SZS Blatt 2

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Aufgabe 1

a)

b)

c)

d)

e)

f)

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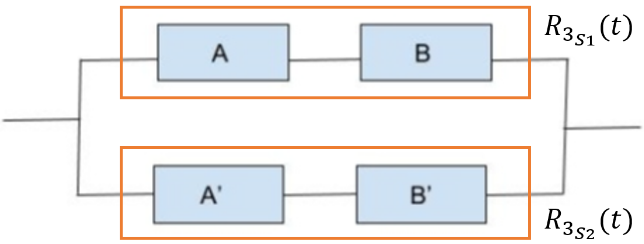
Aufgabe 2

a)

Abbildung 2: RBD für die serielle Komposition

$$R_2(t) = R_A(t) * R_B(t)$$

Abbildung 3: RBD für die Systemredundanz



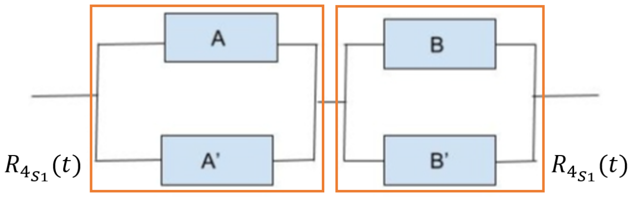
$$R_{3_{S1}}(t) = R_A(t) * R_B(t)$$

$$R_{3_{S2}}(t) = R_{A'}(t) * R_{B'}(t)$$

$$\begin{aligned}
R_3(t) &= 1 - [(1 - R_{3_{S1}}(t)) * (1 - R_{3_{S2}}(t))] \\
&= 1 - [(1 - R_A(t) * R_B(t)) * (1 - R_{A'}(t) * R_{B'}(t))] \\
&\Leftrightarrow 1 - [(1 - R_A(t) * R_B(t)) * (1 - R_A(t) * R_B(t))] \\
&= 1 - [(1 - R_A(t) * R_B(t))^2] \\
&= 1 - [1 - 2 * R_A(t) * R_B(t) + R_A(t)^2 * R_B(t)^2] \\
&= R_A(t)^2 * R_B(t)^2 + 2 * R_A(t) * R_B(t)
\end{aligned}$$

$$R_3(t) = R_A(t)^2 * R_B(t)^2 - 2 * R_A(t) * R_B(t)$$

Abbildung 4: RBD für die Komponentenredundanz



$$R_{4_{S1}}(t) = 1 - [(1 - R_A(t)) * (1 - R_{A'}(t))]$$

$$R_{4_{S2}}(t) = 1 - [(1 - R_B(t)) * (1 - R_{B'}(t))]$$

$$\begin{aligned}
R_4(t) &= R_{4_{S1}}(t) * R_{4_{S2}}(t) \\
&= (1 - [(1 - R_A(t)) * (1 - R_{A'}(t))]) * (1 - [(1 - R_B(t)) * (1 - R_{B'}(t))]) \\
&\Leftrightarrow (1 - [(1 - R_A(t)) * (1 - R_A(t))]) * (1 - [(1 - R_B(t)) * (1 - R_B(t))]) \\
&= (1 - (1 - R_A(t))^2) * (1 - (1 - R_B(t))^2) \\
&= (1 - (1 - 2 * R_A(t) + R_A(t)^2)) * (1 - (1 - 2 * R_B(t) + R_B(t)^2)) \\
&= (2 * R_A(t) - R_A(t)^2) * (2 * R_B(t) - R_B(t)^2)
\end{aligned}$$

$$R_4(t) = (2 * R_A(t) - R_A(t)^2) * (2 * R_B(t) - R_B(t)^2)$$

b)

Beispiel:

$$R_A(t) = R_B(t) = 0.5$$

$$\begin{aligned}
R_2(t) &= R_A(t) * R_B(t) \\
&= 0.5 * 0.5 \\
&= 0.25 \\
R_3(t) &= R_A(t)^2 * R_B(t)^2 - 2 * R_A(t) * R_B(t) \\
&= 0.5^2 * 0.5^2 - 2 * 0.5 * 0.5 \\
&= 0.4375 \\
R_4(t) &= (2 * R_A(t) - R_A(t)^2) * (2 * R_B(t) - R_B(t)^2) \\
&= (2 * 0.5 - 0.5^2) * (2 * 0.5 - 0.5^2) \\
&= 0.5625
\end{aligned}$$

