

Contents

1	Introduction	1
1.1	Introduction	1
1.2	References	4
2	Fuzzy Sets	7
2.1	Introduction	7
2.2	Fuzzy Sets	7
2.2.1	Fuzzy Numbers	8
2.2.2	Alpha-Cuts	9
2.2.3	Inequalities	11
2.2.4	Discrete Fuzzy Sets	11
2.3	Fuzzy Arithmetic	11
2.3.1	Extension Principle	12
2.3.2	Interval Arithmetic	12
2.3.3	Fuzzy Arithmetic	13
2.4	Fuzzy Functions	14
2.4.1	Extension Principle	14
2.4.2	Alpha-Cuts and Interval Arithmetic	16
2.4.3	Differences	16
2.5	Finding the Minimum of a Fuzzy Number	17
2.6	Ordering Fuzzy Numbers	19
2.7	Fuzzy Probabilities	21
2.8	Fuzzy Numbers from Confidence Intervals	21
2.9	Computing Fuzzy Probabilities	23
2.9.1	First Problem	24
2.9.2	Second Problem	26
2.10	Figures	28
2.11	References	28
3	Fuzzy Probability Theory	31
3.1	Introduction	31
3.2	Fuzzy Probability	32
3.3	Fuzzy Conditional Probability	36

3.4	Fuzzy Independence	38
3.5	Fuzzy Bayes' Formula	40
3.6	Applications	41
3.6.1	Blood Types	41
3.6.2	Resistance to Surveys	42
3.6.3	Testing for HIV	44
3.6.4	Color Blindness	45
3.6.5	Fuzzy Bayes	46
3.7	References	48
4	Discrete Fuzzy Random Variables	51
4.1	Introduction	51
4.2	Fuzzy Binomial	51
4.3	Fuzzy Poisson	54
4.4	Applications	57
4.4.1	Fuzzy Poisson Approximating Fuzzy Binomial	57
4.4.2	Overbooking	58
4.4.3	Rapid Response Team	59
4.5	References	60
5	Fuzzy Queuing Theory	61
5.1	Introduction	61
5.2	Regular, Finite, Markov Chains	61
5.3	Fuzzy Queuing Theory	63
5.4	Applications	64
5.4.1	Machine Servicing Problem	65
5.4.2	Fuzzy Queuing Decision Problem	68
5.5	References	69
6	Fuzzy Markov Chains	71
6.1	Introduction	71
6.2	Regular Markov Chains	75
6.3	Absorbing Markov Chains	77
6.4	Application: Decision Model	79
6.5	References	83
7	Fuzzy Decisions Under Risk	85
7.1	Introduction	85
7.2	Without Data	86
7.3	With Data	88
7.4	References	91

8	Continuous Fuzzy Random Variables	95
8.1	Introduction	95
8.2	Fuzzy Uniform	95
8.3	Fuzzy Normal	97
8.4	Fuzzy Negative Exponential	99
8.5	Applications	100
8.5.1	Fuzzy Uniform	101
8.5.2	Fuzzy Normal Approximation to Fuzzy Binomial . . .	101
8.5.3	Fuzzy Normal Approximation to Fuzzy Poisson	104
8.5.4	Fuzzy Normal	105
8.5.5	Fuzzy Negative Exponential	107
8.6	References	108
9	Fuzzy Inventory Control	109
9.1	Introduction	109
9.2	Single Period Model	109
9.3	Multiple Periods	111
9.4	References	112
10	Joint Fuzzy Probability Distributions	115
10.1	Introduction	115
10.2	Continuous Case	115
10.2.1	Fuzzy Marginals	116
10.2.2	Fuzzy Conditionals	118
10.2.3	Fuzzy Correlation	120
10.2.4	Fuzzy Bivariate Normal	121
10.3	References	123
11	Applications of Joint Distributions	125
11.1	Introduction	125
11.2	Political Polls	125
11.2.1	Fuzzy Marginals	126
11.2.2	Fuzzy Conditionals	127
11.2.3	Fuzzy Correlation	128
11.3	Fuzzy Reliability Theory	129
11.4	References	132
12	Functions of a Fuzzy Random Variable	133
12.1	Introduction	133
12.2	Discrete Fuzzy Random Variables	133
12.3	Continuous Fuzzy Random Variables	134

13 Functions of Fuzzy Random Variables	139
13.1 Introduction	139
13.2 One-to-One Transformation	140
13.3 Other Transformations	142
14 Law of Large Numbers	145
15 Sums of Fuzzy Random Variables	147
15.1 Introduction	147
15.2 Sums	149
16 Conclusions and Future Research	151
16.1 Introduction	151
16.2 Summary	151
16.2.1 Chapter 3	151
16.2.2 Chapter 4	151
16.2.3 Chapter 5	152
16.2.4 Chapter 6	152
16.2.5 Chapter 7	152
16.2.6 Chapter 8	152
16.2.7 Chapter 9	152
16.2.8 Chapter 10	153
16.2.9 Chapter 11	153
16.2.10 Chapter 12	153
16.2.11 Chapter 13	153
16.2.12 Chapter 14	153
16.2.13 Chapter 15	153
16.3 Research Agenda	154
16.3.1 Chapter 3	154
16.3.2 Chapter 4	154
16.3.3 Chapter 5	154
16.3.4 Chapter 6	154
16.3.5 Chapter 7	154
16.3.6 Chapter 8	154
16.3.7 Chapter 9	154
16.3.8 Chapter 10	154
16.3.9 Chapter 11	155
16.3.10 Chapter 12	155
16.3.11 Chapter 13	155
16.3.12 Chapter 14	155
16.3.13 Chapter 15	155
16.4 Conclusions	155
Index	157

<i>CONTENTS</i>	xi
List of Figures	162
List of Tables	164



<http://www.springer.com/978-3-7908-1542-9>

Fuzzy Probabilities

New Approach and Applications

Buckley, J.J.

2003, XII, 165 p., Hardcover

ISBN: 978-3-7908-1542-9

A product of Physica-Verlag Heidelberg