

# Index

## A

- Access control, 64, 91–103, 319
  - authority (ACCESSCTRL), 71
  - fine-grained (FGAC), 92
  - Label-Based Access Control (LBAC), 6, 40, 64, 68, 70, 96–104
  - Row and Column Access Control (RCAC), 2, 6, 8, 40, 63, 64, 68, 70, 80, 91–96
- Access plans, 293, 294, 295, 301
- ACCESSCTRL authority, 71, 77, 83, 86, 90
- Active log, 133
- ADO/ADO.NET, 15, 143
- Advanced Copy Services (ACS), 40
- AFTER triggers, 120, 333, 334, 336, 337, 338. *See also* triggers
- Aggregations, 47
- AIX, 36, 38, 42, 44, 45, 61, 65
- Aliases, 14, 75, 80, 81, 109, 117–118, 137, 192
  - chaining and, 118
  - constraints and, 117
  - creating (CREATEALIAS privilege), 80
  - nicknames vs., 81
  - SQL and, 118
  - uses for, 118
- ALL PRIVILEGES clause, 86, 88, 90
- ALTER nickname privilege, 81
- ALTER sequence privilege, 77
- ALTER SEQUENCE statement, 117
- ALTER table privilege, 75
- ALTER TABLE statement, 54, 93, 95, 102, 103, 104, 146, 268, 317, 318, 319, 361, 363, 369
- ALTERIN privilege, 75
- Ambiguous cursors, 215, 217
- Analytics, 46
- Application period, 144
- Application programming interfaces (APIs), 56, 67, 122, 124, 236, 242
- Application time, 144
- ARCHIVE LOG command, 69
- Archive log, 133
- ARCHIVE privilege, 80
- AS/400, 36
- ASC (ascending) sort, 186, 187
- Assembler, 124, 243
- Atomic nature of transactions, 248, 335
- Audit Facility, 42
- Authentication, 64–67
  - CLIENT, 66
  - DATA\_ENCRYPT, 66
  - DATA\_ENCRYPT\_CMP, 66
  - DB2 Database Manager configuration file and, 65
  - encryption and, 67
  - Generic Security Service Application Program Interface (GSS-API) and, 67
  - GSS\_SERVER\_ENCRYPT and, 67
  - GSSPLUGIN, 67
  - KERBEROS, 66–67
  - KRB\_SERVER\_ENCRYPT and, 67

passwords and, 65, 66, 67  
SERVER, 66  
SERVER\_ENCRYPT, 66  
type, 65  
types of, 66–67  
user ID and, 65, 66, 67  
where performed, 65

Authorities, 2, 6, 8, 10, 14, 40, 64, 67–91, 104, 105, 152.  
*See also* privileges

ACCESSCTRL, 71, 83, 85, 86, 90  
administrative, 68–72  
DATAACCESS, 71, 83, 85, 91, 96  
database-level, granting and revoking, 70  
DBADM, 70, 80, 83, 85  
DBCTRL, 70, 71, 80  
DBMAINT, 70, 71  
granting of, 83  
Installation SYSADM, 68, 69, 71  
Installation SYSOPER, 69, 71  
Label-Based Access Control (LBAC) and, 97, 101  
PACKADM, 70, 71  
revoking, 88–91  
SECADM, 6, 70, 71, 72, 77, 83, 86, 90, 94, 96, 97, 101, 104  
SQLADM, 71  
SYSADM, 68, 72, 94, 96, 104  
SYSCTRL, 68–69  
SYSMAINT, 69, 71  
SYSMON, 69, 71  
SYSOPER, 69, 71  
System DBADM, 70, 71  
WLMADM, 71, 83

Authorization ID, 74, 83, 85, 89, 101, 104, 105, 110, 140, 141, 308, 309, 314, 316, 322  
privilege, 74

Authorizations, 63, 64, 68, 130, 134

Automatic commit feature, 248

Automatic maintenance, 42

Automatic storage, 5, 12, 42, 129, 136, 137

AUTOMATIC STORAGE clause, 136, 137

Autonomic features, 41–42

*autorestart* parameter, 252

Availability, 5, 12, 40, 41, 46, 47, 48, 50, 51, 61, 125. *See also* High availability; High Availability Disaster Recovery (HADR)

**B**

Backups, 5, 7, 8, 10, 12, 39, 40, 42, 46

Base tables, 111, 113, 319, 320–322

BEFORE triggers, 112, 120, 333, 336–337. *See also* triggers

BEGIN ATOMIC keywords, 335

BETWEEN predicate, 172–173

BIGINT data type, 118, 259, 270, 297, 305

BINARY LARGE OBJECT data type, 53, 264–265, 270, 299

Binary large objects (BLOBs), 53, 165, 265, 270, 299  
DISTINCT clause with, 165

BIND command, 70, 79, 354

Bind files, 72

BIND package privilege, 70, 79

BIND PACKAGE subcommand, 79

BIND plan privilege, 79

BIND PLAN subcommand, 79

BINDADD database privilege, 72

BINDADD system privilege, 80

BINDAGENT privilege, 80

Binder. *See* SQL Binder

Binding, 125, 364, 369  
deferred, 125, 354  
disabling, 134  
packages, 15, 70, 79, 80  
plans, 79, 80

Bitemporal, 145. *See also* temporal (time travel) tables

BLOB data type, 53, 165, 265, 270, 299

BLOBs. *See* Binary large objects (BLOBs)

BLOCKING option, 215, 364, 365

Bootstrap data set (BSDS), 69, 80, 125, 133–134

BP0, 129

BSDS privilege, 80

Buffer pools, 10, 12, 51, 74, 125, 126–127, 129, 131, 132, 134, 137–139, 248, 360  
default, 129  
privileges, 74

Built-in data types, 53, 121, 257, 258–267, 270–271. *See also* data types  
definitions for use with CREATE TABLE statement, 297–299

Built-in DB2 routines, 70

Built-in functions, 14, 46, 121, 122, 151, 171, 235, 267

Built-in OLE DB consumer, 123, 236

- Business analytics, 46
  - Business intelligence, 117, 332
  - Business rules, 78, 119, 124, 242, 252, 258, 267, 293, 332, 337
  - Business time, 144
- C**
- C/C++, 122, 124, 221, 236, 243
  - Call Level Interface (CLI), 15, 142, 354
    - isolation levels and, 354–355
  - CALL statement, 246–248
  - Cartesian products, 196–197
  - CASCADE clause. *See* ON DELETE CASCADE rule
  - CASE expression, 94–95, 192–196
    - ELSE and, 195–196
    - searched, 192, 194–195
    - simple, 192, 193–194
    - syntax of, 193, 194
    - TRUE, FALSE, and UNKNOWN, 196
  - Case sensitivity, 140, 175, 231
  - CAST function, 78
  - Cast XQuery expressions, 234
  - Casting functions, 78, 121–122
  - Catalog. *See* System catalog
  - Certification, certification exams, certification roles. *See* IBM DB2 certification
  - Chaining, 118
  - CHANGE ISOLATION LEVEL command, 355
  - CHAR LARGE OBJECT, CHARACTER LARGE OBJECT data type, 53, 265, 270, 299
    - DISTINCT clause with, 165
  - Character string data types, 155, 260–263, 270, 298
    - CHAR (CHARACTER), 261, 270, 298
    - GRAPHIC, 262, 270, 298
    - NCHAR (NATIONAL CHARACTER, NATIONAL CHAR), 262, 270, 298
    - NCLOB (NATIONAL CHARACTER LARGE OBJECT, NCHAR LARGE OBJECT), 53, 265, 271, 299
    - NVARCHAR (NATIONAL CHARACTER VARYING, NATIONAL CHAR VARYING, NCHAR VARYING), 262–263, 270, 298
    - VARCHAR (CHARACTER VARYING, CHAR VARYING), 261, 270, 298
    - VARGRAPHIC, 262, 270, 298
  - check condition, 117, 274
  - CHECK constraints, 117, 133, 274
  - CHECK INDEX utility, 70
  - CHECK LOB utility, 70
  - Child tables. *See* tables, child
  - Child views. *See* views, child
  - CLI. *See* Call Level Interface
  - CLIENT authentication type, 66
  - Clients, 65–67, 104, 123
  - CLOB data type, 53, 165, 265, 270, 299
  - CLOBs. *See* character large object
  - Clone, 112
  - CLOSE statement, 220–221, 223
  - Cluster Caching Facility (CF), 51
  - CLUSTER SQL clause, 331
  - Clustering, 7, 12, 43, 46, 49, 50, 51, 111, 117, 329, 331–332
  - Clustering index, 331–332
  - Clustering storage, 329
  - COBOL, 124, 243
  - Codd, Edgar Frank “Ted,” 36
  - Code page, 137, 299
  - Code point, 137
  - Code set, 137
  - Collating sequence, 137, 299
  - Collection privilege, 79
  - Column masks, 94–96
  - Columns, 111
    - identity, 155, 304–306, 307
  - Command Line Processor (CLP), 56–59, 141, 152, 215, 246, 355
    - batch mode, 57
    - command mode, 56–57
    - interactive input mode, 57
  - COMMIT statement, 14, 141, 248–254, 356
  - Common table expressions, 190–192
  - Communications database (CDB), 130
  - Comparison functions. *See* comparison operators
  - Comparison operators, 169–170
  - Comparison predicates, 169, 171
    - BETWEEN, 172–174
    - EXISTS, 178–179
    - IN, 176–178
    - LIKE, 174–176, 195
    - NULL, 179–180
    - Relational, 169–170

