INDEX

NUMBERS AND SYMBOLS
1-M (One-to-many) binary relationship, 81, 82, 83, 85, 110–11
1-M (One-to-many) unary relationship, 84, 85, 114–15
1NF (First normal form), 126–29
1-1 (One-to-one) binary relationship, 80–81, 83, 85, 106–10
1-1 (One-to-one) unary relationship, 84, 85, 113
2NF (Second normal form), 129–31
3NF (Third normal form), 132–34
+ (Addition operators), 197, 207
/ (Division operators), 197
% (Modulo operators), 197
* (Multiplication operators), 197, 207
– (Subtraction operators), 197

A
Accepted SQL function categories, 204
Access path, 192
Access to data/database, see also Connectivity;
    SELECT statements
        - connectivity, 369, 382–92
        - control of, 382
        - data administration, 303, 312–13
        - database controls, 386–87
        - data management, 16–18
        - defined, 13
        - indexes, 275–80
        - operations, 28
        - performance roadblocks, 264–75
        - permissions, 369, 382–87, 393–97
        - programmable objects, 284–92
        - security, 13–14, 382–92
        - server controls, 383–85
        - table access minimization, 397
        - transaction order and time, 352
        - views, 275, 280–83
Accuracy of data, 12, 13
ACID, 341
Active connections, 390
Active Directory, 383
Activity logs, 46–47, 390–91
Activity Monitor, Microsoft SQL Server, 360, 362, 390, 392
ADD, 28
Addition operators (+), 197, 207
    See also Data administration; Database administration
ADO.NET, 189, 378
Agent and alert systems, 46
Aggregate functions, 204–6, 229, 236
Airline company example, 3–5
Alerts, 272
ALL, 225
ALTER, 214, 216, 278
Amazon.com, 6
American National Standards Institute (ANSI), 185, 208
American Standard Code for Information Interchange (ASCII), 172, 387
Analysts, 52
AND logical operator, 198–200, 226–28
Anonymous access, 386
ANSI SQL-99, 202–3, 208, 210, 211, 215, 216
APIs (application programming interfaces), 189, 342,
    376–77, 380
Applications
    as bottleneck, 264
    business rules, 68–70
    creation as IT function, 52
    database design implementation, 151–52
    database performance, 264
    data requirements, 151
    design process, 61–70
    embedded SQL, 189–90
    explicit transactions, 342
    interfaces, 39, 378–82
    life cycle of database applications, 301–2, 319
    servers, 41
    software for, 39
Application support
    administration, 440–41
    centralized databases, 413
    consolidated data source, 417
    data configurations, 414–15
    data theft, 441
    distributed data configurations, 419–23, 427–34
    Internet issues, 434–41
    LAN configuration, 413–14
    multi-purposed servers, 438
    partitioned data, 425–27
    performance issues, 435–36
    privacy, 438–40
    replicated data, 423–28, 430, 433
    security, 438–40
    server configurations, 416–17, 438
    transitions in, 418
Arbitration, 312–13
Architecture of database environment
  hardware, 38–43
  people and procedures, 38–39, 50–53
  software requirements, 38, 39, 43–50
Arithmetic operators, 196–97
ASCII (American Standard Code for Information Interchange), 172, 387
Associative entities, 82, 89
Asterisk (multiplication) operators, 197
Atomicity, 341
At symbol, variables, 253
Attributes, see also Key attributes
  conversion of E-R diagrams to relational tables, 105–17
  defining, 72–73
  determinant attributes, 124–25
  explained, 34, 87
  many-to-many (M-M) relationships, 87–88
  relational database models, 72–73
  search attribute, 173
  table attribute adjustments, 167–68
  as table columns, 172
Audit trail, 315
Authentication, 13, 376–77, 382–84, 387
Authoritative, 430
Autocommit transactions, 341, 343
Automated tasks, 320
Automatic failover, 399
Automatic recovery transactions, 340
Availability of Internet, 436–37
Available utilities, 320

B
Background monitoring, 46
Backups
  servers, 399–400
    for data security, 400–405
    defined, 53
    differential backups, 401–2
    log backups, 333–36, 402
Balanced tree index, 77–78
Base objects, 76
Batches, 187, 251–56
Batch files, 157
BEGIN, 253–56
BEGIN TRAN, 336, 337, 339, 342–44, 346, 431
BETWEEN, 198, 228
Binary data, 172
Binary large object (BLOB), 36
Binary operators, 196
Binary relationships
  converting into database objects, 106–13
  defined, 79
  E-R data diagrams, 80–84
  one-to-many (1-M), 81, 82, 83, 85, 110–11
  one-to-one (1-1), 80–81, 83, 85, 106–10
Binary tree index, 77–78
Bitwise operations, 237
Blocked transactions, 353–54, 358–62
Boolean expressions, 226–28, 254
Bottlenecks, 264–65
Brackets, 195
B-T ree index, 77–78
Buffers, 41–42
Built-in functions, 204
Bulk loading, 64
Business analysts, 52
Business environment, 149, 163
Business problems, 324
Business rules, 67–70

