

Reliability of TMR vs Simplex

$$T \sim \text{Exp}(\lambda)$$

Silent errors $\rightarrow$ 2 fail
in the
same way

Simplex $R(t) = e^{-\lambda t}$

TMR $R(t) = e^{-3\lambda t} + 3e^{-2\lambda t}(1 - e^{-\lambda t})$

2 or 3 out of 3 are working

$$= e^{-3\lambda t} + 3e^{-2\lambda t} - 3e^{-3\lambda t}$$

$$= 3e^{-2\lambda t} - 2e^{-3\lambda t}$$

$$\text{MTTF} = \int_0^{\infty} R(x) dx$$

$$\text{MTTF}_{\text{Simplex}} = \int_0^{\infty} e^{-\lambda x} dx = -\frac{e^{-\lambda x}}{\lambda} \Big|_0^{\infty} = \frac{1}{\lambda}$$

$$\text{MTTF}_{\text{TMR}} = \frac{3}{2\lambda} - \frac{2}{3\lambda} = \frac{5}{6\lambda}$$

$$\text{MTTF}_{\text{Simplex}} > \text{MTTF}_{\text{TMR}}$$