- Compression dictionary, 113
- CONCAT() function, 54
- Concurrency. *See* data concurrency
- Configuration file, Database Manager, 65, 108, 109
- Configuration parameters. *See* database configuration parameters
- CONNECT [1|2] option, 141
- Connect Personal Edition. *See* DB2 Connect Personal Edition
- CONNECT privilege, 72
- CONNECT RESET statement, 140–142
- CONNECT statement, 139–140
- Connection Concentrator, 43
- Connectivity, 6, 12, 38
- Consistency. *See* data consistency
- Constraints, 3, 5, 75, 82, 117, 130, 133, 134, 155, 257, 258, 267–295, 296, 307, 317, 318, 326, 332
  - aliases and, 117–118
  - ALTER TABLE statement and, 268
  - business rules and, 258, 267
  - CHECK, 3, 5, 117, 133, 257, 258, 268, 274–275, 296, 297, 300, 302, 307, 311, 313, 314, 318
  - check conditions in, 117, 274
  - CREATE TABLE statement and, 297, 300–304
  - default, 3, 5, 155, 158, 257, 258, 267, 268–271, 273, 275, 306, 307, 311
  - defined, 267
  - ENABLE QUERY OPTIMIZATION clause and, 293, 294, 301
  - foreign key, 76, 82. *See also* referential integrity constraints
  - informational, 3, 5, 268, 293–295, 296, 301, 302, 318
  - NOT ENFORCED clause and, 293, 294, 301
  - NOT NULL, 3, 5, 155, 257, 258, 267, 268, 269, 271, 273, 275, 285, 301, 306, 310, 312, 314, 315
  - primary key, 117, 274, 296, 297, 300, 301, 302, 312, 314, 316, 318, 329
  - referential. *See* referential integrity constraints
  - referential integrity, 3, 5, 15, 73, 76, 82, 133, 257, 258, 268, 273, 275–293, 294, 296, 297, 300, 301, 302, 303, 307, 312, 313, 314, 316, 317, 318
  - table check. *See* CHECK constraints
  - triggers vs., 332–333
  - UNIQUE, 3, 5, 117, 257, 258, 268, 272–274, 277, 296, 297, 300, 302, 307, 310, 311, 316, 318, 329, 331
- Containers, table space, 127, 128, 129, 136
- Control Center. *See* DB2 Control Center
- CONTROL privilege, 75, 76, 77, 78, 81, 83, 86, 88, 90
  - for indexes, 77
  - for nicknames, 81
  - for packages, 78
  - for tables, 75, 76
  - for views, 76
- Control structures, 79, 125
- Conversion deadlock, 376
- COPY privilege, 70, 79
- COPY utility, 70
- COPYTOCOPY utility, 70
- CREATE DATABASE command, 135–139
- CREATE EVENT MONITOR command, 71
- CREATE FUNCTION statement, 17, 237–240, 244
- CREATE INDEX statement, 329–332
- CREATE MASK statement, 94–95
- CREATE PERMISSION statement, 92–93
- CREATE PROCEDURE statement, 16, 124, 243–245, 246
- CREATE SECURITY LABEL statement, 100–101
- CREATE SECURITY LABEL COMPONENT statement, 97–98
- CREATE SECURITY LABEL POLICY statement, 99–100
- CREATE TABLE statement, 54, 102, 103, 145–149, 296–317, 320, 321
  - data type definitions used with, 297–299
  - duplicate tables, creating with, 306–307
  - examples of, 308–317
  - identity columns, creating with, 304–305
  - syntax, complexity of, 296
- CREATE TRIGGER statement, 17, 333–339
- CREATE VIEW statement, 5, 323–328, 339
- CREATE\_EXTERNAL\_ROUTINE privilege, 72
- CREATE\_NOT\_FENCED\_ROUTINE privilege, 72
- CREATE\_SECURE\_OBJECT privilege, 80
- CREATEALIAS privilege, 80
- CREATEDBA privilege, 80
- CREATEDBC privilege, 80
- CREATEIN privilege, 75
- CREATESG privilege, 80
- CREATETAB privilege, 72, 73
- CREATETMTAB privilege, 80
- CREATETS privilege, 73
- Creating a DB2 database, 135–139
- CUBE. *See* GROUP BY CUBE clause

- cur\_commit* parameter, 369
- CURRENT SCHEMA/CURRENT\_SCHEMA special register, 308, 320
- CURRENT SQLID/CURRENT\_SQLID special register, 308, 320
- Currently Committed semantics, 365–369, 374
- Cursor Stability isolation level, 3, 189, 344, 345, 348–352, 354, 355, 357, 358, 364–369
- Cursors, 3, 14, 16, 113, 142, 157–161, 215–223, 245, 253–254. *See also* Cursor Stability isolation level
- ambiguous, 215, 217
  - blocking, 215, 364, 365
  - closing, 216, 217, 220–221, 223, 253
  - cursor-controlled transactions and, 363–364
  - declaring, 216–218
  - example, 221–223
  - fetching data from result set of, 219–220
  - FOR FETCH ONLY clause and, 216, 217
  - FOR READ ONLY clause and, 216, 217, 218, 364
  - FOR UPDATE clause and, 215, 216, 217
  - opening, 218–219
  - position update operations and, 159, 190, 217
  - positioned delete operations and, 161, 190, 217
  - positions of, 219, 348, 350
  - read-only, 14, 215, 217
  - SQL Descriptor Area (SQLDA) data structure and, 218
  - steps in incorporating/using, 215–216
  - types of, 215–216
  - updatable, 14, 215, 216, 217, 352
  - WHERE CURRENT OF clause and, 156–161, 216, 364
  - WITH HOLD clause for, 142, 216
  - WITH RELEASE option in, 220, 221
  - WITH RETURN clause for, 216, 217, 245
- CYCLE clause, 305
- ## D
- Data concurrency, 341–376. *See also* isolation levels; locks
- data consistency and, 341
  - importance of, 341–344
  - isolation levels and, 342–355. *See also* isolation levels
  - locks and, 356–376. *See also* locks
  - transactions and, 342–343
  - components, 61
- Data consistency, 341. *See also* data concurrency
- Data constraints. *See* constraints
- Data Control Language (DCL), 3, 152, 153
- Data definition control support (DDCS) database, 125, 134
- Data Definition Language (DDL), 3, 45, 81, 107, 134, 152, 153, 302
- Data integrity, 119, 125, 126, 278, 279, 332, 344
- Data Manipulation Language (DML), 3, 14, 81, 87, 152, 153–215, 225, 231, 367
- Data mining, 47, 49, 117, 332
- Data models/modeling, 7, 45, 59
- Data normalization, 196, 275
- Data partitioning. *See* database partitioning; partitioning
- Data Partitioning Feature (DPF), 12, 49. *See also* database partitioning
- Data sharing, 8, 9, 10, 11, 135
- Data source, 132
- Data Studio, 4, 12, 38, 56, 59–61, 117, 135, 142, 143, 152, 215, 296, 323, 329
- Data types, 258–267
- big integer (BIGINT), 118, 259, 270, 297, 305
  - binary large object (BLOB, BINARY LARGE OBJECT), 53, 165, 265, 270, 299
  - built-in, 53, 121, 257, 258–267, 270–271, 297–299
    - definitions for use with CREATE TABLE statement, 297–299
  - casting, 78, 121–122
  - character large object (CLOB, CHARACTER LARGE OBJECT, CHAR LARGE OBJECT), 53, 265, 270, 299
  - character string (CHAR), 261, 270, 298
  - date (DATE), 147, 263, 270, 298
  - date/time, 263–264
  - decimal (DECIMAL, DEC), 118, 259, 260, 270, 297, 305
  - default values, 270–271
  - distinct, 75, 77, 78, 110, 121–122, 267, 308. *See also* user-defined data types
  - double-byte character large object (DBCLOB), 53, 165, 265, 270, 299
    - for double-byte character set (DBCS) data, 52, 262, 265
  - double-precision (DOUBLE, DOUNBLE PRECISION, FLOAT), 260, 270, 298
  - fixed-length character string (CHARACTER, CHAR), 261, 270, 298
  - fixed-length double-byte character string (GRAPHIC), 262, 270, 298
  - integer (INTEGER), 118, 259, 270, 297, 305
  - integer (SMALLINT), 118, 259, 270, 297, 305

- large object (LOB), 53, 264–265, 270–271, 299
- national character large object (NCLOB, NATIONAL CHARACTER LARGE OBJECT, NCHAR LARGE OBJECT), 53, 265, 271, 299
- national fixed-length character string (NCHAR, NATIONAL CHARACTER, NATIONAL CHAR), 262, 270, 198
- national varying-length character string (NVARCHAR, NATIONAL CHARACTER VARYING, NATIONAL CHAR VARYING, NCHAR VARYING), 262–263, 270, 298
- numeric, 259–260, 270, 297–298
- Oracle, 266–267
- precision in, 259, 260, 297, 298
- single-precision (REAL, FLOAT), 260, 270, 297
- strong data typing and, 121, 267
- structured, 113, 121, 267. *See also* user-defined data types
- subtypes and, 121
- supertypes and, 121
- time (TIME), 147, 263, 270, 298
- timestamp (TIMESTAMP), 147, 264, 270, 299
- user-defined, 109, 121–122, 267
- varying-length character string (VARCHAR), 261, 270, 298
- varying-length double-byte character string (VARGRAPHIC), 262, 270, 298
- XML, 46, 52, 56, 230, 265, 299
- Data warehousing, 2, 35, 43, 46, 49
  - requirements of, 47–48
- DATA\_ENCRYPT authentication type, 66
- DATA\_ENCRYPT\_CMP authentication type, 66
- DATAACCESS authority, 71, 83, 85, 91, 96
- DATABASE 2, 36. *See also* DB2
- Database configuration parameters, 109
  - autorestart*, 252
  - cur\_commit*, 369
  - locklist*, 372
  - locktimeout*, 374
  - maxlocks*, 372
  - srvcon\_gssplugin\_list*, 67
- Database Managed Space (DMS), 128, 129
- Database Manager, 72, 108–109, 128, 252, 273, 293. *See also* databases and database objects
  - authentication and, 65
  - configuration file, 65, 108, 109
  - in OS/2 Extended Edition 1.3, 36
  - Database nodes, 49
  - Database partitioning, 12, 46. *See also* Data Partitioning Feature (DPF)
  - Database privileges, 68, 72–73, 83. *See also* privileges; specific privileges
  - Databases (DB2), 107–149. *See also* specific database objects
    - creating, 135–139
    - data objects (data structures), 109–125
    - establishing a connection to, 139–144
    - servers, instances, and, 108–109
    - system objects (database objects), 109, 125–135
      - Type 1, Type 2 connections and, 140–142
      - work file database, 125, 135, 138
  - DATE as TIMESTAMP(0) Oracle data type, 266
  - DATE data type, 147, 263, 270, 298
    - in Oracle, 266
  - Date/time data types, 263–264
  - DB2. *See* databases; DB2 Family; specific DB2 editions; specific DB2 versions
  - DB2 9.5, 365, 366
  - DB2 9.7 for Linux, UNIX, and Windows, 14, 15, 16, 17, 18, 364, 365, 369
  - DB2 10 for z/OS, 2, 47
    - certification roles, 7–11
  - DB2 10.1 for Linux, UNIX, and Windows, 2, 4, 6, 7, 12, 13, 19, 66, 266, 365. *See also* DB2 for Linux, UNIX, and Windows; IBM DB2 certification
  - DB2 Advanced Enterprise Server Edition, 37, 44–45
  - DB2 catalog. *See* System catalog
  - DB2 certification. *See* IBM DB2 certification
  - DB2 Connect, 38, 142–143
    - editions, 142–143
  - DB2 Control Center, 59, 60
  - DB2 Database Manager. *See* Database Manager; databases and database objects
  - DB2 directory, 125, 132–133
    - table spaces used by, 133
  - DB2 Enterprise Server Edition, 37, 38, 43–44, 49
  - DB2 Express Edition, 37, 40–41, 42, 49
  - DB2 Express-C (DB2 Express–Community Edition), 37, 38–40, 41, 42, 49
  - DB2 Family, 35, 36–47, 143. *See also* specific editions; specific versions
    - editions and computing environments, 37