C
Cache, 266, 340, 404
Cardinality, 80–81, 83
Cartesian product, 244
Casual users, 50, 51
Centralized databases, 413
Centralized data environment, 413
Centralized management, 432
Centralized models, 30–31
CGI (Common Gateway Interface), 380
Change auditing, 396
Change replication, 424
Character-based interfaces, SQL, 187–88
Check constraint, 160
Checkpoints, 335, 356
Child segment, hierarchical database model, 32–33
Clauses, 190
Client application software, 45
Client interface, 377
Client/server connectivity
  configurations, 40–41, 414–15
  interfaces, 376–79
  servers, 370–71, 376–79
  traditional model for, 370–71, 376
Clustered index, 77, 276
Collection of data, 7–8, 13, 25–26
Columns, see Table columns
Combining results, SELECT statements, 239–40
Command-line interface utilities, 50
Command operators
  arithmetic, 196–97
  binary, 196
  comparison, 197–201, 226, 238
  concatenation, 196–97
  defined, 186
  logical, 197–201
  precedence of, 200, 207, 322
  unary, 196
Commands
  DDL, 213–16
  DML, 208–13
  parsing, 190
  SELECT, 190–96
  SQL, 186–96, 208–16
  syntax, 190
  transactions, 336–39
Commit, 334
Commit phase, 430
COMMIT TRAN, 336, 337, 339, 342–44, 431
Common Gateway Interface (CGI), 380
Communication, see also Connectivity
  administration, 302
  DBMS interface, 49–50
  distributed data and databases, 419–23
  hardware links, 40, 42
  by operating system, 45
Comparison operators, 197–201, 226, 238
Competitive advantage, 3, 313
Composite keys, 113, 167
Computer viruses, 437
Concatenation operators, 196–97
Conceptual designs, 61–63
Concurrency
  control of, 36
  defined, 64
  designing for, 352
  distributed data and databases, 430–31
  error minimization, 352, 354, 356–58
  hybrid databases, 65
  importance of, 354
  management of, 348, 430–31
  methods of, 352–55
  overview, 347–48
  problem recognition, 324, 348–51
  in transactions, 333, 347–55
Configurations
  client/server, 40–41, 414–15
  distributed data and databases, 419–23, 427–34
  multi-tier approach, 414, 415, 416, 418, 438
Connection, 370. See also Connectivity
Connection path, 372
Connectivity
  and access, 369, 382–92
  client/server, 370–71, 376–79
  connection process, 387–92
  data protection, 392–405
  hardware, 371, 372–74
  interfaces for, 376–82
  multi-tier, 379–82
  performance management, 433–36
  security, 387–92
  software, 374–75
  World Wide Web, 371–72, 379–82
Consistency, 341
Consolidated data sources, application, 417
Constraints, 156
Consumer audience, 14
Control-of-flow statements, 252
Control statements, 252, 253–56
Conversion of relationships, see Relationship conversions
Conversion SQL function category, 204
Core business, 7–8
Correlated subqueries, 247
CREATE, 214–15
CREATE FUNCTION, 288–89
CREATE INDEX command, 175, 277–78
CREATE PROCEDURES, 286–87
CREATE TABLE command, 156, 158, 173
CREATE VIEW command, 176
Cross join, 244
CRUD, 28
Cursors, 343
Custom modeling program, 92

