Errata: Statistics for Mechanical Engineers Notes, 2008

page 1.9, line 15 $\mathrm{var}(Z) = \frac{rq}{p^2}$

page 2.7, eg.1

x	0	1	2	3
$p_X(x)$	0.1	0.3	0.4	0.2

$\mathrm{var}(X) = \mathrm{E}(X^2) - \mathrm{E}(X)^2 = 3.7 - 1.7^2 = 0.81.$

page 3.6, line 9 MATLAB has this option using `ksdensity`;

page 4.2, eg.5 A random sample of $n = 20$ observations on $X \stackrel{\mathrm{d}}{=} \mathrm{Pn}(\lambda)$ yields $\bar{x} = 5.6$. Find an approximate 95% confidence interval for λ.

$\hat{\lambda} = 5.6, \ \ \mathrm{se}(\hat{\lambda}) = \sqrt{5.6/20} = 0.53;$

approx 95% CI: $5.6 \pm 2{\times}0.53 = (4.54, 6.66)$.

page 4.3, eg.2* A random sample of n=40 on $X \stackrel{\mathrm{d}}{=} \mathrm{G}(\theta)$ yields sample mean, $\bar{x} = 17.2$.

$\frac{1-\bar{\theta}}{\bar{\theta}} = 17.2 \ \Rightarrow \ \bar{\theta} = 0.055$ and $\mathrm{se}(\bar{\theta}) = 0.008$; using $\bar{\theta} = \frac{1}{\bar{x}+1}$, and the approximation for the variance of a function of a random variable:

$$\mathrm{var}(\bar{\theta}) \approx \left(\frac{1}{\mathrm{E}(\bar{x})+1}\right)^4 \mathrm{var}(\bar{x}) \ = \ \frac{\theta^2(1-\theta)}{n}; \quad \text{since } \mathrm{E}(\bar{x}) = \frac{1-\theta}{\theta} \ \text{ and } \ \mathrm{var}(\bar{x}) = \frac{1-\theta}{n\theta^2}.$$

page 4.4, example 1

eg: If the likelihood function is given by

$$L(\theta) = e^{-30\theta}\theta^{10}(1-\theta)^{20} \quad (0 < \theta < 1).$$

Find the maximum likelihood estimate of θ and its standard error.

$\ln L = -30\theta + 10\ln\theta + 20\ln(1-\theta);$

$\frac{\partial \ln L}{\partial\theta} = -30 + \frac{10}{\theta} - \frac{20}{1-\theta}; \quad \frac{\partial \ln L}{\partial\theta} = 0 \ \ \Rightarrow \ \hat{\theta} = 0.184;$

$\frac{\partial^2 \ln L}{\partial\theta^2} = -\frac{10}{\theta^2} - \frac{20}{(1-\theta)^2}$

$$\Rightarrow \ \mathrm{se}(\hat{\theta}) = 1\Big/\sqrt{\frac{10}{0.184^2} + \frac{20}{0.816^2}} = 0.055.$$

page 6.4–6.5 The sections (Comparison of two normal populations) and (Comparison of variances) are moved to after material on page 6.8, before (Analysis of Variance).

page 7.10, analysis: *(The following analysis has been added.)*

Analysis of Variance

Source	DF	SS	MS	F	P
P	1	24.00	24.00	1.56	0.230
T	1	216.00	216.00	14.01	0.002
H	1	322.67	322.67	20.93	0.000
P*T	1	1.50	1.50	0.10	0.759
P*H	1	0.17	0.17	0.01	0.918
T*H	1	20.17	20.17	1.31	0.270
P*T*H	1	0.67	0.67	0.04	0.838
Error	16	246.67	15.42	(S = 3.926)	
Total	23				

Analysis of Variance

Source	DF	SS	MS	F	P
T	1	216.00	216.00	15.47	0.001
H	1	322.67	322.67	23.11	0.000
Error	21	293.17	13.96	(S = 3.736)	
Total	23				

Further, the effect of temperature, as measured by the difference [mean at temp=60] – [mean at temp=70], is estimated by $\hat{T} = 6.0$, (i.e. we estimate there are 6.0 more holes at $60°$C than at $70°$C); with $\text{se}(\hat{T}) = 1.5$; and 95% CI = $(2.8, 9.2)$.

Similarly, effect of heat, as measured by the difference [mean with direct heat] – [mean with indirect heat], is estimated by $\hat{H} = 7.3$, with $\text{se}(\hat{H}) = 1.5$; and 95% CI = $(4.2, 10.5)$.

The analysis indicates that temp and heat are the only significant factors. This will be discussed later.

page 8.12, line –6 $\underset{(n-1)}{\text{total}} = \underset{(n-k-1)}{\text{residual}} + \underset{(k)}{\text{regression}}$

page P.13, problem 91 (a) Generate a sample of $n = 10$ observations on $Y \stackrel{\text{d}}{=} \text{N}(\mu{=}50, \sigma^2{=}10^2)$

page P.15, problem 95 (c) … the sample median relates to λ in a similar way, obtain …

page A.5, problem 88 (a) 46.3, 9.70; *[Note:* MATLAB*2007b gives* $\text{IQR} = 49.65 - 40.2 = 9.45$*];*
(b) boxplot (five-number summary: 25.9, 40.0, 46.3, 49.7, 59.4); (c) 44.13, 8.77.

page A.6, problem 93 (a) 80, 20; *(the mean is a bit greater than the mode as the distribution is positively skewed, and* $(40, 120) = (80 \pm 40)$ *contains about 0.95 probability);* (b) dotplot: between 50 and 120 and most between 60 and 90; (c) $\text{E}(\bar{X}) \approx 80$, $\text{sd}(\bar{X}) \approx \frac{20}{\sqrt{100}} = 2$, so an approximate 95% probability interval is $80 \pm 4 = (76, 84)$; (d) five-number summary $\approx (40, 63, 78, 95, 160)$.

page A.11, problem 149 Control limits for the R-chart are $(0.14, 1.86)$.