- history and development of, 36. *See also* specific editions
- tool set, 56–61
- DB2 for Common Servers, 36
- DB2 for Linux on System z, 38
- DB2 for Linux, UNIX, and Windows, 5, 36, 38, 39, 41, 45, 65, 71, 72, 74, 75, 76, 77, 78, 81, 82, 83, 85, 89, 97, 101, 102, 108, 110, 111, 112, 113, 117, 121, 122, 123, 127, 128, 129, 130, 135, 136, 138, 139, 140, 141, 221, 236, 237, 242, 259, 262, 265, 267, 282, 294, 298, 299, 308, 320, 358–360, 361, 363, 365, 369, 371. *See also* DB2 10.1 for Linux, UNIX, and Windows
- DB2 for LUW. *See* DB2 for Linux, UNIX, and Windows
- DB2 for z/OS, 7, 10, 36, 37, 38, 45–47, 59, 61, 71, 72, 73, 74, 75, 76, 77, 78. *See also* DB2 10 for z/OS; IBM DB2 certification
- DB2 profile, sourcing, 58–59
- DB2 pureScale Feature, 5, 13, 37, 41, 42, 43, 49, 50–52
- DB2 Universal Database, 36
- DB2 Workgroup Server Edition (WSE), 37, 41–43, 44
- DB2/2, 36
- DB2/6000, 36
- db2cli.ini configuration file, 355
- DB2LBACRULES rule set, 99
- db2move utility, 5
- db2pd, 5
- DBADM authority, 70, 71, 80, 83, 85
- DBCLOB data type, 53, 165, 265, 270, 299
- DBCLOBs. *See* double-byte character large objects
- DBCTRL authority, 70, 71, 80
- DBMAINT authority, 70, 71
- Deadlocks, 369, 374–376
  - conversion, 376
  - cycle, 376
  - detector, 376
- DEBUGSESSION privilege, 80
- DEC data type, 259, 270, 297
- DECFLOAT data type, 260, 270, 298
- DECIMAL data type, 118, 259, 260, 270, 297, 305
- DECLARE CURSOR statement, 216–218, 223, 245
- DECLARE GLOBAL TEMPORARY TABLE statement, 320, 321
- Declared temporary tables, 15, 319–322
  - base tables vs., 319, 320–322
  - created temporary tables vs., 319, 320–322
- Default constraints, 155, 257, 267, 268–271, 273, 275, 306, 307, 311
- Default values, DB2-supplied data type, 270–271
- Deferred binding, 125, 354
- DELETE nickname privilege, 81
- Delete Rule, referential integrity constraints and, 279, 285–293, 313
  - ON DELETE CASCADE, 285, 286, 288, 291, 292, 313
  - ON DELETE NO ACTION, 285, 288, 289, 291, 292, 293
  - ON DELETE RESTRICT, 285, 288, 290, 291, 292
  - ON DELETE SET NULL, 285, 287
- DELETE statement, 113, 151, 153, 159–162, 321, 322, 360, 364
  - Delete Rule for referential integrity constraints and, 279, 285–293, 313
    - positioned delete operations and, 161, 190, 217
    - referential integrity constraints and, 279, 285–293, 313
    - searched delete operations and, 161
    - temporal (time travel) tables with, 223–224, 225
    - triggers and, 161, 162
    - TRUNCATE statement vs., 161–162
    - XML data and, 233
- DELETE table privilege, 75, 83
- DELETE triggers, 161, 162
- DELETE view privilege, 76
- DESC (descending) sort, 186
- Design Advisor, 5, 117
- DETERMINISTIC clause, 238, 244
- DIAGNOSE utility, 70
- Dirty reads, 344, 345, 346, 348, 350. *See also* isolation levels
- Disaster recovery, 5, 8, 10, 40, 41
- DISCONNECT option, 141
- DISPLAY ARCHIVE command, 80
- DISPLAY BUFFERPOOL command, 80
- DISPLAY DATABASE command, 80
- DISPLAY LOCATION command, 80
- DISPLAY LOG command, 80
- DISPLAY privilege, 80
- DISPLAY system privilege, 80
- DISPLAY THREAD command, 80
- DISPLAY TRACE command, 80
- DISPLAYDB privilege, 73
- DISTINCT clause, 165, 168

Distinct data types, 75, 77, 78, 110, 121–122, 267, 308.  
    *See also* user-defined data types

Distinct type privilege, 77–78

Distributed Computing Environment (DCE) Security Services, 65

Distributed Data Facility (DDF), 130

Distributed requests, 143

Distributed units of work, 15

DML. *See* Data Manipulation Language (DML)

DMS. *See* Database Managed Space (DMS)

Dormant connection, 141

DOUBLE data type, 260, 270, 293, 297, 298

DOUBLE PRECISION data type, 260, 270, 298

Double-byte character large objects (DBCLOBs), 53, 265, 270, 299

    DISTINCT clause with, 165

Double-byte character set (DBCS) data, 53, 262, 265

DriverManager object, 143

DROP EVENT MONITOR command, 71

DROP PACKAGE statement, 79

DROP privilege, 73

DROPIN privilege, 75

DSNDB07, 135

DSNRGFDB, 134

**E**

Eclipse, 38, 47, 59, 60

ELSE, 193, 194. *See also* CASE expression

    CASE expressions and, 195–196

Embedded SQL, 15, 72, 87, 141, 143, 152, 153, 221, 247, 354, 355, 369

ENABLE QUERY OPTIMIZATION clause, 293, 294, 301, 302

Encryption, 46, 104

    authentication types for, 66–67

Enterprise Server Edition (ESE). *See* DB2 Enterprise Server Edition (ESE)

Equal to (=) operator, 169, 171. *See also* comparison operators; relational predicates

Escalation, of locks, 369, 372–374

Event monitors, 71

Exam 610. *See* IBM DB2 10.1 Fundamentals (Exam 610) certification

EXCEPT ALL set operator, 213, 214

EXCEPT set operator, 212, 214

EXCLUSIVE keyword

    in LOCK TABLE statement, 362

    in query isolation clause, 189, 190

Exclusive (X) lock, 190, 360, 362, 363, 364, 366, 370, 371, 375. *See also* EXCLUSIVE keyword

EXECUTE privilege, 70, 78, 79, 87, 90

EXISTS predicate, 169, 178–179

Explain, 5, 17, 71

EXPLAIN privilege, 73, 80

EXPLAIN SQL statement, 71

EXPLICIT keyword, 141

Explicit trusted connections, 105

EXPORT utility, 5

Express, DB2. *See* DB2 Express

Express-C, DB2. *See* DB2 Express-C

Extensible Markup Language (XML). *See* XML

Extents, 117, 127, 128, 137

EXTERNAL ACTION clause, 239

External counters, 118

EXTERNAL option, 124

External routines, 72

External scalar functions, 122, 190, 236

External security services, 64–65

External SQL stored procedures, 124, 242

External stored procedures, 15, 72, 124, 242, 243. *See also* stored procedures

    steps to create, 124

External table functions, 122, 123, 236, 237

External UDFs, 15, 72, 122, 123, 190, 236, 237

**F**

Failover, 40, 41

Federated databases, 13, 81, 143

Federated server, 81. *See also* federated databases

Federation, 45

FENCED option, 124

FETCH FIRST clause, 165, 168, 187–189

FETCH statement, 216, 219–220, 222, 223, 348

Fields, 111

FLOAT data type, 260, 270

FLUSH EVENT MONITOR command, 71

FLUSH OPTIMIZATION PROFILE CACHE command, 71

FLUSH PACKAGE CACHE command, 5, 71



FLWOR acronym, 234  
 FOR BIT DATA clause, 298, 299  
 FOR EACH ROW granularity, 335  
 FOR EACH STATEMENT granularity, 335  
 FOR FETCH ONLY clause, 216, 217  
 FOR READ ONLY clause, 216, 217, 218, 364  
 FOR UPDATE clause, 215, 216, 217, 358, 359, 364  
 Foreign key constraints. *See* referential integrity constraints  
 FREE PLAN subcommand, 79  
 FROM clause, 168, 192, 240  
 Fulfillment ID, 33  
 Full outer joins, 202, 203, 204, 206, 207. *See also* outer joins  
 Function privilege, 78  
 Functions. *See* built-in function; SQL functions; user-defined functions

## G

GENERATED ... AS IDENTITY clause, 304, 305, 306, 308, 313, 314, 315  
 Generic Security Service Application Program Interface (GSS-API), 67  
 getConnection() method, 143  
 GRANT authority, 322  
 GRANT SECURITY LABEL statement, 101–102  
 GRANT statement, 84–88, 101, 153  
   ALL PRIVILEGES clause and, 86, 90  
   authorities/privileges and, 85  
   database-level authorities and privileges and, 70  
   examples of, 87–88  
   roles and, 86  
   security labels and, 101–102  
   WITH GRANT OPTION and, 84  
 Granularity, 120, 333, 335, 363. *See also* locks; triggers  
   FOR EACH ROW, 335  
   FOR EACH STATEMENT, 335  
 GRAPHIC data type, 262, 270, 298  
 Graphical user interface (GUI), 56, 59  
 Greater than (>) operator, 169. *See also* comparison operators; relational predicates  
 Greater than or equal to (>=) operator, 170. *See also* comparison operators; relational predicates  
 GROUP BY clause, 116, 165, 168, 180–181, 185  
   grouping expression of, 180

  nonaggregate columns and, 181  
 GROUP BY CUBE clause, 183–185  
 GROUP BY ROLLUP clause, 181–182  
 Grouping expressions, 180, 181, 182, 185  
 GSS\_SERVER\_ENCRYPT authentication type, 67  
 GSSPLUGIN authentication type, 67

## H

HAVING clause, 165, 168, 185–186  
 Health Monitor, 60  
 Health monitoring, 60  
 Hierarchy of database objects, 108  
 High availability, 5, 12, 48, 51, 125  
 High Availability Disaster Recovery (HADR), 5, 12, 40, 41  
 History files, 145  
 History tables, 112, 145, 146, 147, 149, 226, 306  
 HP-UX, 36, 47, 65