D
Data, see also specific topics
  accuracy, in relational database models, 70–71
  application and configurations, 414–23, 427–34
  characteristics of, 149–51
  defined, 2
  duplication of, 15
  elements of, 25–26
  flow of, 302
  integrity of, 120, 159–62
  organizing, 16, 234–36
  permissions, 393–96
  planning for, 308–9
  protection of, 12–15, 392–405
  as resource, 303
  role of, 2–3
  security, 12–15, 392–405
  sources of, 7–11
  SQL definition and manipulation, 185
  standards for, 16, 309–11
  storage formats, 44
  theft of, 441
  types of, 36, 153, 172
  volume of, 149, 163
Data abstraction, 38–39
Data administration
  access, 312–13
  competitive advantage, 313
  coordination, 308
  and database administration, 303, 307–13
  liaison requirements, 311
  management of, 308–13
  overview, 307–8
  planning, 308–9
<table>
<thead>
<tr>
<th>Index Item</th>
<th>Page Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>publicity</td>
<td>313</td>
</tr>
<tr>
<td>standards</td>
<td>16, 309–11</td>
</tr>
<tr>
<td>training</td>
<td>311–12</td>
</tr>
<tr>
<td>Data administrators</td>
<td>302–3, 317, 378–79</td>
</tr>
<tr>
<td>Data analyst</td>
<td>302</td>
</tr>
<tr>
<td>Data APIs</td>
<td>189, 342, 376–77, 380</td>
</tr>
<tr>
<td>Data application software</td>
<td>45</td>
</tr>
<tr>
<td>Database(s), see also specific topics</td>
<td></td>
</tr>
<tr>
<td>application life cycle</td>
<td>301–2, 319</td>
</tr>
<tr>
<td>basic concepts regarding</td>
<td>26–29</td>
</tr>
<tr>
<td>characteristics of</td>
<td>25–26</td>
</tr>
<tr>
<td>components of</td>
<td>38–53</td>
</tr>
<tr>
<td>DBMS components</td>
<td>45–50</td>
</tr>
<tr>
<td>defined</td>
<td>2, 25, 26</td>
</tr>
<tr>
<td>hardware</td>
<td>40–43</td>
</tr>
<tr>
<td>models of</td>
<td>31–37</td>
</tr>
<tr>
<td>optimization of</td>
<td>270, 274</td>
</tr>
<tr>
<td>people and procedures</td>
<td>38–39, 50–53</td>
</tr>
<tr>
<td>purpose of</td>
<td>6</td>
</tr>
<tr>
<td>security</td>
<td>13–14, 314–15, 382, 386–87, 397</td>
</tr>
<tr>
<td>software requirements</td>
<td>43–50</td>
</tr>
<tr>
<td>tuning of</td>
<td>53</td>
</tr>
<tr>
<td>use of</td>
<td>29–31</td>
</tr>
<tr>
<td>Database administrator</td>
<td></td>
</tr>
<tr>
<td>administration role and justification</td>
<td>302–3</td>
</tr>
<tr>
<td>application support</td>
<td>440–41</td>
</tr>
<tr>
<td>and data administration</td>
<td>307–13</td>
</tr>
<tr>
<td>database application life cycle</td>
<td>301–2, 319</td>
</tr>
<tr>
<td>decentralization requirements</td>
<td>305</td>
</tr>
<tr>
<td>external data integration</td>
<td>305</td>
</tr>
<tr>
<td>Internet</td>
<td>440–41</td>
</tr>
<tr>
<td>job specialization justification</td>
<td>304</td>
</tr>
<tr>
<td>management</td>
<td>304–5, 315–26</td>
</tr>
<tr>
<td>metadata</td>
<td>315</td>
</tr>
<tr>
<td>need justification</td>
<td>302–6</td>
</tr>
<tr>
<td>operational management justification</td>
<td>304–5</td>
</tr>
<tr>
<td>performance monitoring</td>
<td>270–75, 314</td>
</tr>
<tr>
<td>physical database</td>
<td>316</td>
</tr>
<tr>
<td>public vs. private systems</td>
<td>306</td>
</tr>
<tr>
<td>roles and responsibilities</td>
<td>307–18</td>
</tr>
<tr>
<td>security monitoring</td>
<td>314–15</td>
</tr>
<tr>
<td>software</td>
<td>316</td>
</tr>
<tr>
<td>troubleshooting</td>
<td>316–18</td>
</tr>
<tr>
<td>Database administrators</td>
<td>52, 302, 307–18, 378–79</td>
</tr>
<tr>
<td>Database design</td>
<td></td>
</tr>
<tr>
<td>administration</td>
<td>304</td>
</tr>
<tr>
<td>business rules</td>
<td>67–70</td>
</tr>
<tr>
<td>converting an entity to a table</td>
<td>105–6</td>
</tr>
<tr>
<td>converting binary relationships</td>
<td>106–13</td>
</tr>
<tr>
<td>converting E-R diagrams</td>
<td>105–17</td>
</tr>
<tr>
<td>converting unary relationships</td>
<td>113–16</td>
</tr>
<tr>
<td>database application life cycle</td>
<td>301–2, 319</td>
</tr>
<tr>
<td>and data modeling</td>
<td>61–70</td>
</tr>
<tr>
<td>data normalization</td>
<td>123–36</td>
</tr>
<tr>
<td>decision support system (DSS)</td>
<td>64–65</td>
</tr>
<tr>
<td>determination of database type</td>
<td>63–65</td>
</tr>
<tr>
<td>of functions</td>
<td>288</td>
</tr>
<tr>
<td>hybrid databases</td>
<td>65</td>
</tr>
<tr>
<td>information needs</td>
<td>26</td>
</tr>
<tr>
<td>initial process and conceptual designs</td>
<td>61–63</td>
</tr>
<tr>
<td>as IT function</td>
<td>52</td>
</tr>
<tr>
<td>logical design process</td>
<td>61–63</td>
</tr>
<tr>
<td>to minimize concurrency errors</td>
<td>352, 354, 356–58</td>
</tr>
<tr>
<td>modeling goals</td>
<td>66–68</td>
</tr>
<tr>
<td>preliminary modeling</td>
<td>66</td>
</tr>
<tr>
<td>of procedures</td>
<td>285–86</td>
</tr>
<tr>
<td>relational design comparison</td>
<td>117–23</td>
</tr>
<tr>
<td>transactional databases</td>
<td>63–64</td>
</tr>
<tr>
<td>Database designers</td>
<td>52</td>
</tr>
<tr>
<td>Database design implementation</td>
<td></td>
</tr>
<tr>
<td>application characteristics</td>
<td>151–52</td>
</tr>
<tr>
<td>application life cycle</td>
<td>301–2, 319</td>
</tr>
<tr>
<td>business environment</td>
<td>149, 163</td>
</tr>
<tr>
<td>combining tables</td>
<td>163–66</td>
</tr>
<tr>
<td>database objects</td>
<td>171–77</td>
</tr>
<tr>
<td>data characteristics</td>
<td>149–51</td>
</tr>
<tr>
<td>data integrity requirements</td>
<td>159–62</td>
</tr>
<tr>
<td>design requirements</td>
<td>147–48</td>
</tr>
<tr>
<td>final table design</td>
<td>171–73</td>
</tr>
<tr>
<td>GUI management utilities</td>
<td>155–55</td>
</tr>
<tr>
<td>hardware</td>
<td>152–53</td>
</tr>
<tr>
<td>index</td>
<td>173–75</td>
</tr>
<tr>
<td>operational requirements</td>
<td>152</td>
</tr>
<tr>
<td>performance factors</td>
<td>162–71</td>
</tr>
<tr>
<td>physical design process</td>
<td>61–63, 147–58</td>
</tr>
<tr>
<td>software environment</td>
<td>152–53</td>
</tr>
<tr>
<td>splitting tables</td>
<td>168–70</td>
</tr>
<tr>
<td>SQL Command Utilities</td>
<td>155–58</td>
</tr>
<tr>
<td>table attribute adjustments</td>
<td>167–68</td>
</tr>
<tr>
<td>view implementation</td>
<td>175–77</td>
</tr>
<tr>
<td>Database engines</td>
<td>45–47</td>
</tr>
<tr>
<td>Database management</td>
<td></td>
</tr>
<tr>
<td>administration</td>
<td>304–5, 315–26</td>
</tr>
<tr>
<td>application life cycle</td>
<td>301–2, 319</td>
</tr>
<tr>
<td>automation</td>
<td>321</td>
</tr>
<tr>
<td>concurrency</td>
<td>348, 430–31</td>
</tr>
<tr>
<td>connectivity controls</td>
<td>382–92</td>
</tr>
<tr>
<td>distributed database model</td>
<td>432, 434</td>
</tr>
<tr>
<td>maintenance plans</td>
<td>52–53, 322–24</td>
</tr>
<tr>
<td>metadata</td>
<td>315</td>
</tr>
<tr>
<td>ongoing tasks</td>
<td>321–24</td>
</tr>
<tr>
<td>operational management justification</td>
<td>304–5</td>
</tr>
<tr>
<td>physical databases</td>
<td>316</td>
</tr>
<tr>
<td>publicity</td>
<td>313</td>
</tr>
<tr>
<td>SELECT</td>
<td>193–96, 229–31</td>
</tr>
<tr>
<td>software</td>
<td>316</td>
</tr>
<tr>
<td>task performance</td>
<td>319–21</td>
</tr>
<tr>
<td>transaction concurrency</td>
<td>348</td>
</tr>
<tr>
<td>troubleshooting</td>
<td>316–18, 324–26</td>
</tr>
<tr>
<td>utility choices</td>
<td>320</td>
</tr>
</tbody>
</table>
Database management systems (DBMS), see also Applications; Transactions
Administrative needs, 303
Communications interface, 49–50
Components, 43–50
Concurrency, 347–55
Database engine, 43–47
In database environment overall architecture, 38, 39
Data dictionary, 47
Data manipulation, 185
Data type selection, 172
Defined, 27, 39
Forms generator, 49
Hardware performance, 265–70, 314, 436
Operating systems and storage formats, 44
Origins of, 5
Query processor, 47–49
Report writer, 49
Securables, 394–96
Security, 382
Database models
Centralized, 30–31
Database design goals, 66–68
Database objects, 75–79
Deployment, 30
Distributed, 31
Hierarchical, 32–33
Hybrid, 32, 65
Navigational approaches, 31
