

# Contents

<b>1</b>	<b>Multiservice Loss Systems</b>	<b>1</b>
1.1	The Erlang Loss System	2
1.2	Loss Networks with Fixed Routing	3
1.3	Loss Networks with Dynamic Routing	6
1.4	The ATM Multiplexer	7
1.5	ATM Networks	13
1.6	Multiservice Interconnection Networks	16
<b>2</b>	<b>The Stochastic Knapsack</b>	<b>17</b>
2.1	The Model and Notation	17
2.2	Performance Evaluation	22
2.3	Virtual Channel Establishment for ATM Multiplexers	26
2.4	Contiguous Slot Assignment	33
2.5	Stochastic Comparisons	39
2.6	Monotonicity Properties for the Stochastic Knapsack	42
2.7	Asymptotic Analysis of the Stochastic Knapsack	50
2.8	The Stochastic Knapsack with Continuous Sizes*	60
2.9	Bibliographical Notes	67
2.10	Summary of Notation	68
<b>3</b>	<b>The Generalized Stochastic Knapsack</b>	<b>71</b>
3.1	Preliminaries	72
3.2	A Recursive Algorithm	75
3.3	A Convolution Algorithm	80
3.4	Calculating Blocking Probabilities*	83
3.5	Refined Convolution Algorithms*	85
3.6	Monotonicity Properties	89

3.7	ATM with Burst Multiplexing . . . . .	92
3.8	Circuit-Switched Access Networks . . . . .	96
3.9	Sharing Memory* . . . . .	104
3.10	Objects with Continuous Sizes* . . . . .	107
3.11	Bibliographical Remarks . . . . .	109
3.12	Summary of Notation . . . . .	109
<b>4</b>	<b>Admission Control</b> . . . . .	<b>113</b>
4.1	Admission Policies . . . . .	114
4.2	Optimization Concepts . . . . .	120
4.3	Optimal Complete Partitioning Policies . . . . .	122
4.4	Optimal Coordinate Convex Policies . . . . .	124
4.5	Markov Decision Processes . . . . .	129
4.6	Optimal Admission to Broadband Multiplexers . . . . .	136
4.7	Service Separation for ATM . . . . .	141
4.8	Bibliographical Notes . . . . .	151
4.9	Summary of Notation . . . . .	151
<b>5</b>	<b>Product-Form Loss Networks</b> . . . . .	<b>155</b>
5.1	The Model . . . . .	156
5.2	Basic Properties . . . . .	163
5.3	Algorithms for Generalized Access Networks . . . . .	169
5.4	Algorithms for Hierarchical Access Networks . . . . .	177
5.5	The Reduced Load Approximation for Single-Service Networks . . . . .	181
5.6	The Reduced Load Approximation for Multiservice Networks . . . . .	187
5.7	Implied Costs . . . . .	190
5.8	Asymptotic Analysis . . . . .	196
5.9	Loss Models for ATM Networks . . . . .	206
5.10	ATM Networks: Route Separation . . . . .	211
5.11	ATM Networks: Multiplexing Across Routes . . . . .	213
5.12	Continuous Bandwidths* . . . . .	218
5.13	Cellular Networks and Wavelength-Division Multiplexing Networks* . . . . .	220
5.14	Bibliographical Notes . . . . .	223
5.15	Summary of Notation . . . . .	224

<b>6</b>	<b>Monte Carlo Summation for Product-Form Loss Networks</b> . . . . .	<b>229</b>
6.1	The Theory of Monte Carlo Summation . . . . .	231
6.2	Numerical Examples . . . . .	239
6.3	Estimates for Revenue Sensitivity . . . . .	244
6.4	Loss Network Analyzer: A Software Package . . . . .	246
6.5	Bibliographical Notes . . . . .	247
6.6	Summary of Notation . . . . .	247
<b>7</b>	<b>Dynamic Routing in Telephone Networks</b> . . . . .	<b>249</b>
7.1	An Overview of Contemporary Routing Techniques . . . . .	251
7.2	Bounds on Average Revenue . . . . .	255
7.3	Reduced Load Approximation for Dynamic Routing . . . . .	261
7.4	Symmetric Networks . . . . .	263
7.5	Computational Effort of Reduced Load Approximation . . . . .	271
7.6	Computational Examples for the Reduced Load Approximation . . . . .	276
7.7	Bibliographical Notes . . . . .	281
7.8	Summary of Notation . . . . .	283
<b>8</b>	<b>Dynamic Routing in ATM Networks</b> . . . . .	<b>285</b>
8.1	ATM Routing Concepts . . . . .	286
8.2	Static-Service, Dynamic-Route Separation . . . . .	287
8.3	Static-Service Separation, Multiplexing Across Routes . . . . .	290
8.4	Dynamic-Service, Dynamic-Route Separation . . . . .	298
8.5	Dynamic-Service Separation, Multiplexing Across Routes . . . . .	300
8.6	The Reduced Load Approximation for Multiservice Networks with Dynamic Routing . . . . .	301
8.7	Bibliographical Notes . . . . .	304
<b>9</b>	<b>Multiservice Interconnection Networks</b> . . . . .	<b>305</b>
9.1	Model Description . . . . .	307
9.2	Three-Stage Clos Networks . . . . .	309
9.3	Cantor Networks . . . . .	314
9.4	Rearrangeable Interconnection Networks . . . . .	320
9.5	Bibliographical Notes . . . . .	322
9.6	Summary of Notation . . . . .	322

**Bibliography**

**325**

**Index**

**341**