## I

“IBM Certified” mark, 33  
 IBM DB2. *See* DB2 Family; specific DB2 editions; specific DB2 versions  
 IBM DB2 10.1 Fundamentals (Exam 610), 4, 6, 7, 9, 11, 13, 19, 20, 21, 35, 63, 107, 151, 257, 296, 341. *See also* IBM DB2 certification, preparing for; IBM DB2 certification, process  
   certification role, 2–4  
   content  
     data concurrency, 341, 379  
     planning, 34, 377  
     security, 63, 377–378  
     working with databases and database objects, 107, 378  
     working with DB2 data using SQL, 151, 378  
     working with DB2 tables, views, and indexes, 257, 378–379  
   exam objectives, 377  
   road map, 4  
   practice questions, answers, 380, 439  
 IBM DB2 certification, 1–33  
   exams  
     DB2 V8.1 Family Fundamentals (Exam 700), 15, 16, 17, 18

- DB2 9 Family Fundamentals (Exam 730), 6, 7, 9, 11, 13, 15, 16, 17, 18
- DB2 10.1 Advanced Database Administrator for Linux UNIX and Windows (Exam 614), 13
- DB2 10.1 Fundamentals (Exam 610). *See* IBM DB2 10.1 Fundamentals (Exam 610)
- mark, 33
- preparing for, 18–20
- process, 18–33
  - agreement, 33
  - applicant identification number, 21, 22
  - arranging to take, 20–22
  - Begin Test button, 25
  - Begin Test screen, 24, 25
  - cost, 20, 22
  - Done button, 29
  - exam process, 18–33
  - Exam Results panel, 31
  - Examination Score Report screen, 32
  - Flag for Review check box, 26, 27, 28, 29
  - formal education, 19
  - Help button, 27
  - identification requirements, 22
  - Item Review screen, 27, 28, 29, 30
  - Marked status, 28
  - multiple-answer questions, 27–28
  - Next/Previous buttons, 23, 27, 28, 30, 31
  - objectives, 18, 20
  - online tutorials, 19
  - practice exams, 20
  - publications, 19–20
  - question screen, 25–28
  - Review All button, 28, 29
  - Review button, 27
  - Review Incomplete button, 28, 29
  - Review Marked button, 28, 29
  - reviewing items, 26, 27, 28–30
  - sample questions, 20
  - score/score report, 25, 29, 30, 31
  - section scores, 31–32
  - Skipped status, 28
  - skipping questions, 26, 28
  - taking, 22–32
  - Test Results screen, 30–31
  - Time Remaining information, 26
  - Title screen, 22, 23
- road maps, 4, 7, 9, 11, 13, 16, 18
  - roles, 1, 2–18
    - Advanced Database Administrator—DB2 10.1 for Linux, UNIX, and Windows, 2, 12–13
    - Application Developer—DB2 9.7 for Linux, UNIX, and Windows, 14–16
    - Database Administrator—DB2 10 for z/OS, 2, 7–9
    - Database Administrator—DB2 10.1 for Linux, UNIX, and Windows, 2, 4–7
    - Database Associate—DB2 10.1 Fundamentals, 2–4
    - Solution Developer—DB2 9.7 SQL Procedure, 16–18
    - System Administrator—DB2 10 for z/OS, 2, 10–11
  - website, 20
- IBM Information Management, 1
- IBM Insight conference, 21
- IBM Learning Services, 19
- IBM Professional Certification, 33. *See also* IBM DB2 certification
  - program, 18
  - website, 20
- IBM Tivoli. *See* Tivoli System
- IBMDEFAULTBP buffer pool, 129, 137
- Identity columns, 155, 304–306, 307, 314, 315
- IGNORE DELETE TRIGGERS CLAUSE, 161–162
- IMAGCOPY privilege, 73
- Implicit granting of privileges, 83
- Implicit trusted connections, 105
- IMPLICIT\_SCHEMA privilege, 73
- IMPORT utility, 5, 153
- IN predicate, 176–178
- INCLUDE clause, 330, 331
- Inclusive-exclusive approach, for time-period specification, 225–226, 227
- Inclusive-inclusive approach, for time-period specification, 225, 227
- Inconsistent data/database, 252, 342
- INDEX privilege, 75, 76, 82. *See also* indexes, privileges associated with
- Indexes, 3, 5, 7, 12, 39, 40, 42, 46, 49, 56, 68, 70, 73, 74, 75, 76, 77, 82, 109, 110, 112, 113, 115–117, 126, 130, 133, 138, 257, 258, 273, 307, 308, 310–316, 322, 329–332, 350, 352, 359, 360, 366, 367, 376
  - CLUSTER clause and, 331
  - clustering, 331–332
  - clustering storage and, 117
  - CREATE INDEX statement and, 329–332
  - creating using Data Studio, 117, 329

- creating using Design Advisor, 117
  - creating using SQL, 117, 329–332. *See also* CREATE INDEX statement
  - explicit creation of, 117
  - importance of, 116–117
  - keys/key columns, 77, 111, 115–116, 117, 329, 330, 331, 332, 366
  - online transaction processing (OLTP) and, 117
  - performance effects of, 117
  - privileges associated with, 75, 76, 77, 82
  - reorganizing and, 332
  - unique, 117, 273, 274
  - UNIQUE clause for, 117
  - UNIQUE constraints and, 273
  - Indirect granting of authorities/privileges, 83
  - Infinity, 260
  - Information Center, 19, 264, 322, 360, 370
  - Informational constraints, 3, 5, 268, 293–295, 296, 318
  - Informix, 39, 41, 59
  - InfoSphere Optim, 45, 59–60, 142, 143
  - InfoSphere Warehouse, 49–50
  - Ingest utility, 5, 44
  - Ingres, 36
  - INLINE LENGTH clause, 54
  - Inline LOBs, 54–55. *See also* large objects (LOBs)
  - Inner joins, 197–201, 202
  - INSERT privilege, 75, 76, 82
  - INSERT statement, 113, 151, 153–157, 159, 163, 223–224, 231–232, 235, 321, 322, 324, 358, 359, 360, 364
    - informational constraints and, 294
    - Insert Rule for referential integrity constraints, 279–282
    - locks and, 358, 359, 360, 364
    - NULL and, 155, 156
    - referential integrity constraints and, 274–293
    - tokens in, 155
    - VALUES clause in, 155, 156, 216
    - XML and, 231–233
  - Insert Rule for referential integrity constraints, 279–282
  - Insert time clustering tables, 12 111
  - Installation SYSADM authority, 68, 69, 71
  - Installation SYSOPER authority, 69, 71
  - Instances, 4, 6, 107, 108–109, 112, 113, 136, 321
    - access to, 63–71, 79, 81
    - administration/management of, 38, 56, 59, 71
    - authentication and, 64–66
    - authorities and privileges and, 67–71, 79, 81
    - DB2 Database Manager and, 108
    - distributed request functionality and, 143
    - function of, 108
    - multiple, 108–109
  - INSTEAD OF triggers, 120, 333, 334, 336, 338–339. *See also* triggers
  - INTEGER data type, 118, 259, 270, 297, 305
  - Integrated development environment (IDE), 38, 59. *See also* Eclipse
  - Intent exclusive (IX) lock, 358, 359, 364, 370, 372
  - Intent none (IN) lock, 358, 370
  - Intent share (IS) lock, 358, 364, 370
  - Interleaved transactions, 343
  - International DB2 User’s Group (IDUG), 20
  - INTERSECT ALL set operator, 211, 214
  - INTERSECT set operator, 210, 214
  - iSeries, 143
  - Isolation clause, 189–190
  - Isolation levels, 3, 14, 165, 341, 342, 343–355, 356
    - CHANGE ISOLATION LEVEL command and, 355
    - choosing the proper level of, 352–354
    - Currently Committed semantics and, 3, 365–369
    - Cursor Stability (CS), 189, 344, 348–350, 351, 352, 354, 355, 358, 364, 365, 366, 367, 368, 369
    - effect on lock duration of, 357
    - isolation clause and, 189–190
    - ISOLATION option for, 354–355
    - Read Stability (RS), 189, 344, 345, 346–348, 349, 355, 358, 368, 369
    - Repeatable Read (RR), 189, 190, 344, 345–346, 347, 355, 359
    - SELECT statement and, 355
    - specifying, 354–355
    - SQLSetConnectAttr() function and, 355
    - TXNISOLATION keyword and, 355, 345
    - Uncommitted Read (UR), 190, 344, 345, 350–352, 353, 354, 355, 360, 361, 364
  - ISOLATION option, 354–355
- ## J
- JAR file privilege, 79
  - Java, 15, 45, 46, 61, 79, 80, 122, 124, 143, 236, 243, 355, 369
  - Java Database Connectivity (JDBC), 15, 46, 143, 355
  - java.sql connection interface, 355

Java Universal Driver, 46

Joins, 196–207. *See also* inner joins; outer joins

Cartesian products and, 196–197

inner joins, 197–201, 202

outer joins, 202–207

## K

KERBEROS authentication type, 66–67

Kerberos security protocol, 66–67

Key columns, 115, 329

Keys. *See also* constraints

cryptography and, 66

foreign, 55, 76, 82, 114, 275, 276, 277, 278, 279, 282, 285, 303, 313, 314, 317

GROUP BY clause, 181

index and table, 77, 111, 112, 114, 115, 116, 117, 273, 329, 330, 331, 332, 366

parent, 276, 277, 279, 282, 300, 312, 314, 317

primary, 273–274, 277, 296, 297, 300, 301, 302, 303, 312, 313, 314, 316, 318, 329

record, 111

in referential constraint terminology, 277

sequences and, 77

KRB\_SERVER\_ENCRYPT authentication type, 67

## L

Label-Based Access Control (LBAC), 6, 40, 64, 68, 70, 96–104, 128, 233, 258

implementing, 102–104

Large objects (LOBs), 2, 35, 39, 53–55, 273. *See also* BLOBs; CLOBs; DBCLOBs; NCLOBs

inline, 54–55. *See also* large object data types

locators, 53–54

table spaces, 129

Large object data types, 53, 264–265, 270–271, 299

BLOB (BINARY LARGE OBJECT), 53, 165, 265, 270, 299

CLOB (CHAR LARGE OBJECT, CHARACTER LARGE OBJECT), 53, 265, 270, 299

DBCLOB, 53, 165, 265, 270, 299

NCLOB (NATIONAL CHARACTER LARGE OBJECT, NCHAR LARGE OBJECT), 53, 265, 271, 299

LDAP. *See* Lightweight Directory Access Protocol

Left outer joins. *See* outer joins, left

LENGTH() function, 43

Less than (>) operator, 169. *See also* comparison operators; relational predicates