Network, 33–34
Object-oriented, 32, 35–36
Object-relational, 36–37
Relational, 31–32, 34–35
Relational database, 31–32, 34–35, 70–75
Database objects
Converting binary relationships into, 106–13
Converting unary relationships into, 113–16
Database design, 106–16
DDL commands, 213–14
Final table design implementation, 171–73
Implementation of, 171–77
Index implementation, 173–75
Modeling of, 75–79
Object-oriented model, 32, 35–36
Object-relational model, 36–37
Performance, 270
Programmable objects, 284–92
View implementation, 175–77
Database performance, see Performance
Database persistence, 436
Database practitioners, 28
Database servers, see also Microsoft SQL Server 2005
Access controls, 383–85
Application configurations, 416–17
Application software, 45
Backup servers, 399–400
Client/server connectivity, 370–71, 376–79
Dedicated servers, 266–67
Defined, 41
Direct connection to, 371
Multi-purposed servers, 416, 438
Protection and security, 383–85, 399–400, 404–5, 415
Proxy servers, 436
Database software, 27. See also Software
Data carousel, 403
Data catalog, 38
Data collection, 7–8, 13, 25–26
Data consumers, 11, 14, 38, 302
Data definition language (DDL)
ALTER, 214, 216
Commands, 185, 186, 213–16
CREATE, 214–15
Defined, 186
DROP, 214, 216
SQL, 213–16
Triggers, 162
Data diagrams, 82. See also Entity-relationship (E-R) data diagrams
Data dictionary, 38, 39, 43, 47
Data encryption, 439
Data management
Access to data, 16–18
Accuracy of data, 12, 13
Administration, 308–13
Coordination, 308
Data planning, 308–9
distributed data models, 31, 432, 434
Need for, 5–6
Organization of data, 16
Potential concerns, 12–18
Roles in, 2–3
Security, 12–15, 392–405
Sources of data, 7–12
Standards, 309–11
Data manipulation language (DML)
Commands, 208–13
Defined, 186
DELETE, 208, 211–12
Embedding, 213
Expression evaluation, 208–10
INSERT, 208–9
Parameters, 212–15
SQL, 208–13
UPDATE, 208, 209–11
Data mart, 65
Data mining, 5–6
Data modelers, 52
Data models
database and application design, 61–70
data comparison, 91–97
defined, 61
distributed data, 31, 432, 434
modeling tools, 92–96
relationships, 79–91
Data normalization
    database design, 123–36
database performance, 265
decomposition process, 123–34
defined, 123
denormalizing data, 134–36, 166
exception conditions, 126
new table discovery, 135
normalization techniques, 123–25
and performance, 162
shortening the process, 134
unnormalized data, 126
Data objects
    embedded SQL, 189
    large object (LOB) data, 70, 172
    managed, 394–96
    many-to-many (M-M) relationships, 111–13, 115–16
    programmable objects, 284–92
Data query, 17
Data query language (DQL), 185
Data read/write and performance, 264
Data repository, 27, 38, 39, 42
Data retrieval, see also Indexes; SELECT statements
    as data manipulation, 185
    joins, 242–46
    SELECT statements, 193–96
    subqueries, 242, 246–50
Data security, 12–13, 392–405
Data volatility, 149
Data warehouse, 64–65, 67
Date/time data, 172, 204, 352
DBMS, see Database management systems (DBMS)
DB2 software, 185
Deadlocks, 357–58, 361
Decentralization, database administration, 305
Decision-support databases, 29, 30
Decision support system (DSS), 64–65, 417
Declarative statement, 192
Decomposition process, 123–34
Dedicated servers, 266–67
Default constraint, 160
Default database, 191
Defining associations, 123–25
DELETE, 28, 185, 208, 211–12
Denial of Service (DoS) attacks, 437
Denormalization, 134–36, 166
Deployment models, 30
Design of database, see Database design
Determinant attributes, 124–25
Deterministic functions, 202
Diagrams, see Entity-relationship (E-R) data diagrams
    Differential backups, 401–2
    Direct memory access (DMA), 42
    Dirty pages, 340
    Dirty read, 349
    Disk drive performance, 265–68
    Disk duplexing, 398
    Disk fragmentation, 267
    Disk mirroring, 398
    Disk queue, 265
    Disk striping with parity, 398–99
    DISTINCT, 225
    Distributed data and databases
        application software, 45
        application support, 419–23
        concurrency management, 430–31
        configuration, 419–23, 427–34
        join, 431
        management models, 31, 432, 434
        models, 31
        operations, 433
        queries management, 431–32
        support for, 429–34
        transaction management, 430–31
    Division operators (/), 197
    DLL, see Data definition language
    DMA (direct memory access), 42
    DML, see Data manipulation language (DML)
    Domain integrity, 159–60
    Domains, 215, 383
    DoS (Denial of Service) attacks, 437
    DQL (data query language), 185
    DROP, 214, 216, 278
    DSS (decision support system), 64–65, 417
    Durability, 341
    Dynamic SQL, 186–89
E
    Electronic data interchange (EDI), 310
    Embedded SQLs, 186, 189
    Embedding DML, 213
    END, 253–56
    Enterprise Resource Planning (ERP) software, 305
    Entities
        associative entities, 89–90
        defined, 34
        defining, 71–72
        E-R modeling, 71–75
        integrity of, 159, 160
        intersection data, 88–89
        relational database models, 70–75
        relationships, 35
        Entity-Relationship Diagram (ERD), 66, 92–96
        Entity-relationship (E-R) data diagrams
            binary relationships, 80–84
            cardinalities, 80–81, 83
conversion to relational tables, 105–17
E-R model, 80–82
modality, 82–83
modeling, 71–75, 80–81
modeling tools, 92–96
unary relationships, 84–86
Equal to operators, 197–98, 226
ERD (Entity-Relationship Diagram), 66, 92–96
ERP (Enterprise Resource Planning) software, 305
Errors
concurrency, 352, 354, 356–58
data protection, 393
error logs, 46–47, 361
SQL, 190
EXCEPT, 239–40
Exception conditions, 126
Exclusive locks, 353
Execution
with Boolean expressions, 254
query plans, 48–49
SQL commands, 186–89
Explicit conversion, 196
Explicit transactions, 341–42
Expressions
Boolean, 226–28, 254
defined, 195
DML commands, 208–10
parentheses, 207
SELECT commands, 194–98
SQL-99 functions, 202–3
External data integration, 305
F
Fault detection, operating system, 45
Fault-tolerant storage, 15, 397
Fields, 75
File management, operating system, 45
Filtering results, 226–29, 280–81, 291–92
Firewalls, 438–39
First normal form (1NF), 126–29
Fixed length data, 172
Flows of data, 11
Foreign keys, 34–35, 160–61
Forms generator, 49
Fragmentation, 321, 427
FROM, 190, 242–43, 279
Front-end tools, 39
Full backups, 401
Fully qualified object name, 156
Functionality, 320
Functions
creating, 288–92
defined, 186
dependencies, 123
programmable objects, 284, 287–92
SQL, 201–8
variations in, 202–7
G
Galileo spacecraft, 18
Gateway computers, 413
Generic draw program, 92
Globally unique identifier (GUID), 160
Graphical user interface (GUI), 50, 154–55, 188–89
Greater than operators, 197–98, 226
Greater than or equal to operators, 198, 226
GROUP, 234–37
GROUP BY, 225
Guest account, 386
H
Hard drive performance, 265–68
Hardware
backups, 401–4
connectivity, 371, 372–74
database design implementation, 152–53
database environment architecture, 38–43
defined, 39
Internet performance management, 436
operating system management, 43
performance, 265–70, 314, 436
platforms as bottleneck, 264
RAID, 40, 42, 398
HAVING, 225, 236–37
Heterogeneous data environment, 31
Hierarchical database model, 32–33
Historic data sources, 10
Horizontal partitioning, 168, 427
Human data sources, 10–11
Hybrid databases, 32, 65
Hypertext Transfer Protocol (HTTP), 379–80
I
Identifiers, 72–73, 90–91, 252
IM (instant messaging), 370, 374
Implementation of database, see Database design implementation
Implicit conversion, 196
Implicit transactions, 342–43
IN, 228
Inactive portion, 402
Inconsistent analysis, 350
Incremental backups, 401
Indexed view, 283
Indexes, see also Tables
access, 275–80
creating, 277–78
as database objects, 77–79
defined, 77
designing, 276–77
INDEX

