Reliability and Availability Engineering: Modeling, Analysis, Applications

Errata Corrige

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Errata Corrige, Page 118 - The second part of Equation 4.30 with two i.i.d. components with distribution EXP(λ), is not correct. The correct formula is:

$$R_{\text{p}}(t) = 2e^{-\lambda t} - e^{-2\lambda t},$$
$$\text{MTTF} = \frac{3}{2\lambda}.$$

Errata Corrige, Page 123 - The formula for $R_{sys}(t)$ in Example 4.14 is not correct. The correct formula is:

$$R_{sys}(t) = 1 - (1 - R_i(t))^3$$

Errata Corrige , Page 142 - Example 4.27 Consider the non-series-parallel system of Figure 4.25. We condition on component 2 and apply Eq. (4.63).. The term $P\{S|X_2\}$ is the probability of the system functioning given that component 2 is functioning. Observe that under the assumption that component 2 is functioning the system is equivalent to the parallel composition of components 4 and 5. Therefore, using Eq. (4.24) we get

$$P\{S|X_2\} = 1 - (1 - R_4(t))(1 - R_5(t)) = R_4(t) + R_5(t) - R_4(t)R_5(t). \tag{4.64}$$

To compute $P\{S|\overline{X}_2\}$, observe that given that component 2 is down the system is equivalent to the series of components 1 and 4 in parallel with the series of components 3 and 5. Thence:

$$\begin{aligned} P\{S|\overline{X}_2\} &= 1 - (1 - R_1(t)R_4(t))(1 - R_3(t)R_5(t)) \\ &= R_1(t)R_4(t) + R_3(t)R_5(t) - R_1(t)R_3(t)R_4(t)R_5(t). \end{aligned} \tag{4.65}$$

Combining Eqs. 4.64 and 4.65, we have

$$\begin{aligned} R_S(t) &= [R_4(t) + R_5(t) - R_4(t)R_5(t)]R_2(t) + [R_1(t)R_4(t) + R_3(t)R_5(t) \\ &\quad - R_1(t)R_3(t)R_4(t)R_5(t)](1 - R_2(t)). \end{aligned}$$

Errata Corrige, Page 143: Problem 4.18 - The correct formulation is:
For the non-series-parallel system of Figure 4.25, derive expressions for the reliability importance of all the five components. Next, assume that the time to failure of component i is Weibull distributed with scale parameter hi and common shape parameter b. Write down an expression for the system MTTF.

Errata Corrige, Page 145 - The formula of the reliability for Case 1 is

Case 1, $k < n_2$:

$$R_{\text{Case 1}} = 1 - \sum_{i=0}^{k-1} \sum_{j=0}^{k-1-i} \binom{n_1}{i} R_1^i \, (1-R_1)^{n_1-i} \binom{n_2}{j} R_2^j \, (1-R_2)^{n_2-j}.$$

Errata Corrige, Page 293 - The conditional distribution of Y given $X = 0$ is $\mathrm{EXP}((4+\alpha)\lambda)$. Thus the correct conditional LST in the second line of Eq. (8.5) is:

$$\mathscr{L}_{Y|X}(s\,|X=0) = \frac{(4+\alpha)\lambda}{s+(4+\alpha)\lambda}\,.$$

The LST in Eq. (8.6) needs to be corrected accordingly, and using the theorem of total probability, the first line of Eq. (8.6) becomes:

$$\mathscr{L}_Y(s) = \frac{4c+\alpha}{4+\alpha}\,\frac{(4+\alpha)\lambda}{s+(4+\alpha)\lambda}\,\frac{4\lambda}{s+4\lambda} + \frac{4(1-c)}{4+\alpha}\,\frac{(4+\alpha)\lambda}{s+(4+\alpha)\lambda}\,.$$

Errata Corrige, Page 365: Section 10.1.1 - The correct expression for the probability $\pi_j(t)$ at time t is:

$$\pi_j(t) = \pi_j(0)e^{q_{jj}t} + \int_0^t \sum_{k,k\neq j} \pi_k(x) q_{kj} e^{q_{jj}(t-x)} dx.$$

Errata Corrige, Page 381: Expression (10.62) - The correct expression (10.62) is:

$$E[T_a^i] = (-1)^i \left.\frac{d^i f_a^*(s)}{d\,s^i}\right|_{s=0} = (-1)^i\, i\,!\,\boldsymbol{\pi}_{\mathrm{u}}(0)\,(\boldsymbol{Q}_{\mathrm{u}})^{-i}\,\boldsymbol{e}^{\mathrm{T}}.$$

Errata Corrige, Page 404: Initial probability vector of *Case 3* - The initial probability vector reported in the book for *Case 3* of Example 10.27, is not correct. The correct initial probability vector is given below.

$$\begin{aligned}
\pi_1(0) &= c_{\mathrm{e}}^2\, c_{\mathrm{d}},\\
\pi_2(0) &= 2\,(1-c_{\mathrm{e}})\,c_{\mathrm{e}}\,c_{\mathrm{d}},\\
\pi_3(0) &= c_{\mathrm{e}}^2\,(1-c_{\mathrm{d}}),\\
\pi_4(0) &= c_{\mathrm{d}}\,(1-c_{\mathrm{e}})^2,\\
\pi_5(0) &= 2\,c_{\mathrm{e}}\,(1-c_{\mathrm{e}})\,(1-c_{\mathrm{d}}),\\
\pi_6(0) &= (1-c_{\mathrm{e}})^2\,(1-c_{\mathrm{d}})\,.
\end{aligned}$$

Verify that $\sum_{i=0}^{6} \pi_i(0) = 1$

Errata Corrige, Page 635: Table 17.1 The correct Table 17.1 is reported below.

Table 17.1 Nearly independent approximation for shared repair with travel time

Subsys.	Up state A_{Sys}	Repair state q	Updated repair rate μ'	Indep. repair availability $A_{\text{indep. repair}}$	Shared repair availability $A_{\text{shared repair}}$
P	$\pi_{11}+\pi_{01}+\pi_{10}$	π_{0t}	μ_P	0.997 7773	0.997 7784
V	$\pi_2+\pi_{1u}+\pi_{1t}$	$\pi_{1t}+\pi_{0t}$	$\mu_V(1-Q_P)$	0.999 7989	0.999 7989
S	$\pi_3+\pi_{2u}+\pi_{2t}$	$\pi_{2t}+\pi_{1t}+\pi_{0t}$	$\mu_S(1-Q_P)$ $(1-Q_V)$	0.999 9799	0.999 9798
L	$\pi_{2u}+\pi_{1u}+\pi_{1t}$	$\pi_{1t}+\pi_{0t}$	$\mu_L(1-Q_P)$ $(1-Q_V)(1-Q_S)$	0.999 6976	0.999 6967