Less than or equal to (<=) operator, 169. *See also* comparison operators; relational predicates

Lightweight Directory Access Protocol (LDAP), 6

LIKE clause, 54, 146

LIKE predicate, 169, 174–176

Linux, 36, 38, 39, 41, 47, 58, 61, 65. *See also* DB2 for Linux, UNIX, and Windows

LIST COMMAND OPTIONS command, 58

LOAD privilege, 73

LOAD utility, 5

LOBs. *See* large objects (LOBs); large object data types

LOCAL CHECK OPTION. *See* WITH CHECK OPTION; WITH LOCAL CHECK OPTION

Locators. *See* large objects (LOBs)

Lock list, 372

*locklist* parameter, 372

Locks, 3, 189, 190, 220, 249, 252–253, 322, 341–376. *See also* specific lock states

acquisition of, 361–364

ALTER TABLE statement and, 361, 363

attributes of, 357

avoidance of, 364–365

compatibility of, 370

conversion of, 369, 371–372

Currently Committed semantics and, 365–369

deadlocks and, 369, 374–376

DELETE statement and, 360, 364

duration of, 357

escalation of, 369, 372–374

Exclusive (X), 190, 360, 362, 363, 364, 371, 375

granularity of, 363

holder/owner of, 345

INSERT statement and, 364

Intent Exclusive (IX), 358, 359, 364, 372

Intent None (IN), 358

Intent Share (IS), 358, 364

isolation clause and, 189

lock list and, 372

LOCK TABLE statement and, 362

Next Key Weak Exclusive (NW), 359, 370

object of, 357

performance and, 369–376

promotion of, 369, 371–372

purpose of, 356

- row-level, 361–363
  - Scan Share (NS), 358, 370
  - SELECT statement and, 345, 347, 349, 351, 353, 355, 358, 359, 360, 364, 365, 367, 368
  - Share (S), 190, 358, 359, 362, 363, 364, 371, 372
  - Share with Intent Exclusive (SIX), 359, 370, 372
  - size of, 357
  - state (mode) of, 357, 358–360
  - Super Exclusive (Z), 360, 370
  - table-level, 361–363
  - timeouts. *See* locks, waits and timeouts
  - transaction categories and, 363–364
  - Update (U), 190, 360, 364, 371
  - UPDATE statement and, 347, 349, 351, 353, 358, 359, 360, 364, 368
  - victim processes and, in deadlocks, 376
  - waits and timeouts for, 252, 354, 365, 366, 368, 369, 370, 374–376. *See also* locktimeout
  - locktimeout* parameter, 374
  - Logging, 12, 54, 131, 132, 133, 161, 322, 369
    - active log, 133
    - archive log, 133
    - log buffer, 131
    - process, 132
    - transaction log files (logs, log files), 131
    - write-ahead, 131
  - Logic. *See* division of business application and logic
  - Lost updates, 343, 345, 346, 348. *See also* isolation levels
- M**
- Manageability, 48
  - Materialized Query Tables (MQTs), 15, 43, 46, 49, 71, 92, 94, 112
  - maxlocks* parameter, 372
  - Memory, 11, 12, 39, 40, 43, 49, 50, 51, 52, 53, 72, 74, 82, 113, 126, 131, 190, 242, 305, 319, 372
    - self-configuring, 42
    - self-tuning, 42
  - Metadata, 39, 130, 136, 137, 138
  - Methods. *See* user-defined functions (UDFs)
  - Microsoft SQL Server, 59
  - Microsoft Windows, 41, 44, 45
  - MODIFY RECOVERY utility, 70
  - MODIFY STATISTICS utility, 70, 71
  - MODIFY TRACE command, 81
  - MONITOR1 privilege, 80
  - MONITOR2 privilege, 80
  - MQTs. *See* Materialized Query Tables (MQTs)
  - Multi-temperature data management, 43
  - Multidimensional clustering (MDC) tables, 12, 43, 49, 111
  - Multidimensional query tables. *See* Materialized Query Tables (MQTs)
  - MVS, 36
- N**
- Named pipes, 44
  - NaN. *See* Not a Number (NaN)
  - National character data types, 53, 262, 265, 270, 271, 298, 299
  - National character large objects (NCLOBs), 53, 265, 271, 299
  - NCHAR (NATIONAL CHARACTER, NATIONAL CHAR) data type, 262, 270, 298
  - NCLOB data type, 53, 265, 271, 299
  - NCLOBs. *See* National character large objects (NCLOBs)
  - Nested SELECT, 163
  - NEW <AS> keywords, 334, 335
  - NEW TABLE <AS> keywords, 334, 335
  - Next key weak exclusive (NW) locks, 359, 370
  - NEXT VALUE expression, 77, 119
  - Nicknames, 81
    - privileges associated with, 81–82
  - NO ACTION clause. *See* ON DELETE NO ACTION rule; ON UPDATE NO ACTION rule
  - NO EXTERNAL ACTION clause, 239
  - Nodes, 41, 49, 233, 234
  - Nonaggregate columns and GROUP BY clause, 181
  - Nonrelational data, managing, 52–56
  - Nonrepeatable reads, 344, 345, 346, 348, 350. *See also* isolation levels
  - Normalization. *See* data normalization
  - Not a Number (NaN), 260
    - quiet NaN, 260
    - signaling NaN, 260
  - NOT DETERMINISTIC clause, 238
  - NOT ENFORCED, NOT ENFORCED ENABLE QUERY OPTIMIZATION keywords, 293, 294, 301
  - Not equal to, 170. *See also* comparison operators; relational predicates
  - NOT NULL constraint, 3, 5, 155, 257, 258, 267, 268, 269, 271, 273, 275, 285, 301, 306, 310, 312, 314, 315

NULL/null values, 65, 155, 156, 158, 159, 165, 179–180, 195, 269, 273, 277, 285. *See also* NOT NULL constraints  
 vs. zero and blank, 180

NULL predicate, 169, 179–180

NUM (NUMERIC) data type, 259–260, 270, 297

NUMBER Oracle data type, 266

Numeric data types, 259–260, 270, 297–298

- big integer (BIGINT), 259, 270, 297
- decimal (DEC, DECIMAL, NUM, NUMERIC), 259–260, 270, 297
- decimal floating-point (DECFLOAT), 260, 270, 298
- double-precision floating-point (DOUBLE, DOUBLE PRECISION, FLOAT), 260, 270, 298
- integer (INT, INTEGER), 118, 259, 270, 297, 305
- single-precision floating-point (FLOAT, REAL), 260, 270, 297
- small integer (SMALLINT), 259, 270, 297

NVARCHAR2 Oracle data type, 267

## O

Object Linking and Embedding (OLE), 123, 236

Object Linking and Embedding Database (OLE DB), 15, 123, 143, 236, 237

Object name, schemas and, 75, 110, 308

Object privileges, 73–83. *See also* privileges; specific privileges

ODBC. *See* Open Database Connectivity

OLAP. *See* On-Line Transaction Processing

OLD <AS> keywords, 334, 335

OLD TABLE <AS> keywords, 334, 335

OLE. *See* Object Linking and Embedding (OLE)

OLE DB. *See* Object Linking and Embedding Database (OLE DB)

OLTP. *See* online transaction processing (OLTP)

ON DELETE CASCADE rule, 285, 286, 288, 291, 292, 313

ON DELETE NO ACTION rule, 285, 288, 289, 291, 292, 293

ON DELETE RESTRICT rule, 285, 288, 290, 291, 292

ON DELETE SET NULL rule, 285, 287

ON UPDATE NO ACTION rule, 282, 283, 285

ON UPDATE RESTRICT rule, 282, 283, 284

Online analytical processing (OLAP), 47, 49

Online reorganization, 40

Online transaction processing (OLTP), 2, 35, 43, 47, 48, 49, 51, 117, 332

Open Database Connectivity (ODBC), 15, 142, 354, 355, 369

OPEN statement, 113, 116, 218–219, 223, 321

Optimization, 46

- ENABLE QUERY OPTIMIZATION clause and, 293, 294, 301, 302
- informational constraints and, 293–295
- storage, 44

Optimizer, 12, 49, 218, 293, 294, 301. *See also* optimization

Oracle, 3, 17, 39, 45, 53, 59, 81, 143, 257

- compatibility data types, 266–267
- data types, 266–267

ORDER BY clause, 93, 116, 165, 168, 186–187, 188

OS/2, 36

Outer joins, 202–207

- full, 202, 203, 204, 206, 207
- left, 202, 203, 204, 205
- right, 202, 203, 205, 206

## P

PACKADM authority, 70, 71, 93, 109, 125

Packages, 15, 75, 125, 133, 134

- administrator authority for. *See* PACKADM authority
- authorities and privileges using, 70, 71, 72, 78–79, 80, 83
- binding and, 15, 70, 79, 80

Page cleaners, 126–127, 131, 132

Parallelism, 13, 44

Parent keys, 276, 277. *See also* referential integrity constraints

Parent tables. *See* tables, parent and child

Parent views. *See* views, parent

Partitions, 5, 7, 49, 112, 129. *See also* database partitioning; table partitioning; table space partitioning

PASSTHRU privilege, 81

Passwords, 65, 66, 67, 140, 141

Pearson Vue, 20, 21, 22, 32

Percent wildcard character (%), 174

Performance, 7, 8, 9, 10, 11, 12, 42, 43, 44, 45, 46, 47, 48, 52, 54, 125, 129, 142,