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Aufgabe 3

a)

y(x) = m*x + c

$\mathrm{MTBF}_c(\mathrm{t}) = \kappa * \mathrm{t}^{\alpha}$

$\Rightarrow \mathrm{y} = \log(\mathrm{MTBF}_c(\mathrm{t}))$

$\Rightarrow \mathrm{m} = \alpha$

$\Rightarrow \mathrm{c} = \log(\kappa)$

$\Rightarrow \mathrm{x} = \log(\mathrm{t})$

b)

$\mathrm{t}_1 = 20 \quad \mathrm{MTBF}_c(\mathrm{t}_1) = 7$

$\mathrm{t}_2 = 100 \quad \mathrm{MTBF}_c(\mathrm{t}_2) = 25$

$\mathrm{MTBF}_c(\mathrm{t}_1)$:

$\Rightarrow 7 = \kappa * 20^{\alpha}$

$\Rightarrow \kappa = \frac{7}{20^{\alpha}}$

$\mathrm{MTBF}_c(\mathrm{t}_2)$:

$\Rightarrow 25 = \kappa * 100^{\alpha}$

mit $\kappa = \frac{7}{20^{\alpha}} \Rightarrow 25 = \frac{7}{20^{\alpha}} * 100^{\alpha}$

$\Rightarrow 25 = \frac{7*100^{\alpha}}{20^{\alpha}}$

$\Rightarrow 25 = 7 * (\frac{100}{20})^{\alpha}$

$\Rightarrow 25 = 7 * 5^{\alpha}$

$\Rightarrow \alpha = \log_5(\frac{25}{7}) = 0{,}79$

mit $\alpha = 0{,}79 \Rightarrow \kappa = \frac{7}{20^{0{,}79}} = 0{,}66$

c)

$\mathrm{MTBF}_c(200) = 0{,}66 * 200^{0{,}79} = 43$

$\lambda_i(100) = 7\mathrm{e}^{-\frac{7}{25}*100} = 5$

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Aufgabe 4

a)

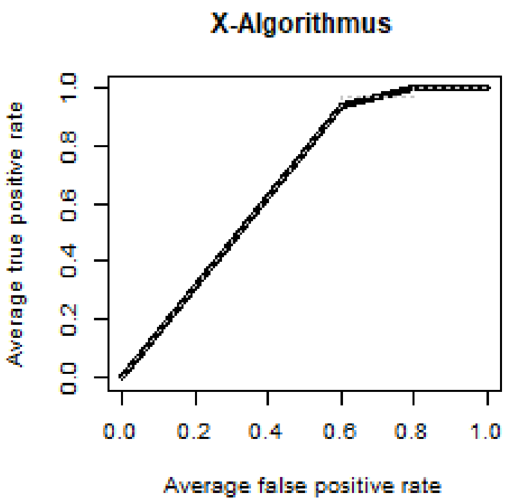
Algorithmus X:

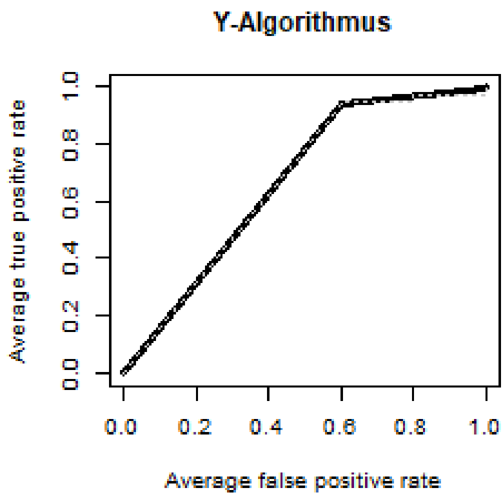
	Pos. Pred.	Neg. Pred.
True Failure	2	3
No Failure	3	95

Algroithmus Y:

	Pos. Pred.	Neg. Pred.
True Failure	1	4
No Failure	4	91

b)





Algorithmus X hat eine leicht bessere TPR.

c)

Höherer Schwellwert → Tatsächliche Fehler werden nicht erkannt. Niedriger Schwellwert → Sehr hohes Rauschen, System wird empfindlich

d)