Quality Control Testing of Diodes

An Example of Discrete Probability Modeling

CURM Background Materially, Fall 2014

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Numerically Determining Minimum Average Cost of Testing Diodes

restart

$A := x \to \frac{4}{x} + 6 - 5 \cdot (0.997)^x;$

$$x \to \frac{4}{x} + 6 - 5\ 0.997^x \quad \textbf{(1.1)}$$

$dA := unapply(diff(A(x), x), x)$

$$x \to -\frac{4}{x^2} + 0.01502254510\ 0.997^x \quad \textbf{(1.2)}$$

$ddA := unapply(diff(dA(x), x), x)$

$$x \to \frac{8}{x^3} - 0.00004513537226\ 0.997^x \quad \textbf{(1.3)}$$

Note that for $x > 0$, $A''(x) > 0$, so our result will be a minimum. We will now solve using Newton's method, which you first saw in Calculus.

$\text{epsilon} := 10^{-5}; \text{delta} := 10^{-5};$

$$\frac{1}{100000}$$

$$\frac{1}{100000} \quad \textbf{(1.4)}$$

$x0 := 1;$

$$1 \quad \textbf{(1.5)}$$

while $\text{abs}(dA(x0)) \geq \text{delta}$ **do**

$x1 := x0 - \frac{dA(x0)}{ddA(x0)}:$

$err := x1 - x0:$

if $\text{abs}(err) < \text{epsilon}$ **then**

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break;
end if:
x0 := x1 :
end do:
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$$16.73232549 \tag{1.6}$$

$x0$

$$16.73232549 \tag{1.7}$$

$A(17)$

$$1.484264962 \tag{1.8}$$

Note: What happens if we try to solve this exactly?

$solve(A(x) = 0)$

Warning, solutions may have been lost

$$-4.276513460 \tag{1.9}$$