- Cartesian product joins and, 197

- dirty pages and, 126
- indexes and, 117, 331, 332
- locks and, 341, 254, 363, 369–370
- prefetching and, 126
- queries and, 54, 77, 112, 117, 293, 330
- sequences and, 118–119
- stored procedures and, 242
- Period, 144
- Permissions. *See* rows, permissions
- Phantoms, 344, 345, 346, 348, 350. *See also* isolation levels
- PHP, 15
- PL/I, 124, 243
- Planning, 35–61
- Plans, 71, 134
  - privileges associated with, 79, 80
- Positioned delete operations, 161, 190, 217
- Positioned update operations, 159, 161, 190, 217
- Power Systems, 142
- Precision, numeric data types and, 259, 260, 297, 298
- PRECOMPILE command, 354
- Precompiler. *See* SQL precompiler
- Predictive governing, 134
- Prefetching, 126
- PREPARE command, 71
- PREPARE statement, 217
- PREVIOUS VALUE expression, 77, 119
- Primary database, 41
- Primary keys. *See* keys, primary
- Privileges, 67–68, 72–91. *See also* authorities
  - ALL PRIVILEGES clause and, 86, 88, 90
  - ALTER, 75, 77, 81
  - ALTERIN, 75
  - ARCHIVE, 80
  - dirty reads and, 344
  - authorization ID, 74
  - BIND, 70, 79
  - BINDADD, 72, 80
  - BINDAGENT, 80
  - BSDS, 80
  - buffer pool, 74
  - collection, 79
  - CONNECT, 72
  - CONTROL, 75, 76, 77, 78, 81, 83, 86, 88, 90
  - COPY, 70, 79
  - CREATE\_EXTERNAL\_ROUTINE, 72
  - CREATE\_NOT\_FENCED\_ROUTINE, 72
  - CREATEALIAS, 80
  - CREATEDBA, 80
  - CREATEDBC, 80
  - CREATEIN, 75, 79
  - CREATESG, 80
  - CREATE\_SECURE\_OBJECT, 80
  - CREATETAB, 72, 73
  - CREATETMTAB, 80
  - CREATETS, 73
  - database (LUW), 72–73
  - database (z/OS), 73
  - DEBUGSESSION, 80
  - DELETE, 75, 76, 81, 82, 83
  - DISPLAY, 80
  - DISPLAYDB, 73
  - distinct type, 77–78
  - DROP, 73
  - DROPIN, 75
  - EXECUTE, 70, 78, 79, 87, 90
  - EXPLAIN, 73, 80
  - explicit granting of, 83
  - function, 78
  - granting of, 83–88. *See also* GRANT statement
  - IMAGCOPY, 73
  - implicit granting of, 83
  - IMPLICIT\_SCHEMA, 73
  - index, 75, 76, 77, 82
  - INDEX, 75, 76, 82
  - indirect granting of, 83
  - INSERT, 75, 76, 82
  - JAR file, 79
  - LOAD, 73
  - MONITOR1, 80
  - MONITOR2, 80
  - nickname, 81–82
  - object, 72, 73–83
  - package, 78–79
  - PASSTHRU, 81
  - plan, 79
  - procedure, 78
  - QUIESCE\_CONNECT, 73
  - READ, 82
  - RECOVER, 81
  - RECOVERDB, 73
  - REFERENCES, 76, 82

REORG, 73  
REPAIR, 73  
revoking, 88–91  
roles and, 86  
routine, 78  
schema, 75  
SELECT, 75, 76, 82  
sequence, 77  
server, 81  
SETSESSIONUSER, 74  
STARTDB, 73  
STATS, 73  
STOPALL, 81  
STOPDB, 73  
STOSPACE, 81  
storage group, 74  
system, 80–81  
table, 75  
table space, 74  
TRACE, 81  
TRIGGER, 76  
UPDATE, 75, 82  
USAGE, 77, 79, 82, 83  
USAGE OF DISTINCT TYPE, 78  
USAGE OF TYPE, 78  
USE, 74. *See also* USE privilege  
variable, 82  
view, 73, 75, 76–77, 80, 81, 82, 87–88  
WRITE, 82  
XML schema repository (XSR) object, 82–83

Problem Determination Tool (db2pd), 5  
Procedure privilege, 78  
Procedures. *See* stored procedures  
Profile commands, 71  
Profile, sourcing the DB2, 58–59  
Propagation, of delete operation, 188  
PUBLIC, 86, 89, 322  
pureScale. *See* DB2 pureScale Feature  
pureXML, 39, 46, 56, 230

## Q

QMF. *See* Query Management Facility (QMF)  
Qualifiers  
comparison, 170  
correlation names and, 168

schemas and, 73, 110, 308, 320  
Queries, 162. *See also* SQL  
Query Management Facility (QMF), 47  
Query optimizer. *See* Optimizer  
Query parallelism, 44  
QUIESCE utility, 70  
QUIESCE\_CONNECT privilege, 73

## R

Range clustering, 12, 111–112  
Range partitioning, 12, 112. *See also* tables, partitioned  
RDO, 143  
Reactive governing, 134  
READ privilege, 82  
Read Stability (RS) isolation level, 189, 344, 345, 346–348, 349, 355, 358, 368, 369  
Read-only cursors. *See* cursors  
REAL data type, 260, 270, 297  
REBIND utility, 5, 8, 79  
REBUILD INDEX utility, 70  
Records, 111  
RECOVER BSDS command, 69, 80  
RECOVER INDOUBT command, 81  
RECOVER privilege, 81  
RECOVER utility, 70  
RECOVERDB privilege, 73  
Recovery, 5, 7, 8, 10, 12, 40, 41, 46, 51, 52, 68, 70, 73, 133, 134, 322  
Recursion, 190  
Red Hat Enterprise Linux (RHEL), 41  
Redbooks, 19  
REFERENCES clause, 300, 303  
REFERENCES privilege, 76, 82  
Referential constraints. *See* referential integrity constraints  
Referential cycle, 278  
Referential integrity constraints, 3, 5, 15, 73, 76, 82, 133, 257, 258, 268, 273, 275–293, 294, 296, 297, 300, 301, 302, 303, 307, 312, 313, 314, 316, 317, 318  
child table of, 276  
data normalization and, 275  
delete operations and, 279. *See also* Delete Rule for referential integrity constraints  
Delete Rule for, 279, 285–293, 313  
foreign key and, 276–277



- insert operations and, 278. *See also* Insert Rule for referential integrity constraints
  - Insert Rule for, 279–282
  - keys used with, 276–77
  - ON DELETE CASCADE rule for, 285, 286, 288, 291, 292, 313
  - ON DELETE NO ACTION rule for, 285, 288, 289, 291, 292, 293
  - ON DELETE RESTRICT rule for, 285, 288, 290, 291, 292
  - ON DELETE SET NULL rule for, 285, 287
  - ON UPDATE NO ACTION rule for, 282, 283, 285
  - ON UPDATE RESTRICT rule for, 282, 283, 284
  - parent key of, 276–277
  - parent table of, 276
  - purpose of, 278
  - self-referencing tables/rows and, 278
  - terminology of, 277–278
  - update operations and, 278–279. *See also* Update Rule for referential integrity constraints
  - Update Rule for, 279, 282–285, 293
  - Relational database management systems (RDBMSs), 47, 51, 52, 55, 56, 64, 81, 143, 216, 230, 266, 275
  - Relational predicates, 169–172
  - RELEASE statement, 141, 255
  - Remote Direct Memory Access (RDMA), 51, 52
  - REORG privilege, 73
  - REORG utility, 5, 10, 71, 75, 332, 360
  - REORGCHK utility, 5
  - REPAIR privilege, 73
  - Repeatable Read (RR) isolation level, 189, 190, 344, 345–346, 347, 355, 359
  - Replication, 8, 9, 13, 40
    - SQL, 40, 41
  - REPORT utility, 70
  - Resource Access Control Facility (RACF), 10
  - Resource Description Framework (RDF), 44
  - Resource limit facility, 125, 134
  - RESTRICT clause, 99, 162. *See also* ON DELETE RESTRICT rule; ON UPDATE RESTRICT rule
  - RESTRICT WHEN DELETE TRIGGERS clause, 162
  - Result set, result data set, 162. *See also* SELECT
  - Result tables, 112, 114, 323
  - RETURN statement, 238
  - REVOKE statement, 88–91, 153
  - REXX, 124, 243
  - Right outer joins. *See* outer joins, right
  - Road maps, certification, 4, 7, 9, 11, 13, 16, 18
  - roles, 86
  - ROLLBACK statement, 14, 248, 249–251, 253–255, 356
    - savepoints and, 253–254
    - transactions and, 248
  - ROLLBACK TO SAVEPOINT statement, 254, 255
  - routine privilege, 78
  - Row and Column Access Control (RCAC), 2, 6, 8, 40, 63, 64, 68, 70, 80, 91–96
  - Rows, 111. *See also* locks; Row and Column Access Control (RCAC); tables
    - permissions, 92–94
  - RUNSTATS command/utility, 5, 8, 11, 70, 71, 75
- ## S
- SAVEPOINT statement, 14, 252–253
  - Savepoints, 252–256, 322
  - Scalability, 46, 47, 48
  - Scalar functions, 54, 122, 123, 190, 236, 239, 240, 245
  - Scale, numeric data types and, 118, 259, 260, 297
  - Scan Share (NS) locks, 358, 370
  - Schemas, 3, 14, 46, 73, 109, 110–111, 319
    - ALTERIN privilege in, 75
    - assigning a table object to, 110
    - CREATEIN privilege in, 75
    - CURRENT SCHEMA special register and, 308, 320
    - CURRENT SQLID special register and, 308, 320
    - DROPIN privilege in, 75
    - IMPLICIT\_SCHEMA privilege and, 73
    - name/qualifier in, 110, 320
    - object naming and, 308
    - privileges available with, 75, 82
    - SET SCHEMA statement and, 308
    - system schema, 111
    - XML, 10, 14, 56, 82, 233, 257, 258, 296, 307–308
  - Search condition, 169
  - Searched CASE expressions, 194, 195
  - Searched delete operations, 161
  - Searched update operations, 159
  - SECADM authority, 6, 70, 71, 72, 77, 83, 86, 90, 94, 96, 97, 101, 104
  - Security, 8, 10, 29, 63–105, 134. *See also* authorities; privileges; SECADM authority
    - access control in, 64. *See also* access control

