P. Sandborn, *Cost Analysis of Electronic Systems*, 2nd Edition, World Scientific, Singapore, 2017.

Errata (2nd Edition)

Page 44, Line before Figure 3.4 should refer to Equation (3.24) instead of Equation (3.34)

Page 53, The line after Equation (3.37), $(C_{in} + C_1 + C_2)/Y_{in}Y_1Y_2$ should be $(C_{in} + C_1 + C_2)/(Y_{in}Y_1Y_2)$

Page 86, Equation (5.12) is incorrect, the correct equation is:

$$\text{Productive Time} = \frac{\sum_{i=1}^{\text{all activities}} \text{Total Activity Time}_i}{\text{Practical Capacity}} = \frac{875{,}550}{(10)(90{,}000)} = 0.973 \qquad (5.12)$$

Also, the paragraph after Equation (5.12) should refer to column 3 of Table 5.5 and the last column of Table 5.6.

Page 100, Equation (6.8) should be $C_{die} = 46.877\left[0.01363N_G^{0.2555} + 0.011811\right]^2$

Page 152, Problem 7.10 in the last column of the table, the column heading should read "Defect Density (defects/sq cm)"

Page 207, Problem 9.8 in the figure, "19 = x = 50" should be "$19 \le x \le 50$"

Page 219, Reference [Ref. 20.13] should be [Ref. 10.13]

Page 220, "Equation (20.21a)" should be "Equation (10.21a)"

Page 226, "Equation (10.254)" should be "Equation (10.25)"

Page 245, "[Ref. II.8]" should be "[Ref. II.9]"

Page 257, Table 11.1, the last column title should include "per 100 hours". The correct numerical values for the last column should be: 0.010, 0.030, 0.104, 0.244, 0.477, 0.559, 0.800, 0.667, 1.000

Page 257, Figure 11.4, the numerical values on the vertical axis in the right plot should be removed, they do not correspond to a continuous PDF, $f(t)$ that represents the data.

Page 284, Problem 12.6, disregard the Hint at the end of the first paragraph of the problem statement

Page 333, Footnote 3, "μ is the ln(t)." should be "μ is the mean of ln(t)."

Page 372, In second line after Equation (16.18), C_{CR_0} should be C_{DR_0} (two instances of this in the line)

Page 521, S_1 = investment or project value at "$T = 0$" should be "$T = 1$"

Clarifications and Comments (2nd Edition)

Section 3.3 Often each process step will have its own yield model. Therefore, the most general way to accumulate yield is to calculate the individual step yields and take the product, as opposed to summing the defect densities through the process steps and calculating the yield from the total defect density (this assumes that all the steps are governed by the same yield model).

Section 4.4 In the final paragraph a calculation is performed to determine the value of C_C of Machine B from the COO analysis. This calculation results in a value of \$3.09/wafer, which is incorrect. The problem with this calculation is that the production penalty is not part of the cost of Machine B and should be removed. The production penalty is included for comparison purposes only. With the production penalty removed, the effective cost per wafer is \$3729/5498 = \$0.68. There is still nearly an order of magnitude difference between the estimated equipment cost from Section 2.3.2 and this estimate (0.68 >> 0.0872). Equation (2.4) does not account for the following: salvage value, consumable costs, labor costs associated with maintenance, product investment lost (scrappage) due to errors caused by this machine, product repair costs due to errors caused by this machine (this is a large contribution), and lost product cost (this is also a large contribution). Equation (2.4) attempts to account for all the sustainment and the performance cost associated with the machine, with a single factor of 0.6 utilization.

