

Contents

Acknowledgments	ix
Introduction	xix
Part One: Introduction	1
Chapter 1: Introduction to Data Warehousing and Analysis Services 2005	3
A Closer Look at Data Warehousing	3
Key Elements of a Data Warehouse	6
Fact Tables	7
Dimension Tables	8
Dimensions	8
Cubes	9
The Star Schema	11
The Snowflake Schema	12
Inmon Versus Kimball — Different Approaches	12
Business Intelligence Is Data Analysis	13
Analysis Services 2005	14
The Unified Dimensional Model	17
Summary	18
Chapter 2: First Look at Analysis Services 2005	21
Differences between Analysis Services 2000 and Analysis Services 2005	22
Development, Administrative, and Client Tools	22
Analysis Services Version Differences	23
Upgrading to Analysis Services 2005	24
Using the Business Intelligence Development Studio	31
Creating a Project in the Business Intelligence Development Studio	32
Creating an Analysis Services Database Using the Business Intelligence Development Studio	35
Using the SQL Server Management Studio	54
Querying Using the MDX Query Editor	58
Summary	60

Chapter 3: Introduction to MDX	61
What Is MDX?	61
Fundamental Concepts	62
Members	64
Cells	66
Tuples	68
Sets	69
MDX Query	70
SELECT Statement and Axis Specification	71
FROM Clause and Cube Specification	72
WHERE Clause and Slicer Specification	72
WITH Clause and Calculated Member	74
MDX Expressions	78
Operators	79
Arithmetic Operations	79
Set Operations	79
Comparison Operations	80
Logical Operations	80
Special MDX Operations—Curly Braces, Commas, and Colons	80
MDX Functions	81
MDX Function Categories	82
SET Functions	83
Member Functions	85
Numeric Functions	86
Dimension Functions, Level Functions, and Hierarchy Functions	87
String Manipulation Functions	87
Other Functions	87
Summary	88
Chapter 4: Working with Data Sources and Data Source Views	89
Data Source	89
Data Sources Supported by Analysis Services	91
.NET versus OLE DB Data Providers	93
Data Source View	94
DSV Designer	94
Data Source Views in Depth	101
Data Source View Properties	103
Different Layouts in DSVs	105
Validating Your DSV and Initial Data Analysis	106
Multiple Data Sources within a DSV	108
Summary	109

Chapter 5: Dimension Design	111
Working with the Dimension Wizard	112
Working with the Dimension Editor	120
Attributes	121
Hierarchies and Levels	123
Browsing the Dimension	124
Sorting Members of a Level	130
Optimizing Attributes	132
Defining Translations in Dimensions	133
Creating a Snowflake Dimension	135
Creating a Time Dimension	136
Creating a Parent-Child Hierarchy	139
Summary	142
Chapter 6: Cube Design	143
The Unified Dimensional Model	143
Creating a Cube using Cube Wizard	145
Browsing Cubes	152
Cube Dimensions	156
Dimension Types	157
Browsing Reference Dimensions	162
Measures and Measure Groups	163
Calculated Members	169
Calculated Measures	170
Querying Calculated Measures	173
Creating Perspectives	173
Creating Translations	175
Browsing Perspectives and Translations	176
Summary	178
Part Two: Advanced Topics	179
Chapter 7: Advanced Topics in MDX	181
Calculation Fundamentals	182
MDX Scripts	182
Restricting Cube Space/Slicing Cube Data	197
Using the SCOPE statement	197
Using CREATE and DROP SUBCUBE	197
Using EXISTS	198
Using EXISTING	199
Using SUB-SELECT	200

Contents

Removing Empty Cells	201
Filtering Members on Axes	203
Ranking and Sorting	203
Example 1	204
Example 2	204
Example 3	204
Example 4	204
Example 5	205
Parameterize Your Queries	205
New MDX Functions	207
Summary	208
Chapter 8: Advanced Dimension Design	209
Custom Rollups	210
Enhancements to Parent-Child Hierarchies	218
Unary Operators	218
Specifying Names to Levels of a Parent-Child Hierarchy	223
Using Properties to Customize Dimensions	225
Ordering Dimensions Members	225
The All Member, Default Member and Unknown Member	226
Error Configurations for Processing	227
Storage Mode	228
Grouping Members to Form a Single Member	229
Dimension Intelligence using the Business Intelligence Wizard	230
Account Intelligence	231
Time Intelligence	235
Dimension Intelligence	239
Server Time Dimension	241
Dimension Writeback	246
Summary	249
Chapter 9: Advanced Cube Design	251
Measure Groups and Measures	252
Adding and Enhancing Dimensions	257
Fact Dimension	259
Many-to-Many Dimension	260
Data Mining Dimension	262
Role-Playing Dimensions	264
Adding Calculations to Your Cube	264
Key Performance Indicators (KPIs)	272
KPI Creation	273
Drill-Through	280