... implementation of, 173–75
query optimization, 279–80
Index keys, 176
Individual users, 51
Information, see also specific topics
  current, as data source, 9–10
  in database design, 26
  defined, 2
  role in data management, 2
Information services (IS), 302, 305, 310, 311, 314, 316
Information Technology (IT), 25, 38–39, 50–53
Informix software, 185
In-line table-valued functions, 288
Inner join, 244
Input/output (I/O), 40, 42, 45, 347
Input parameters, 284
INSERT
  DML commands, 208–9
  keyword combinations, 240–42
  procedures, 285–86
  views, 283
Insertion of new records, 185
Instant messaging (IM), 370, 374
Integrated security, 387
Integration, external data, 305
Integrity of data, 120, 159–62
Interaction and conflict, 320
Interactive SQL, 186–89
Interfaces
  application programming interfaces (APIs), 189, 342, 376–77
  character-based, 187–88
  client/server, 376–79
  command-line interface, 50
  connectivity, 39, 376–82
  DBMS, 49–50
  graphical user interface (GUI), 50, 154–55, 188–89
  network interface card (NIC), 373
International Organization for Standardization (ISO), 185
Internet, see also World Wide Web (WWW)
  administration, 440–41
  application support, 434–41
  availability issues, 436–37
  connectivity, 371–72
  data theft, 441
  performance issues, 435–36
  privacy, 438–40
  security, 438–40
  traffic on, 435–36
INTERSECT, 239–40
Intersection data, 87, 88–89
INTO, 225
I/O (input/output), 40, 42, 45, 347
IS (information services), 302, 305, 310, 311, 314, 316
ISO (International Organization for Standardization), 185
Isolation in transactions, 341, 352–53, 356–58
IT (Information Technology), 25, 38–39, 50–53
J
Job specialization, 304
JOIN, 225, 242–44
Join
  data normalization, 135
  defined, 242
  distributed join, 431–32
  explained, 242–44
  indexes, 279–80
  and performance, 162–63
  syntax, 244–46
K
Key attributes
  composite keys, 113, 167
  foreign keys, 34–35, 160–61
  index keys, 176
  primary keys, 34–35, 72–73, 107, 160
Key columns, 276
Keywords
  combining, 241
  DDL commands, 214–15
  SELECT, 225–26, 240–42
  SQL commands, 186, 190
Kill, 360, 362
L
LANs (local area networks), 372–73, 413–14
Large object (LOB) data, 70, 172
Latency, 424
Leaf nodes, 79
Less than operators, 197–98, 226
Less than or equal to operators, 198, 226
Liaison requirements, data administration, 311
Life cycle of database applications, 301–2, 319
LIKE, 198, 201, 229
Linux, 43
LOB (large object) data, 70, 172
Local area networks (LANs), 372–73, 413–14
Local autonomy, 421
Localized management with central oversight, 434
Local variables, 253
Lock, 353
Locking levels, 353
Lock scope, 353
Log backups, 335–36, 402
Logical designs, 61–63
Logical operators, 197–201, 226–28
Login credentials, 369, 384
Logins, 369, 382–85
Lost updates, 349
M
Mainframe, 40
Main memory, 40, 41
Maintenance plans, 52–53, 322–24
Managed objects, 394–96
Management, see Database management; Data management
Manual failover, 399
Manual modeling, 92
Manual tasks, 320
Many-to-many (M-M) binary relationship, 81–85, 87–90, 111–13
Many-to-many (M-M) relationships, 87–91
Many-to-many (M-M) unary relationships, 84, 85–86, 115–16
Mass deployment databases, 29
Mathematical SQL function category, 204
Member records, network database models, 33–34
Memory and performance, 266, 268–69
Memory buffers, 41–42
Memory management by operating system, 45
Merge replication, 424
Merge-scan join, 280
Metadata, 43, 47, 315
Microsoft Access, 44, 306
Microsoft Developer Network (MSDN), 225, 253
Microsoft Distributed Transaction Coordinator (MS DTC), 431
Microsoft Maintenance Plan Wizard, 322–23
Microsoft SQL Server 2005
  Activity Monitor, 360, 362, 390, 392
  automation, 321–22, 325
  command context, 191
  configurations, 414–17
  connectivity interfaces, 376–77
  database performance, 266–67
  distributed data, 415–17, 431–32, 439
  functions, 204, 288
  hardware performance, 265–70
  indexed view, 176–77
  interactive SQL, 187
  maintenance, 322–23
  Management Studio, 188–89, 320, 386, 390
  object-relational database model, 36
  performance monitoring, 270–75
  programmable objects, 284–92
  query mode, 187
  security, 382–83, 439
  SELECT, 185–87, 191–92, 208, 213, 224, 225
  server security and access, 383–92
  transaction management, 355–62
  triggers, 162
  troubleshooting, 324–25
  utility decisions, 320
  Windows authentication, 383–84, 387, 391–92
Microsoft Visio, 92–93
Microsoft Windows
  access authentication, 383–84, 387, 391–92
  disk fragmentation utility, 267
  as PC operating system, 43
  performance monitors, 271–72, 275
  security, 387
Middleware, 379
Mini-computer, 40
Minimally logged operation, 212
Minus sign operators, 197
Mirror image, 15
Mixed authentication, 383
M-M (many-to-many) binary relationship, 81–85, 87–90, 111–13
M-M (many-to-many) relationships, 87–91
M-M (many-to-many) unary relationships, 84, 85–86, 115–16
Modalities, 82–83
Models, see Database models; Data models
Modems, 373–74
Monitoring
  active connections, 390
  activity logs, 46–47, 390–91
  Activity Monitor, Microsoft SQL Server 2005, 360, 362, 390, 392
  background, 46
  performance, 270–75, 314
  security, 314–15
MSDN (Microsoft Developer Network), 225, 253
MS DTC (Microsoft Distributed Transaction Coordinator), 431
Multiplication operators (*), 197, 207
Multi-purposed servers, 416, 438
Multi-statement table-valued functions, 288
Multi-tier approach, data configuration, 414, 415, 416, 418, 438
Multi-tier connectivity, 379–82
Mutual authentication, 376–77
MySQL software, 185, 186, 417
Navigational approaches to databases, 31
Nested-loop join, 280
Nested procedures, 286
Nested subqueries, 242, 246–47
Nested transactions, 343–45
NET Framework, 378, 390
Network adapter, 373
Network interface card (NIC), 373
Networks
  database models of, 33–34
  defined, 39
  local area networks (LANs), 372–73, 413–14
  operating system controls, 45
  shared for data backup, 402–4
INDEX