Section 7.6.2 It is unclear from the text what "parallel test steps" means. If the parallel test in Figure 7.11 effectively represents a single test that has a different fault coverage with respect to two different defect types (1 and 2), what are Y_{out}, C_{out} and S? Assuming that the total test cost is just C_{test} and that no parts have both defects 1 and 2. In this case, $Y_{in} = Y_{in1}Y_{in2}$ and Y_{out} is correctly given by Equation (7.54). If we let $C_{test1} = C_{test}$ and $C_{test2} = 0$ (or vice versa) then C_{out} becomes,

$$C_{out} = \frac{C_{in} + C_{test}}{Y_{in1}^{f_{c1}} Y_{in2}^{f_{c2}}} \tag{7.55}$$

and the total scrap is P,

$$S = 1 - Y_{in1}^{f_{c1}} Y_{in2}^{f_{c2}} \tag{7.56}$$

Note, there are other possible interpretations of a parallel test step and Figure 7.11. One alternative is that if Figure 7.10 represents a logical "AND", then Figure 7.11 could represent a logical "OR". In this case, the parallel test step requires a "gatekeeper" that sorts parts into either Test 1 or Test 2 (but not both). If this is the case then an additional parameter is needed that defines the fraction of the parts sorted into one or the other test.

Page 200 First paragraph, "\$44 (717)" means that there are 717 values that are below \$44.

Page 223 M appearing in (10.23) and (10.24) is the number of data points. For the example given in Section 10.6.1, $M = 4$.

Section 11.2.1, Technically you can't convert a histogram to a PDF because you don't have enough information to do it. However, you can try to find a distribution that "looks like" the histogram. If your histogram looks like a normal distribution, you could assume the distribution is normal and do a fit to find the parameters, then claim that it is the PDF. For example, you can calculate the mean and standard deviation of a histogram that can be used to determine a normal distribution. In Figure 11.4, the numerical values on the vertical axis in the right plot should be removed, they do not correspond to a continuous PDF, $f(t)$ that represents the data. If you have the data used to create the histogram there are numerical approaches, e.g., kernel density estimation, which can numerically produce a distribution.

Section 14.1.1, Technically the acceleration factor (A_F) appearing in (14.1) is 1 for burn-in, i.e., no acceleration. A_F may be greater than 1 for other environmental stress screening (ESS) approaches. All the development in Chapter 14 is applicable to any type of stress screening that exposes infant mortality.

Page 347, Section 15.6.2, An additional reason for PPAs (maybe the most important reason) is that they allow both the buyer and seller of power to avoid the volatility of the energy spot market.

Page 372 The second paragraph incorrectly implies that the costs associated with buying parts after the design refresh to support the system to some future end-of-support date are not relevant for determining the optimum design refresh date. The cost of buying parts after the refresh is relevant and should be taken into account if the end-of-support date for the system is later than the design refresh date.

Section 17.2.1 The ROI of a manufacturing equipment replacement example is does not properly account for the value of the yield improvement. Assuming that the yield loss due to the step occurs after the recurring cost for the step has been charged, (17.2) should be written as:

$$ROI = \frac{V[(\$0.50-\$0.40)+(0.97)(\$1.35+\$0.40)-(0.95)(\$1.35+\$0.50)]-\$100{,}000}{\$100{,}000} \tag{17.2}$$

With this correction, the breakeven volume of units is 2,500,000.

Page 388, In Equation (17.4), r should be a fraction and D_S and M_S must be percentages.

Page 430, Problem 19.1, the table describing the two groups appears at the top of page 431. Both groups use the Technical Complexity Factors given.

Page 430, Problem 19.1b, the information to solve this part is not contained in the chapter. You must consult [Ref. 19.8] to obtain the appropriate conversion factors.

Page 447, Equation (20.11) assumes that I_i, M_i, and F_i are all appropriately discounted and that I_i includes financing costs.

Page 485, Section 22.3.1, the last sentence in the section infers that the value of the option from the real options analysis will always be less than the value of the option obtained from DTA. This does not have to be the case. Depending on the values of u, d, R_f and the objective probabilities assumed in the DTA, the value of the option from real options analysis could be larger or smaller than the value obtained from DTA.

Page 502, Problem 22.12, The 50% increase in the value of the manufacturer's project and the fact that u = 1.5 are unrelated. The 50% increase applies to both S_u and S_d.