- authentication in, 64–67. *See also* authentication
  - authorities in, 67–72, 83–91. *See also* authorities
  - column masks and, 94–96
  - controlling database access with, 64
  - Distributed Computing Environment (DCE) security services and, 65
  - encryption and, 46, 66–67, 104
  - external services for, 64–65
  - Generic Security Service Application Program Interface (GSS-API) and, 67
  - GRANT statement and, 84–88. *See also* GRANT statement
  - Kerberos security protocol for, 66–67
  - label components, 97–98
  - Label-Based Access Control (LBAC) and, 96–104
    - column-level, 103–104
    - row-level, 102–103
  - labels, 97, 100–102
  - multilevel, 96
  - passwords in, 65, 66, 67, 140, 141
  - policies and, 97, 98–100
  - privileges and, 72–91. *See also* privileges
  - REVOKE statement and, 88–91. *See also* REVOKE statement
  - roles and, 86
  - Row and Column Access Control (RCAC) and, 91–96
  - row permissions and, 92–94
  - trusted contexts and, 104–105
  - user IDs in, 65, 66, 67, 140
- Segments, in segmented table spaces, 129
- SELECT privilege, 75, 76, 82
- SELECT statement, 112, 113, 148, 151, 152, 153, 154, 156, 157, 160, 162–214
- BETWEEN predicate and, 172–174
  - CASE expressions in, 192–196
  - case sensitivity in, 175
  - common table expressions and, 190–192
  - cursors and, 215–217. *See also* cursors
  - DISTINCT clause in, 165
  - EXCEPT ALL set operator in, 213, 214
  - EXCEPT set operator in, 212, 214
  - EXISTS predicate in, 178–179
  - FETCH FIRST clause and, 187–189
  - FROM clause in, 163
  - GROUP BY clause and, 180–181
  - GROUP BY CUBE clause in, 183–185
  - GROUP BY ROLLUP clause in, 181–182
  - HAVING clause and, 185–186
  - IN predicate in, 176–178
  - INSERT statement and, 163
  - INTERSECT ALL set operator in, 211, 214
  - INTERSECT set operator in, 210, 214
  - isolation clause and, 189–190
  - joining tables using, 196–207. *See also* joins
  - LIKE predicate in, 174–176
  - locks and, 189, 190. *See also* locks
  - nested, 163, 176
  - nonaggregate columns and GROUP BY in, 181
  - NULL predicate in, 179–180
  - ORDER BY clause and, 186–187
  - queries and, 162–163
  - relational predicates (comparison operators) and, 169–172
  - result sets, result data sets and, 162
  - set operators and combined query results using, 215
  - subqueries and, 163
  - subselects and, 156, 159
  - syntax of, 163, 164–165, 196, 198, 199–200, 204
  - UNION ALL set operator in, 209, 214
  - UNION set operator in, 208, 214, 215
  - UPDATE statement and, 163
  - WHERE clause and, 169–172
  - wildcard characters and, 174–175
  - WITH keyword and, 192
  - XML data and, 165, 233–235
  - XQuery and, 233–235
- Self-configuration, 42
- Self-referencing tables, rows, constraints and, 278
- Self-Tuning Memory Manager (STMM), 42
- SEPARATE\_SECURITY system parameter, 94
- SEQUEL, 36
- Sequence XQuery expressions, 234
- Sequences, 7, 15, 109, 118–119
  - benefits of, 18–119
  - identity columns vs., 118
  - privileges available with, 77
- SERVER authentication type, 66, 67
- server privilege, 81
- SERVER\_ENCRYPT authentication type, 66, 67
- Servers, 108
  - authentication and, 65–67
  - federated, 81. *See also* federated databases
- SET CURRENT SQLID statement, 308

- SET EVENT MONITOR STATE command, 71
- SET INTEGRITY statement, 5, 75
- SET NULL clause. *See* ON DELETE SET NULL rule
- Set operators, 208–215. *See also* specific operators
- SET SCHEMA statement, 308
- SETSESSIONUSER privilege, 74
- setTransactionIsolation() method, 355
- SGML. *See* Standard Generalized Markup Language (SGML)
- SHARE mode, 362. *See also* Share (S) locks
- Share (S) locks, 190, 358, 359, 362, 363, 364, 371, 372
- Share with Intent Exclusive (SIX) locks, 359, 370, 372
- Shredding, of XML documents, 55
- Sign, numeric data types and, 259, 260
- SMALLINT data type, 118, 259, 270, 297, 305
- SMS. *See* System Managed Space (SMS)
- Snapshot monitor data, 69, 109
- Software Development Kit, 125
- Solaris. *See* Sun Solaris
- Sourced functions, 122, 236. *See also* user-defined functions (UDFs)
- Sourcing the DB2 profile, 58–59
- Spatial Extender, 39
- SQL, 3, 5, 9, 14, 15, 16–18, 36, 39, 43, 45, 48, 51, 54, 55, 56, 57, 59, 61, 68, 114, 115, 117, 118, 119, 125, 130, 133, 134, 135, 141, 143, 144, 151–255, 296, 322, 323, 342, 354, 355, 368. *See also* specific statements, clauses, and keywords
  - authorities associated with, 68, 71, 101
  - Binder, 125, 141
  - built-in functions, 151
  - CASE expressions, 94–95, 192–196
  - column masks and, 94–96
  - common table expressions, 190–192
  - Data Control Language (DCL), 3, 152, 153
  - Data Definition Language (DDL), 3, 45, 81, 107, 134, 152, 153, 302
  - Data Manipulation Language (DML), 3, 14, 81, 87, 152, 153–215, 225, 231, 367
  - Embedded, 15, 72, 87, 141, 143, 152, 153, 221, 247, 354, 355, 369
  - executing statements, 152
  - external stored procedures, 124, 242
  - for Java. *See* SQL for Java (SQLJ)
  - isolation levels and, 354
  - joining tables using, 196–207. *See also* joins
    - locks and, 356, 364, 365
    - precompiler, precompile process, 125, 141, 364
    - privileges associated with, 72, 78, 79, 80, 81, 82, 87
    - Procedural Language (SPL), 16, 61, 124, 236, 335
    - replication, 40, 41
    - Row and Column Access Control (RCAC) and, 92, 96
    - savepoints and, 253–255
    - scalar functions, 237–241
    - SQLADM authority and, 71
    - statement categories, 152
    - stored procedures, 45, 80, 124, 151, 152, 241–248
    - subqueries, 163, 176
    - syntax, 51, 152, 223. *See also* specific statements
    - table functions, 237–241
    - transactions and transaction boundaries, 248–255
    - triggers and, 120, 333, 335
    - user-defined functions, 45, 122–123, 235–237
    - working with, 151–255
    - XML and, 230–235. *See also* XQuery
- SQL Communications Area (SQLCA), 15, 219
- SQL Descriptor Area (SQLDA), 218
- SQL for Java (SQLJ), 15, 46, 143, 355
- SQL Procedural Language (SPL), 16, 61, 124, 236, 335
- SQL/400, 36
- SQL\_ATTR\_TXN\_ISOLATION connection attribute, 355
- SQLADM authority, 71
- SQLCA. *See* SQL Communications Area (SQLCA)
- SQLDA. *See* SQL Descriptor Area (SQLDA)
- SQLJ. *See* SQL for Java (SQLJ)
- SQLRULES precompiler option, 141
- SQLSetConnectAttr() function, 142, 355
- svrcon\_gssplugin\_list parameter, 67
- Standard Generalized Markup Language (SGML), 55
- Standby databases, 41
- Standby server, 5
- START DATABASE command, 69
- START TRACE command, 81
- STARTDB privilege, 73
- STATS privilege, 73
- STOGROUP clause, 138, 139
- STOP DATABASE command, 69
- STOP TRACE command, 81
- STOPALL privilege, 81
- STOPDB privilege, 73
- storage group privileges, 74

Storage Optimization Feature, 44

Stored procedures, 14, 15, 16, 17, 45, 56, 71, 72, 80, 109, 110, 123–125, 144, 152, 241–248, 308

- authorities associated with, 71
- benefits of, 123, 124, 241–242
- business rules and, 124
- calling, 246–248
- creating, 124, 243–245. *See also* CREATE PROCEDURE statement
- developing, 124, 242–243
- external, 15, 72, 124, 242, 243
- external SQL, 124, 242
- Java, 80
- privileges associated with, 72, 78, 80
- SQL (Native SQL), 45, 80, 124, 151, 152, 242–246
- tasks performed by, 243
- types of, 124, 242–243
- working with, 241–248

STOSPACE privilege, 81

Strong data typing, 121, 267

Structured data types, 113, 121, 267. *See also* user-defined data types (UDTs)

Structured Query Language. *See* SQL

Subqueries, 163

- nested, 176

SUBSTR() function, 54

Subtypes, 121

Sun Solaris, 36, 41, 44, 45, 47, 65

Super exclusive lock, 360

Supertypes, 121

SUSE Enterprise Linux Server (SLES), 41

Sybase, 39, 59, 266

SYSADM authority, 68, 69, 71, 72, 94, 96, 104

SYSCATSPACE table space, 137

SYSCTRL authority, 68–69

SYSMAINT authority, 69, 71

SYSMON authority, 69, 71

SYSOPER authority, 69

System administrator. *See* SYSADM authority

System catalog tables, 70, 71, 73, 74, 130

System catalog, 10, 68, 69, 70, 71, 73, 74, 113, 125, 130, 133, 134, 139, 143, 162, 319, 320

System DBADM authority, 70, 71

System i, 142, 143

System Managed Space (SMS), 128, 129

System period, 144

System privileges, 80–81

System R, 36

System schemas, 111

System time, 144

System z, 38, 46, 47, 50, 142

## T

Table check constraints. *See* CHECK constraints

Table functions, external, 122, 123, 236, 237

Table partitioning, 43–44, 112

Table spaces, 7, 12, 42, 112, 113, 125, 127–129, 135

- Automatic Storage (AS), 129
- containers in, 127
- Database Managed Space (DMS), 128
- default, 137
- extents in, 127
- in DB2 for Linux, UNIX, and Windows, 129
- in DB2 for z/OS, 129
- large object (LOB), 129
- locks and, 356, 357, 358, 360
- pages in, 127
- partitioned, 129
- privileges available with, 73, 74
- segmented, 129
- System Managed Space (SMS), 128
- temporary, 322
- universal, 129
- used by the DB2 directory, 132–133
- XML, 129

Tables, 3, 7, 8, 12, 14, 15, 17, 39, 40, 41, 42, 43, 45, 47, 54, 55, 56, 68, 70, 71, 72, 73, 74, 75, 76, 81, 92, 94, 109, 110, 111–113, 257, 258

- altering, 317–319. *See also* ALTER TABLE statement
- auxiliary, 112
- base, 111, 113, 319, 320–322
- child, 276, 277. *See also* referential constraints
- delete-connected, 288
- clone, 112
- columns in, 111
- common table expressions and, 190–192
- creating, 296–317. *See also* CREATE TABLE statement
- data concurrency and, 341–376
- deleting, 153
- duplicate, 306–307
- fields in, 111