virtual private network (VPN), 374
wide-area network (WAN), 374
Node, 79
Nonclustered index, 77, 276
Noncorrelated subqueries, 246–47
Nondeterministic functions, 202
Non-logged operation, 212
Non-loss decomposition, 125
Nonrepeatable read, 350
Nonvolatile storage media, 42
Normal forms, see also Data normalization
defined, 126
first normal form (1NF), 126–29
second normal form (2NF), 129–31
third normal form (3NF), 132–34
Not equal to operators, 198
NOT logical operator, 198
Not operators, 198
NULL, 209, 291
Nullability, 159
Null value, 107
Numeric data, 172
Numeric SQL function category, 204

O
Object-oriented database model, 32, 35–36
Object-relational database management systems
(ORDBMS), 36
Object-relational database model, 36–37
Object-relation models (ORM), 92–93
Objects, see Database objects; Data objects;
Programmable objects
Objectype, 214
ODBC (Open Database Connectivity), 377
OLE DB, 377, 378, 390
OLTP (online transaction processing), 64–65
One-tier security system, 383
One-to-many (1-M) binary relationship, 81, 82, 83, 85, 110–11
One-to-many (1-M) unary relationship, 84, 85, 114–15
One-to-one (1-1) binary relationship, 80–81, 83, 85, 106–10
One-to-one (1-1) unary relationship, 84, 85, 113
Online transaction processing (OLTP), 64–65
Open Database Connectivity (ODBC), 377
Open transactions, 344–45
Operating system software (OSS), 43–45
Operating systems (OS), 43–45, 269
Operations and operators, see also Command operators
access, 28
management and database administration, 304–5
precedence in SELECT, 237–38
requirements, database design implementation, 152
SQL, 196–201
transaction limits, 352
Optimistic processing, 354
Optimization, database, 274
Oracle software, 36, 185, 380
ORDBMS (object-relational database management systems), 36
ORDER BY, 225, 236–37, 280
Order processing, transactions, 334–35
Organizing data, 16, 234–36
OR logical operators, 198–201, 226–28
ORM (object-relation models), 92–93
OS (operating systems), 43–45, 269
OSS (operating system software), 43–44
Outer join, 244
Output parameters, 284
Owner records, network database, 33–34

