V. Seshadri

The Inverse Gaussian Distribution
Statistical Theory and Applications
PART I  STATISTICAL THEORY

1.  Distribution theory
    1.0 Introduction ............................................. 1
    1.1 Limit laws ............................................ 5
    1.2 Sampling distributions ............................... 7
    1.3 Conditional distributions ......................... 15
    1.4 Bayesian sampling distributions .................. 19

2.  Estimation
    2.0 Introduction ........................................... 23
    2.1 Estimation ............................................. 24
    2.2 A shifted model ....................................... 26
    2.3 Maximum likelihood estimation .................... 28
    2.3 Estimation under truncation ....................... 37

3.  Significance tests
    3.0 Introduction ........................................... 38
    3.1 Likelihood-ratio tests.  One sample case ............ 38
    3.2 Brownian motion process ............................. 43
    3.3 Power considerations .................................. 44
    3.4 Two sample tests ..................................... 45
    3.5 Interval estimation ................................... 52
    3.6 Examples ............................................... 58
    3.7 Tolerance limits ...................................... 61
    3.8 Tests of separate families ......................... 65
    3.9 Bahadur efficient tests ............................. 70

4.  Sequential methods
    4.0 Introduction ........................................... 73
    4.1 Sequential probability ratio test ................... 73
    4.2 Sequential test for the mean and asymptotics ....... 78
    4.3 Tests with known coefficient of variation ........... 84
    4.4 Asymptotically risk-efficient sequential estimation 87
    4.5 Control charts ........................................ 90

5.  Reliability & Survival analysis
    5.0 Introduction ........................................... 92
5.1 Estimation of reliability ........................................ 92
5.2 Confidence bounds and tolerance limits ......................... 96
5.3 Hazard rate ......................................................... 102
5.4 Estimation of critical time ........................................ 104
5.5 Confidence intervals for hazard rate. ........................... 106

6. Goodness-of-fit
6.0 Introduction ....................................................... 114
6.1 Modified Kolmogorov-Smirnov test ................................ 114
6.2 Anderson-Darling Statistic ...................................... 116

7. Compound laws & mixtures
7.0 Introduction ....................................................... 121
7.1 Poisson-inverse Gaussian ......................................... 121
7.2 Inference .......................................................... 125
7.3 Examples .......................................................... 133
7.4 A compound inverse Gaussian model ............................. 136
7.5 Normal-gamma mixture ........................................... 139
7.6 Normal inverse Gaussian mixture ................................ 141
7.7 A mixture inverse Gaussian ....................................... 143
7.8 Exponential-inverse Gaussian mixtures ......................... 150
7.9 Birnbaum-Saunders distribution .................................. 154
7.10 Linear models and the P-IG law ................................ 159
7.11 P-IG regression model .......................................... 163

PART II APPLICATIONS

A. Actuarial science .................................................. 167
Claim cost analysis .................................................. 167

B. Analysis of reciprocals ............................................. 172
One-way classification ............................................... 172
An application in environmental sciences .......................... 175
Analysis of two factor experiments ................................ 181
Tests for model adequacy ............................................ 185
The analysis of reciprocals ........................................... 187

C. Demography .......................................................... 191

D. Histomorphometry .................................................. 194

E. Electrical networks .................................................. 198
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>F. Hydrology</td>
<td>203</td>
</tr>
<tr>
<td>Emptiness of a dam</td>
<td>204</td>
</tr>
<tr>
<td>G. Life tests</td>
<td>206</td>
</tr>
<tr>
<td>Shelf life failures</td>
<td>206</td>
</tr>
<tr>
<td>Accelerated life tests</td>
<td>207</td>
</tr>
<tr>
<td>Least squares</td>
<td>210</td>
</tr>
<tr>
<td>Variable stress accelerated tests</td>
<td>214</td>
</tr>
<tr>
<td>H. Management science</td>
<td>220</td>
</tr>
<tr>
<td>Labour turnover</td>
<td>220</td>
</tr>
<tr>
<td>Duration of strikes</td>
<td>223</td>
</tr>
<tr>
<td>I. Meteorology</td>
<td>230</td>
</tr>
<tr>
<td>J. Mental health</td>
<td>232</td>
</tr>
<tr>
<td>K. Physiology</td>
<td>235</td>
</tr>
<tr>
<td>Tracer dilution curves</td>
<td>235</td>
</tr>
<tr>
<td>Pharmacokinetics</td>
<td>237</td>
</tr>
<tr>
<td>Interspike train interval analysis</td>
<td>239</td>
</tr>
<tr>
<td>L. Remote sensing</td>
<td>252</td>
</tr>
<tr>
<td>Photogrammetry</td>
<td>252</td>
</tr>
<tr>
<td>Cookie cutter detection</td>
<td>257</td>
</tr>
<tr>
<td>M. Traffic-noise intensity</td>
<td>259</td>
</tr>
<tr>
<td>Model assumptions</td>
<td>259</td>
</tr>
<tr>
<td>N. Market research</td>
<td>262</td>
</tr>
<tr>
<td>O. Regression</td>
<td>265</td>
</tr>
<tr>
<td>Asymptotics</td>
<td>270</td>
</tr>
<tr>
<td>Analysis of Reciprocals (revisited)</td>
<td>273</td>
</tr>
<tr>
<td>Regression diagnostics</td>
<td>275</td>
</tr>
<tr>
<td>Strong consistency and bookstrap</td>
<td>280</td>
</tr>
<tr>
<td>P. Slug lengths in pipelines</td>
<td>284</td>
</tr>
<tr>
<td>Q. Ecology</td>
<td>286</td>
</tr>
<tr>
<td>Time till extinction</td>
<td>286</td>
</tr>
<tr>
<td>Endangered species</td>
<td>289</td>
</tr>
</tbody>
</table>
R. Entomology ................................................. 298
  A stochastic model ........................................ 298
  Estimation and model adequacy .......................... 300

S. Small area estimation .................................... 305

T. CUSUM ....................................................... 309
  Cusum charts ............................................... 309

U. Plutonium Estimation .................................... 314
  Model development ......................................... 314

References ...................................................... 317
Author Index .................................................. 340
Subject Index .................................................. 345
Glossary ......................................................... 347