Actions	281
URL Action	282
Report Actions	287
Drill-Through Action	289
Adding Intelligence to the Cube	294
Semi-Additive Measures	294
Currency Conversion	296
Working with Partitions	301
Building a Local Partition	303
Building a Remote Partition	306
Storage Modes & Storage Settings	312
Building Aggregations	314
Defining Security	316
Summary	319
Chapter 10: Extending MDX using External Functions	321
COM User Defined Functions	322
Built-in COM UDFs	322
Creating Your COM UDFs	323
Adding a COM UDF to an Analysis Services Database	324
Accessing COM UDFs in MDX Queries	326
.NET User Defined Functions (Stored Procedures)	327
Creating Stored Procedures	327
Adding Stored Procedures	332
Querying Stored Procedures	334
Debugging Stored Procedures	336
COM UDFs vs .NET Assemblies	337
Summary	338
Part Three: Administration, Performance Tuning Integration	339
Chapter 11: Updating Your UDM Data	341
Updating Dimension Data in UDM	342
Adding a Member to a Dimension	345
Modifying Data of Members in a Dimension	348
Deleting Dimension Data	351
Updating Your Cube Data	354
Update a Single Cell Value	358
Update NON-Leaf Cell Value using Allocation	361
Summary	365

Chapter 12: Administering Analysis Services	367
Administration using SQL Server 2005 Tools	367
Managing the Server	368
Managing Analysis Services Objects	370
Processing Analysis Services Database Objects	371
Managing Partitions	382
Managing Assemblies	386
Back-up and Restore	389
Synchronization	392
Managing Security	397
Online Mode	399
Administration via Programming	402
Analysis Management Objects (AMO)	402
Back-up and Restore	410
Adding Assemblies to Analysis Services	411
HTTP Connectivity to Analysis Services	414
Legacy DSO Applications	415
Analysis Services and Fail-over Clustering	417
Summary	419
Chapter 13: Performance Optimization	421
Optimizing UDM Design	424
Fine Tuning Your Dimensions	424
Fine Tuning Your Cube	430
Optimize for Processing	437
Create Partitions to Speed Up Processing	439
Choose Small and Appropriate Data Types and Sizes	440
SQL Server and Analysis Services Installations	440
Optimizing a Relational Data Source	441
Avoid Excessive Aggregation Design	441
Use Incremental Processing when Appropriate	442
Parallelism during Processing	443
Identify Resource Bottlenecks	446
Query Performance Improvement	447
Understanding Aggregations	448
Creating Aggregations	450
Usage-Based Aggregation Design	458
Aggregation Design Options	464
Optimizing MDX Queries	469

Scalability Optimizations	473
Configuring Server Configuration Properties	473
Scale Out	475
Scale up	475
Handling Large dimensions	475
Using Profiler to Analyze Performance	476
Summary	480
Chapter 14: Data Mining	481
<hr/>	
The Data Mining Process	481
Topic Area Understanding	484
Data: Understand It, Configure It	484
Choose the Right Algorithm	485
Train, Analyze, and Predict	485
Real-World Applications	486
Fraud Detection	486
Increasing Profits in Retail	486
Data Mining in the NBA	486
Data Mining in Call Centers	487
Data Mining Algorithms in Analysis Services 2005	487
Microsoft Decision Trees	489
Naïve Bayes	489
Microsoft Clustering	489
Sequence Clustering	489
Association Rules	489
Neural Networks (SSAS)	490
Time Series	490
Microsoft Linear Regression	490
Microsoft Logistic Regression	490
Working with Mining Models	491
Relational Mining Model	491
OLAP Mining Models	512
Analyzing the Cube with a Data Mining Dimension	518
Summary	520
Chapter 15: Analyzing Cubes using Office Client Components	521
<hr/>	
Microsoft Excel Pivot Tables	522
Creating a Pivot Table against Analysis Services Data	522
Analyzing Data using Pivot Tables	528
Drilling Down to Detailed Data	536
Viewing Multiple Measures with Your Pivot Table	539

Contents

Custom Grouping within a Pivot Table	540
Formatting Your Pivot Table Report	542
Creating Pivot Chart Reports	544
Creating Local Cubes from Excel	547
Office Web Component Pivot Table	550
Analyzing UDM Data using Microsoft Data Analyzer	556
Summary	563
Chapter 16: Integration Services	565
Creating an Integration Services Project	566
Integration Services Task	566
Integration Services Transform	566
Creating Integration Services Packages for Analysis Services Operations	567
Execute DDL Task	567
Processing an Analysis Services Object	576
Loading Data into an Analysis Services Partition	579
Integration Services Tasks for Data Mining	587
Automating SSIS Packages	587
Summary	591
Part Four: Scenarios	593
Chapter 17: Reporting Services	595
Report Designer	596
Report Definition Language	596
Report Wizard	597
Report Server	597
Creating a Report on Relational Database	597
Creating Reports based on a UDM	604
Designing Your Analysis Services Report	605
Enhancing Your Analysis Services Report	610
Custom Aggregates	620
Deploying Your Report	623
Managing Your Analysis Services Reports	625
Security and Report Execution	625
Automating your Reports	628
Ad-Hoc Reports using Report Builder	629
Report Model	629
Ad-hoc Reports	632
Summary	636

Chapter 18: Designing Real-Time Cubes	637
Proactive Caching	638
Proactive Caching at Work	642
Long Latency Scenario	647
Average Latency Scenario	651
No Latency Scenario	655
Summary	658
Chapter 19: Securing Your Data in Analysis Services	659
Securing Your Source Data	660
Securing Your Dimension Data	662
Scenario using Dimension Security	663
Securing your Cube Data	683
Scenario using Cell Security	684
Summary	691
Appendix: MDX Function and Operator Reference	693
Index to Functions	693
Alphabetical Index	693
Return Type Index	696
Basic Operators	700
Value Operators	700
Constructing Tuples	702
Constructing Sets	702
Function and Operator Reference	703
Index	795