P
Packet size, 387
Paging file, 269
Parameters
command syntax, 190
DML commands, 212–15
embedded SQL, 189
programmable objects, 284
SELECT, 195
SQL-99 functions, 203
Parentheses in expression evaluation, 207
Parent segment, hierarchical database model, 32–33
Parity, disk striping with, 398–99
Parsing, 190
Partial functional dependency, 129
Partial rollback, 336
Partial updates, 334
Partitioned data, 425–27
Passwords, 382–83, 385
People
data administrators, 302–3, 317, 378–79, 384
database administrators, 52, 302, 307–18, 378–79, 384
database designers, 52
database environment architecture, 25, 38–39, 50–53
database practitioners, 28, 38, 39, 50–53
data consumers, 11, 14, 38, 302
data modelers, 52
programmers, 52
stakeholders, 61
training for data administration, 311–12
users, 39, 50–51, 382
Percent sign (%), Modulo operators, 197
Performance
access roadblocks, 264–75
administration needs, 303
application support, 435–36
baseline, 271
bottlenecks, 264–65
counters, 271  
database design implementation, 162–71  
database optimization, 267, 270, 274  
hardware, 265–70, 314, 436  
Internet, 433–36  
Microsoft Windows utilities, 271–72  
monitoring, 270–75, 314  
    objects, 271  
tools for, 274–75  
transaction isolation level, 356–58  
Periodic task automation, 270–75  
Permissions to access, 369, 382–87, 393–97  
Phantom reads, 351  
Phantoms, 351  
Physical database designs  
    application data requirements, 151–52  
    business environment, 149, 163  
    and database administration, 316  
    data characteristics, 149–51  
    design process, 61–63  
    design requirements, 147–49  
    GUI utilities, 154–55  
    hardware, 152–54  
    implementation, 61–63, 147–48  
    operational requirements, 152  
    software environment, 152–54  
    SQL Command Utilities, 153–58  
Physical data pointers, 32–33, 34  
Physical data storage, 402–5  
Physical entities, 71  
Physical security, 15–16  
Plus sign operators, 197  
Policy integrity, 159, 161  
Power users, 51  
Practitioners, 38, 39, 50–53  
Precedence constraints, 322  
Preliminary modeling, database design, 66  
Prepare phase, 430  
Primary index, 77  
Primary keys, 34–35, 72–73, 107, 160  
Primary process identification, 8–9  
Privacy, 438–40  
Private databases, 30  
Problems, recognition and resolution, 324, 345–51  
Procedures  
    architecture of database environment, 38–39, 50–53  
    database design, 285–86  
    programmable objects, 285–87  
    SQL commands, 186  
Processors and processing  
    affinity, 270  
    client/server configurations, 40–41, 414–15  
    concurrency, 347  
    as hardware, 40, 41  
    management by operating system, 43  
    performance, 269–70  
Production, database application life cycle, 301–2, 319  
Production databases, 29  
Programmable objects  
    defined, 284  
    functions, 287–92  
    procedures, 284–87  
Programmers, 52  
Protection, see Security  
Protocol, 374  
Proxy servers, 436  
Public accounts, 386  
Publicity, 313  
Q  
Qualifying conditions, 190  
Queries  
    aggregate functions, 229, 236  
    batches, 251–56  
    control statements, 253–56  
    defined, 45  
    distributed query, 431–32  
    execution plans for, 48–49  
    joins, 242–46  
    as procedure, 52  
    scripts, 251–56  
    subqueries, 242, 246–50  
    syntax of, 224–42  
    variables, 252–53  
Query Analyzer, 189  
Query mode, 187  
Query optimizer, 47  
Query processor, 47–49  
Query scale, 436  
Query window, 369  
R  
RAID  
    database performance, 265–66  
    data protection, 397–400  
    disk mirroring, 308  
    disk striping with parity, 398–99  
    fault-tolerant storage, 15, 397  
    hardware, 40, 42, 398  
    security, 397–400  
    software configurations, 398  
Random write, 404  
RDBMS (relational database management system), 37  
READ, 28  
Read committed, 356  
Read uncommitted, 356  
Records, 75  
Recovery, 45, 53, 336, 340  
Redundant Array of Independent Disks, see RAID  
Referencing entities, 74  
Referential integrity, 74, 120, 159, 160–61
Regular users, 50–51
Relational database design, 117–23
Relational database management system (RDBMS), 37
Relational database models, 31–32, 34–35, 70–75
Relational integrity, 120
Relational result, 191
Relationship conversions
  - binary, into database objects, 106–13
  - in database design, 105–17
  - of E-R diagrams to relational tables, 105–17
  - single entity to a table, 105–6
  - unary, into database objects, 79, 84–86, 113–16
Relationships, 35
Removable media, 403
Removable storage, 43
Repeatable read, 356–57
Replication, 423–28, 430, 433
Reporting and reports, 49, 52, 65, 320
Resources, transaction concurrency, 352
Response time, 149, 435
Result set, 191
Retirement, database application life cycle, 301–2, 319
Retrieval, see Data retrieval
Roles
  - of administrators, 52, 302, 307–18, 378–79, 384
  - of data, 2–3
  - of databases, 2
Rollbacks, 334
ROLLBACK TRAN, 334, 336, 337, 338, 339, 342, 344, 346, 352, 431
Rolled forward, 336
Routine maintenance, 52–53, 322–24
Rows, see Table rows
Rules, business, 67–70