- history, 112, 145, 146, 147, 149, 226, 306
- identity columns in, 155, 304–306, 307
- indexes and, 329
- insert time clustering (ITC), 12, 111
- joining, 196–207. *See also* Cartesian products; inner joins; outer joins
- locks and, 356, 361. *See also* LOCK TABLE statement
- materialized query (MQT), 15, 43, 46, 49, 71, 92, 94, 112
- multidimensional clustering (MDC), 12, 43, 49, 111
- parent, 276, 277. *See also* referential constraints
- partitioned, 43–44, 112
- populating, 153
- privileges associated with, 72, 73, 75
- range-clustered, 12, 111–112
- range-partitioned, 12
- records in, 111
- result, 112, 114, 323
- retrieving data from, 153
- rows in, 111
- self-referencing, 278
- similar to existing tables, creating, 306–307
- storage space used by, reducing, 13
- structure depicted, 111
- system catalog, 70, 71, 73, 74, 130
- temporal (time travel) tables, 3, 39, 107, 108, 144–149, 151, 152, 223–229
- temporary, 15, 44, 113, 319–322
- triggers and, 332–333
- typed, 113, 121
- types of, 111–113
- values in, 111
- Template UDFs, 122, 236
- Temporal data. *See also* temporal (time travel) tables
  - concepts, 144–145
  - management, 107, 108, 144–149
- Temporal restriction, 225
- Temporal (time travel) tables, 3, 39, 107, 108, 144–149, 151, 152, 223–229
  - application-period, 3, 112, 145, 226–229
  - bitemporal, 3, 112, 145, 229
  - querying, 225–229
  - system-period, 3, 112, 145, 225–226
  - temporal restriction for, 225
  - time-period specification, 225–229
  - working with, 223–229
- Temporary tables, 15, 44, 113, 319–322
  - created, 319, 320–322
  - declared, 15, 319–322
- TEMPSPACE1 table space, 137
- Text Search, 39
- Time. *See* date/time data types
- TIME data type, 147, 263, 270, 298
- Time period, 144
  - specification, 225–229
- Time travel query, 39. *See also* temporal (time travel) tables
- Time travel tables. *See* temporal (time travel) tables
- Timeouts. *See* locks, waits and timeouts
- TIMESTAMP data type, 147, 264, 270, 299
- Tivoli System Automation for Multiplatforms (SA MP), 51
- Token values, INSERT statement and, 155
- Trace, 8, 9, 10, 11, 15, 46, 80, 81
- TRACE privilege, 81
- Transactions and transaction boundaries, 248–255
  - interleaved transactions, 343
  - dirty reads and, 344
  - lost updates and, 343
  - nonrepeatable reads and, 344
  - parallel transactions, 343
  - phantoms and, 344
  - serializable, 343
  - transaction logging, transaction log files. *See* Logging types, and locks acquired for, 364
- Transition tables/transition variables, triggers and, 334, 335–336
- TRIGGER privilege, 76
- Triggers, 3, 5, 16, 17, 75, 76, 80, 109, 110, 112, 119–120, 130, 144, 161–162, 257, 258, 304, 307, 308, 332–339
  - action of, 120, 333, 334–335
  - activation time of, 120, 333
  - AFTER, 120, 333, 334, 336, 337–338
  - altering, 339
  - BEFORE, 112, 120, 333, 334, 336–337
  - constraints vs., 332–333
  - CREATE TRIGGER statement for, 17, 333–339
  - DELETE, 161–162
  - delete operations and, 335, 337, 339
  - event, 120, 333
  - firing of, 120, 333, 335, 336, 337, 338
  - granularity of, 120, 333, 335

IGNORE DELETE TRIGGERS CLAUSE and, 161–162  
insert operations and, 335, 337, 339  
INSTEAD OF, 120, 333, 334, 336, 338–339  
multiple, 338  
privileges associated with, 76, 80  
purposes of, 119, 120  
RESTRICT WHEN DELETE TRIGGERS clause and, 162  
rows affected by, 120, 333  
table/view associated with, 120, 333  
transition variables, transition tables and, 334, 335–336  
UDFs and, 337  
update operations and, 335, 337, 339  
views and, 339  
Trusted connections, 105  
Trusted context, 3, 6, 8, 15, 63, 83, 104–105  
Tuning, 12, 38, 42, 48, 59  
TXNISOLATION keyword, 355  
Type 1, Type 2 database connections, 140–142  
Typed tables, 113, 121

## U

UDFs. *See* user-defined functions (UDFs)  
Uncommitted Read (UR) isolation level, 190, 344, 345, 350–352, 353, 354, 355, 360, 361, 364  
Underscore wildcard character (`_`), 174  
Unfenced UDFs, 72  
UNION ALL set operator, 209, 214  
UNION set operator, 208, 214, 215  
UNIQUE clause, 117, 253, 330, 331  
UNIQUE constraints, 3, 5, 117, 257, 258, 268, 272–274, 277, 296, 297, 300, 302, 307, 310, 311, 316, 318, 329, 331  
Unique keys, referential integrity constraints and, 277  
Units of work, 15, 141, 248, 342. *See also* transactions and transaction boundaries  
Universal Database, 36  
UNIX, 10, 38, 43, 57, 58, 65. *See also* DB2 9.7 for Linux, UNIX, and Windows; DB2 10.1 for Linux, UNIX, and Windows  
Updatable cursors, 215, 352  
UPDATE privilege, 75, 82  
Update Rule, referential integrity constraints and, 279, 282–285, 293

ON UPDATE NO ACTION, 282, 283, 285  
ON UPDATE RESTRICT, 282, 283, 284  
UPDATE statement, 113, 151, 153, 156–159, 163, 223, 224, 225, 227, 232, 233, 321, 322, 358, 359, 360, 364. *See also* Update Rule; Update (U) locks  
Update (U) locks, 190, 360, 364, 371  
USAGE OF DISTINCT TYPE privilege, 78  
USAGE OF TYPE privilege, 78  
USAGE privilege, 77, 79, 82, 83  
USE AND KEEP UPDATE LOCKS clause, 189–190  
USE privilege, 74  
USE OF ALL BUFFERPOOLS, 74  
USE OF BUFFERPOOL, 74  
USE OF STOGROUP, 74  
USE OF TABLESPACE, 74  
User IDs, 65, 66, 67, 140  
User-defined data functions. *See* user-defined functions (UDFs)  
User-defined data types (UDTs), 109, 121–122, 267  
distinct, 267  
strong data typing and, 121, 267  
structured, 267  
subtypes and, 121  
supertypes and, 121  
User-defined functions (UDFs), 3, 45, 72, 109, 122–123, 151, 235–241  
CREATE FUNCTION statement and, 237–40  
CREATE\_EXTERNAL\_ROUTINE privilege and, 72  
CREATE\_NOT\_FENCED\_ROUTINE privilege and, 72  
creating, 237–240  
external scalar, 122, 190, 236  
external table, 122, 123, 236, 237  
invoking, 240–241  
OLE DB external table, 123, 236–237  
sourced (template), 78, 122, 236  
SQL, scalar and table, 122, 237–241  
types of, 236–237  
USERSPACE1 table space, 137, 309, 312, 314, 315, 316  
Utilities, DB2, 44, 68, 69, 70

## V

Valid time, 144  
Validation Number, 33  
VALUE() function, 54

VALUES clause, 154, 155, 156, 216, 223–224, 232

VARBINARY data type, 262, 270, 298

VARCHAR data type, 261, 270, 298

VARCHAR2 Oracle data type, 266

VARGRAPHIC data type, 262, 270, 298

Variable privileges, 82

Victim pages, in buffer pools, 126

Victim processes, in deadlocks, 376

Views, 3, 5, 7, 14, 39, 41, 43, 45, 109, 112, 114–115, 117, 118, 121, 122, 130, 139, 143, 153, 154, 156, 157, 158, 159, 160, 163, 164, 165, 182, 190, 191, 192, 231, 236, 257, 258, 291, 307, 323–328, 332, 345, 348, 352, 352, 354

- for access control, 91–92
- authorities and, 68–71
- child, 326–28
- creating, 323. *See also* CREATE VIEW statement
- data concurrency and, 91–92
- deletable, 114
- INSERT operations and, 326, 327
- insertable, 114
- parent, 326
- privileges and, 73, 75, 76–77, 80, 81, 82, 87–88
- read-only, 114
- SELECT statement and, 323
- symmetric, 325
- triggers and, 332, 334, 338, 339
- updatable, 114
- WITH CASCADED CHECK OPTION clause and, 325–328
- WITH LOCAL CHECK OPTION clause and, 324–325

VSAM, 127, 132, 133

## W

Waits, on locks, 252, 354, 365, 366, 368, 369, 370, 374, 375, 376. *See also* locktimeout parameter

Warehousing. *See* data warehousing

Weak exclusive (WE) lock, 359

WebSphere, 46, 47

WHERE clause, 92, 157, 160, 165, 168, 169–180, 185, 198, 200, 204, 358, 359

- search condition, 169
- XQuery and, 233

WHERE CURRENT OF clause, 156–161, 216, 364

Wildcard characters, in LIKE clause, 174–175

WITH ADMIN option, 86

WITH CASCADED CHECK OPTION clause, 326–328

WITH CHECK OPTION clause, 5, 339

WITH DEFAULT clause, 296, 310

WITH GRANT OPTION clause, 84, 86, 87

WITH HOLD clause, 142, 216, 217

WITH keyword, 192

WITH LOCAL CHECK OPTION, 324–325

WITH RELEASE option, 220, 221

WITH RETURN clause, 217

WITH RETURN FOR clause, 245

WITH RETURN TO clause, 217

WLM. *See* Workload Manager (WLM)

WLMADM authority, 71, 83

Work file database, 125, 135, 138

Workgroup Server Edition. *See* DB2 Workgroup Server Edition (WSE)

Workload Deployer, 42

Workload Manager (WLM), 5, 9, 10, 11, 12, 44–45, 71

Workload privilege, 82

Workload. *See* database workload management

Workloads, database, 47–52

Workstations. *See* servers

WRITE privilege, 82

## X

Extensible Markup Language (XML), 2, 5, 8, 10, 14, 15, 35, 36, 39, 46, 54, 55–56, 61, 82, 128, 151, 165, 230–235, 258, 265, 271. *See also* pureXML; XQuery

- application programming interfaces (APIs) and, 56
- attributes, 231
- benefits of, 55
- Data Manipulation Language (DML) and, 231
- data type, 46, 52, 56, 230, 265, 299
- DELETE and, 233
- DISTINCT clause with, 165
- documents, 55–56
- elements, 231
- functions, 14, 151, 233
- INSERT and, 232
- parsing, 230
- pureXML and. *See* pureXML
- sample document, 230
- schemas and, 14, 56
- shredding of documents, 55

SQL and, 39, 151, 233  
storing of data/documents, 55–56, 230–231. *See also*  
    pureXML  
table spaces, 129  
tags, 231, 235–266  
UPDATE and, 232  
white space and, 14  
working with data, 230–235  
XQuery and, 39, 151, 233–235. *See also* XQuery  
XML schema repository (XSR) privilege, 82  
XMLEXISTS() function, 233  
XMLPARSE() function, 233, 266  
XMLQUERY() function, 233

XMLSERIALIZE() function, 233, 266  
XMLTABLE() function, 233  
XMLTEXT() function, 233  
XMLVALIDATE() function, 233  
XPath, 233–234  
XQuery, 3, 15, 39, 56, 68, 151, 233, 234, 235  
    expressions, 234

## **Z**

z/OS, 45  
z/OS, DB2 for. *See* DB2 for z/OS  
zLinux, 38