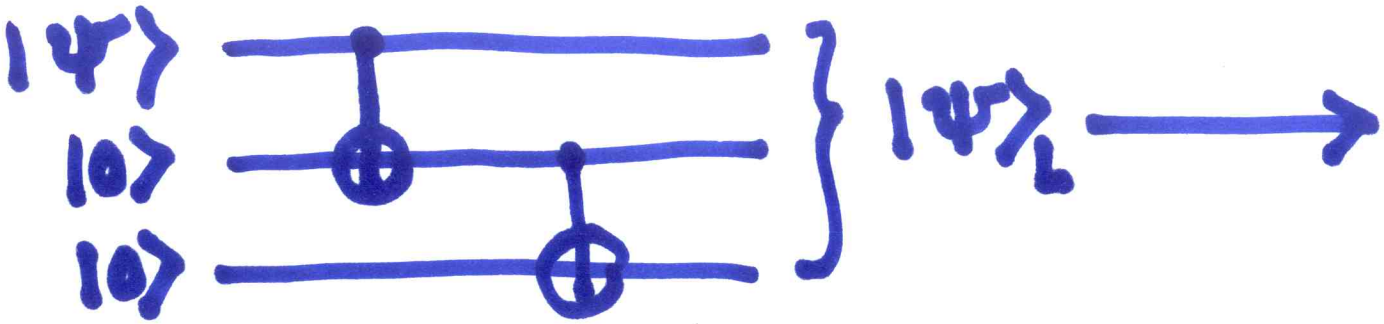
Alice



$$|\psi\rangle = (\alpha|0\rangle + \beta|1\rangle)|0\rangle|0\rangle$$

$$\Rightarrow (\alpha|00\rangle + \beta|11\rangle)|0\rangle$$

$$\Rightarrow \underbrace{\alpha|000\rangle + \beta|111\rangle}_{|\psi_2\rangle}$$

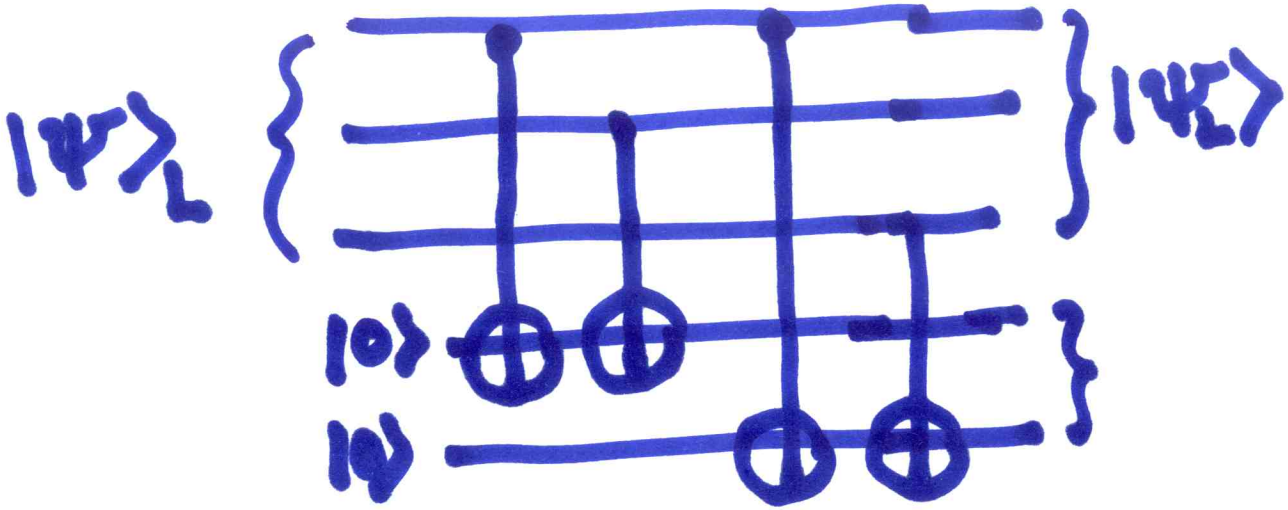
Noisy channel flips a qubit with some probability p : Leaves a bit unchanged $1-p$

$\alpha|000\rangle + \beta|111\rangle \qquad (1-p)^3$

$\left.\begin{array}{l}\alpha|100\rangle + \beta|011\rangle \\ \alpha|010\rangle + \beta|101\rangle \\ \alpha|001\rangle + \beta|110\rangle\end{array}\right\} 3p(1-p)^2.$

$\left.\begin{array}{l}\alpha|110\rangle + \beta|001\rangle \\ \alpha|101\rangle + \beta|010\rangle \\ \alpha|011\rangle + \beta|100\rangle\end{array}\right\} 3p^2(1-p)$

$\alpha|111\rangle + \beta|000\rangle \rightarrow p^3$


$|\Psi\rangle_L$
$|0\rangle$
$|1\rangle$
$|\Psi_L\rangle$

ψ_2

$(\alpha|000\rangle + \beta|111\rangle)|00\rangle$

$= \alpha|000\rangle|00\rangle + \beta|111\rangle|00\rangle$

$= (\alpha|000\rangle + \beta|111\rangle)|00\rangle$

$(\alpha|100\rangle + \beta|011\rangle)|00\rangle$

$= \alpha|100\rangle|11\rangle + \beta|011\rangle|11\rangle$

$= (\alpha|100\rangle + \beta|011\rangle)|11\rangle$

Measure Ancilla

$|00\rangle$ $|01\rangle$ $|10\rangle$ $|11\rangle$

Ancilla $|00\rangle$ Bob's Action None

$|01\rangle$ $\{$ $(\alpha|1001\rangle + \beta|1110\rangle) \rightarrow p(1-p)^2$

$\alpha|1110\rangle + \beta|1001\rangle) \rightarrow p^2(1-p)$.

σ_x on ~~second~~ third qubit

$\alpha|1000\rangle + \beta|1111\rangle \rightarrow p(1-p)^2$

$\alpha|1111\rangle + \beta|1000\rangle \rightarrow p^2(1-p)$

Ancilla

$|10\rangle$ $(\alpha|1010\rangle + \beta|1011\rangle)|10\rangle$

σ_x on the 2nd qubit

$(\alpha|1000\rangle + \beta|1111\rangle)|10\rangle$ $p(1-p)^2$.

$\alpha|1011\rangle + \beta|0010\rangle$

$\alpha|1111\rangle + \beta|1000\rangle \rightarrow$ $p^2(1-p)$

$|11\rangle$ σ_x is applied on 1st qubit

$3p^2(1-p) + p^3$.

$= 3p^2 - 2p^3 < p$.

$p = 0.01$

3×10^{-4} Reduction of error.

300.