

The background of the cover is a dramatic, high-contrast image of a thunderstorm. Dark, swirling clouds are illuminated from within by bright green and yellow lightning bolts, creating a stark, energetic scene. The overall color palette is dominated by deep blues, blacks, and vibrant greens.

Comprehensive Probability Review for Actuarial Exams

***A Manual for
SOA Exam P***

First Edition

©2010 Digital Actuarial Resources

Table of Contents

CHAPTER 1: INTRODUCTION TO PROBABILITY	3
<u>SECTION 1-1: THE STUDY OF UNCERTAINTY</u>	3
<u>SECTION 1-2: SET THEORY</u>	5
<u>SECTION 1-3: VENN DIAGRAMS</u>	15
<u>SECTION 1-4: INDEPENDENT EVENTS</u>	18
<u>SECTION 1-5: CONDITIONAL PROBABILITY</u>	21
<u>SECTION 1-6: LAW OF TOTAL PROBABILITY AND BAYES' THEOREM</u>	28
CHAPTER 2: COUNTING TOOLS	33
<u>SECTION 2-1: COUNTING BY MULTIPLICATION</u>	34
<u>SECTION 2-2: PERMUTATIONS AND COMBINATIONS</u>	35
<u>SECTION 2-3: MULTINOMIAL COMBINATIONS</u>	40
<u>SECTION 2-4: DISCRETE UNIFORM DISTRIBUTION</u>	42
CHAPTER 3: BASICS OF PROBABILITY DISTRIBUTIONS	44
<u>SECTION 3-1: RANDOM VARIABLES</u>	44
<u>SECTION 3-2: STRUCTURE OF DISCRETE PROBABILITY DISTRIBUTIONS</u>	46
<u>SECTION 3-3: STRUCTURE OF CONTINUOUS PROBABILITY DISTRIBUTIONS</u>	47
<u>SECTION 3-4: DISTRIBUTION FUNCTIONS</u>	51
<u>SECTION 3-5: THE QUANTILE FUNCTION</u>	59
<u>SECTION 3-6: BERNOULLI DISTRIBUTION</u>	63
<u>SECTION 3-7: BINOMIAL DISTRIBUTION</u>	66
<u>SECTION 3-8: CONTINUOUS UNIFORM DISTRIBUTION</u>	70
CHAPTER 4: MULTIVARIATE DISTRIBUTIONS	73
<u>SECTION 4-1: BASICS OF BIVARIATE DISTRIBUTIONS</u>	73
<u>SECTION 4-2: COMPUTING MARGINAL DISTRIBUTIONS</u>	81
<u>SECTION 4-3: DISTRIBUTIONS WITH MORE THAN TWO RANDOM VARIABLES</u>	86
<u>SECTION 4-4: DETERMINING THE DISTRIBUTION FOR Y DEPENDING ON X</u>	87
<u>SECTION 4-5: DETERMINING THE DISTRIBUTION FOR MANY Y'S DEPENDING ON MANY X'S</u>	92
<u>SECTION 4-6: CONDITIONAL PROBABILITY DISTRIBUTIONS</u>	104
CHAPTER 5: ANALYZING DISTRIBUTIONS	109
<u>SECTION 5-1: EXPECTED VALUE</u>	109
<u>SECTION 5-2: CONDITIONAL EXPECTED VALUE</u>	119
<u>SECTION 5-3: MEDIAN</u>	124

<u>SECTION 5-4: MODE</u>	129
<u>SECTION 5-5: VARIANCE</u>	131
<u>SECTION 5-6: MEASURES OF LINEAR RELATIONSHIP—COVARIANCE AND CORRELATION</u>	135
<u>SECTION 5-7: MOMENT-GENERATING FUNCTIONS</u>	141
<u>CHAPTER 6: COMMON DISCRETE DISTRIBUTIONS</u>	<u>148</u>
<u>SECTION 6-1: BERNOULLI AND BINOMIAL DISTRIBUTIONS REVISITED</u>	148
<u>SECTION 6-2: POISSON DISTRIBUTION</u>	153
<u>SECTION 6-3: NEGATIVE BINOMIAL AND GEOMETRIC DISTRIBUTIONS</u>	158
<u>SECTION 6-4: HYPERGEOMETRIC DISTRIBUTION</u>	166
<u>SECTION 6-5: MULTINOMIAL DISTRIBUTION</u>	170
<u>CHAPTER 7: COMMON CONTINUOUS DISTRIBUTIONS</u>	<u>175</u>
<u>SECTION 7-1: CONTINUOUS UNIFORM DISTRIBUTION REVISITED</u>	175
<u>SECTION 7-2: NORMAL DISTRIBUTION</u>	178
<u>SECTION 7-3: CORRECTION FOR CONTINUITY</u>	184
<u>SECTION 7-4: CENTRAL LIMIT THEOREM</u>	187
<u>SECTION 7-5: BIVARIATE NORMAL DISTRIBUTION</u>	193
<u>SECTION 7-6: GAMMA DISTRIBUTION</u>	198
<u>SECTION 7-7: BETA DISTRIBUTION</u>	207
<u>SECTION 7-8: CONJUGATE PRIORS</u>	211
<u>APPENDIX A: STANDARD NORMAL DISTRIBUTION</u>	<u>222</u>
<u>APPENDIX B: COMMON SERIES</u>	<u>223</u>