S
Scalability, 67, 437
Scalar functions, 284, 288, 291
Scaling out, 153
Scaling up, 153
Schema, 43
Schema binding, 283
Scope of transactions, 341–45
Scripts, 187, 251–56
Search argument, 190
Search attribute, 173
Search conditions, 196, 210–12
Secondary index, 77
Secondary storage, 42
Second normal form (2NF), 129–31
Securables, 394
Security
  - access, 13–14, 382–92
  - administration monitoring, 314–15
  - application support, 438–40
  - backups, 400–405
  - backup servers, 399–400
  - change auditing, 396
  - connection process, 387–92
  - connectivity, 392–405
  - context of, 382
  - data backups, 400–405
  - database protection, 386–87, 397
  - data management, 12, 13–15
  - data permissions, 393–96
  - data protection, 12–15, 392–405
  - DBMS, 382
  - Internet, 438–40
  - logins, 369, 382–85
  - managed objects, 394–96
  - permissions, 393–96
  - physical security, 15–16
  - privacy, 438–40
  - RAID configurations, 397–400
  - server protections, 383–85, 399–400, 404–5
  - table access minimization, 397
  - triggers, 161–62
Security principals, 382, 383, 385
Selectivity, 173
SELECT statements
  - batches, 251–56
  - combining results, 239–40
  - command operators, 196–201
  - command syntax, 190, 192–93
  - control statements, 253–56
  - data retrieval, 193–96
  - explained, 195
  - expression evaluation, 194–98
  - filtering results, 226–29
  - GROUP, 234–37
  - joins, 242–46
  - keyword combinations, 240–42
  - managing results set, 229–31
  - operator precedence, 237–38
  - organizing data, 234–36
  - parameters, 195
  - permissions, 396
  - scripts, 251–56
  - sorting data, 231–34
  - SQL, 190, 192–96
  - subqueries, 242, 246–50
  - syntax of, 190, 224–42
  - variables, 252–53
Serialization, 352–53, 357
Server instances, 416
Servers, see Database servers
Shared data, 26
Shared lock, 353
Shared network for data backup, 402–4
Single-tier security system, 383
Slash (/), division operators, 197
Snapshot, 357
Snapshot replication, 424
Software, see also under Microsoft connectivity, 374–75
database administration, 316
database design, 152–53
database environment architecture, 38, 39, 43–50 explained, 27
Internet performance management, 436
RAID configurations, 398
Sorting data, SELECT, 231–34
Sources of data, 7–11
Specialized users, 51
Speed of storage devices, 43
sp_helpdb system, 284–85
Split reads, 398
SQL, see Structured Query Language (SQL)
sqlcmd connections, 187, 369, 390
SqlConnection object, 390
SQL Server, see Microsoft SQL Server 2005
Stakeholders, 61
Standards
ANSI, 172, 387
ANSII, 185, 208
data, 16, 309–11
SQL, 185–86
Storage devices, 15, 40, 41, 402–4
Strategic data planning, 309
String data, 172
String SQL function category, 204
Strong password, 385
Structured Query Language (SQL)
ANSI SQL-99, 202–3, 208, 210, 211, 215, 216
command execution, 186–92
command utilities, 155–58
data definition, 185
data manipulation, 185
DDL commands, 213–16
defined, 17, 47
DML commands, 208–13
dynamic SQL, 186–89
embedded SQL, 186, 189
functions, 201–8
interactive SQL, 186–89
Native Client, 377
operators, 196–201
query mode, 187
SELECT commands, 190, 192–96
standards, 185–86
Subqueries, 198, 242, 246–50
Subtraction (−) operators, 197
Surface area, 14
Syntax of statements, 190, 224–42

Systems analysts, 52, 302
Systems software, 39
System stored procedures, 284

T
Table alias, 243
Table columns
attributes as, 172
combine SELECT results, 239–40
filtering results, 280–81, 291–92
index implementation, 173–74
vertical partitioning, 168–69, 427
Table orders, 231
Table rows
filtering results, 280–81, 291–92
horizontal partitioning, 168, 427
Tables, see also Indexes
access, 243, 397
attribute adjustments, 167–68
combining, and database design, 163–66
as database objects, 75–76
data normalization, 123–36
data protection, 397
DML commands, 208–13
E-R diagram conversion to, 105–17
filtering results, 280–81, 291–92
final design implementation, 171–73
joining two or more, 242–46
relational database models, 34
splitting, 168–70
Telecommunication, distributed databases, 419–23
Temporary tables, 215
Ternary relationships, 79, 86–87
Third normal form (3NF), 132–34
Three-tier approach, data configuration, 414, 415, 416, 418
Threshold values, 272
Throughput, 64, 149
Time
of backup, 401
date/time data, 172, 204, 352
response time, 149, 435
time-outs, 359
timestamp ordering, 353
Tools and utilities
available utilities, 320
client connectivity interface, 377–78
command-line interface utilities, 50
DBMS, 50
GUI utilities, 50, 154–55
for modeling, 92–96
performance, 274–75
performance monitoring, 270–75
SQL command, 155–58
toolkits, 50
TOP, 225, 280
Training for data administration, 311–12
Transactional database, 63–64
Transactional replication, 424
Transactions
ACID, 341
autocommit, 341, 343
automatic recovery, 340
BEGIN TRAN, 336, 337, 339, 342–44, 346
blocked transactions and deadlocks, 358–62
commands, 336–39
COMMIT TRAN, 336, 337, 339, 342–44
concurrency, 347–55
control of, 186
defined, 28, 334
design to minimize concurrency errors, 352, 354, 356–58
distributed data and database management, 430–31
explicit, 341–42
flow of, 336–41
implicit, 342–43
isolation of, 341, 352–53, 356–58
logs and log backups, 335–36, 402
Microsoft SQL Server 2005 management, 355–62
nested transactions, 343–45
problem recognition and resolution, 324, 345–47
processing basics, 333–36
properties of, 341
ROLLBACK TRAN, 334, 336, 337, 338, 339, 342, 344, 346, 352
scheduling, 352
scope of, 341–45
size of, 352
support for, 28–29
Transact-SQL (TSQL), 187, 237, 288
Transitions in application support, 418
Transitive dependency, 132
Triggers, 161–62
Troubleshooting, database administration, 316–18
Trusted connections, 387–88
two-phase commit, 430
two-tier approach, data configuration, 414, 415
two-tier security system, 382–83

U
UDFs (user-defined functions), 224, 287–89, 291, 397
Unary operator, 196
Unary relationships, 79, 84–86, 113–17
Uncommitted dependency, 349
Unicode, 172, 387
Unified Modeling Language (UML), 37
Uninterruptible power source (UPS), 404–5
UNION, 239–40
Unique constraint, 160
Unique identifiers, 90–91
Uniqueness, 90–91
Unnormalized data, 126
UPDATE, 28, 208–11, 240–42, 283
Update of data, 185
Usage, 52
User-defined data type, 215
User-defined functions (UDFs), 224, 287–89, 291, 397
Users, 39, 50–51, 382
Utilities, see Tools and utilities

V
Validation and authentication, 13, 376–77, 382–84, 387
Variables, 252–53
Verification of data source, 13
Vertical partitioning, 168–69, 427
Views
access, 275, 280–83
creating, 280–81
as database objects, 75–77
defined, 44
implementation of, 175–77
replacing, 291
using, 281–83
Virtual desktop, 155
Virtual private network (VPN), 374

W
Well-connected servers, 431
WHERE, 190, 210–11
Wide-area network (WAN), 374
WiFi, 372–73
Windows, Microsoft, see Microsoft Windows
Wireless connectivity, 372–73
Working database, 191
World Wide Web (WWW), see also Internet connectivity, 371–72, 379–82
database access, 379–80
e-commerce growth, 437
multi-tier connectivity, 379–82
Writing batches and scripts, 251–52

X
XML, 33, 225, 377