



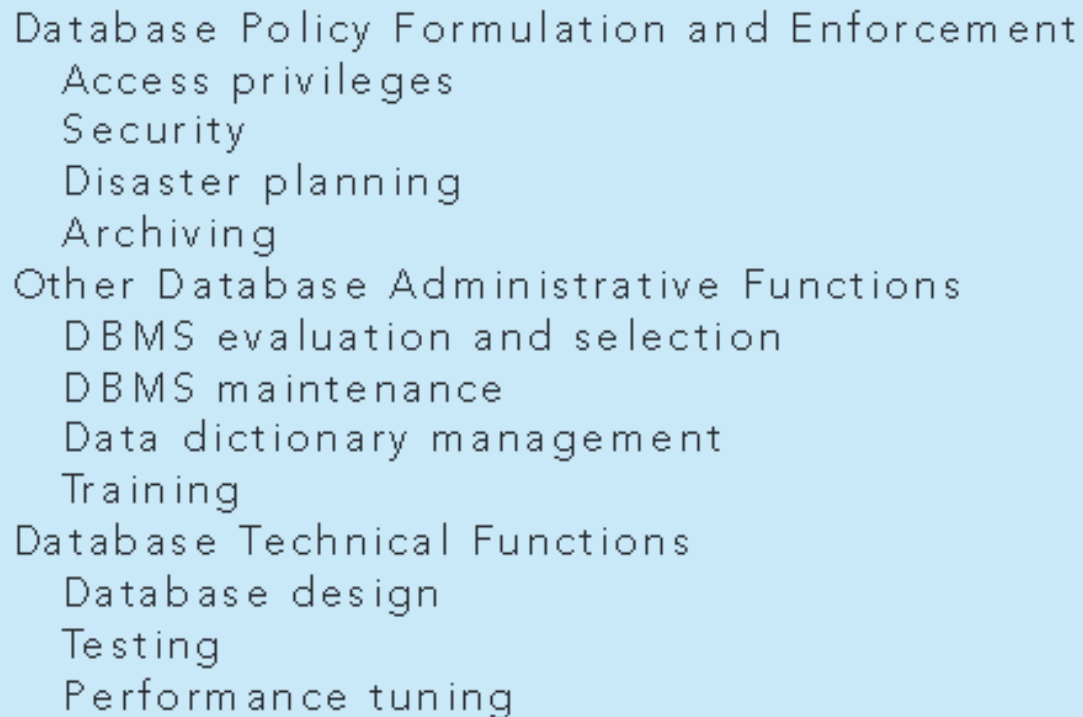
**CIS 412**

**DATABASE MANAGEMENT SYSTEMS**

**Chapter 8**

**Database Administration**

# INTRODUCTION



- Database Policy Formulation and Enforcement
  - Access privileges
  - Security
  - Disaster planning
  - Archiving
- Other Database Administrative Functions
  - DBMS evaluation and selection
  - DBMS maintenance
  - Data dictionary management
  - Training
- Database Technical Functions
  - Database design
  - Testing
  - Performance tuning

**FIGURE 8-1: DBA responsibilities**



# DATABASE POLICY FORMULATION AND ENFORCEMENT

## ○ DBA

- Formulates database policies
- Communicates policies to users
- Enforces policies

## ○ Policies

- Access privileges
- Security
- Disaster planning
- Archiving

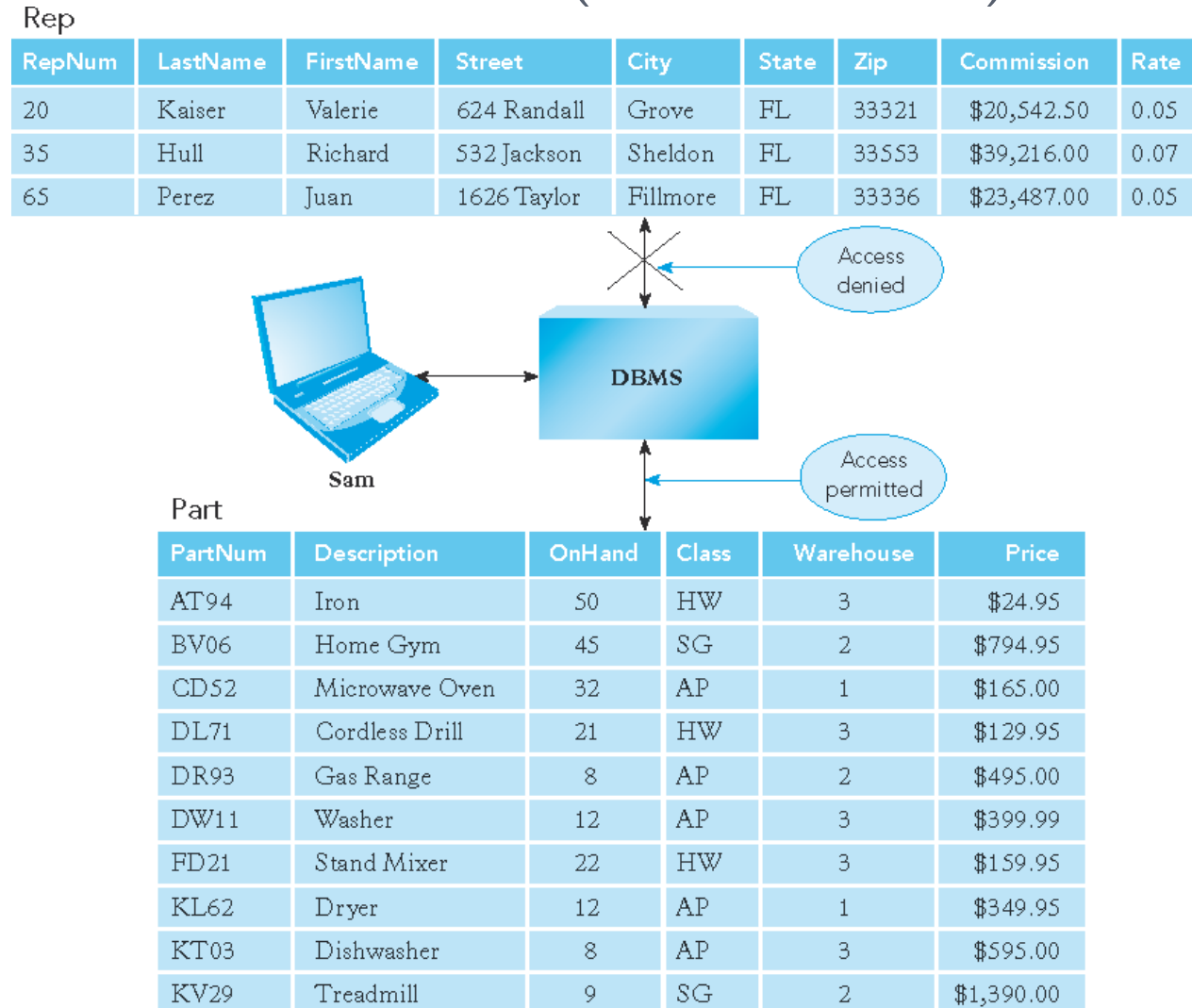


# ACCESS PRIVILEGES

- DBA
  - Determines access privileges for all users
  - Enters appropriate authorization rules in DBMS
    - SQL GRANT statement
- Access privilege policy
  - Documented by DBA
  - Approved by top-level management
  - Communicated by DBA to all users

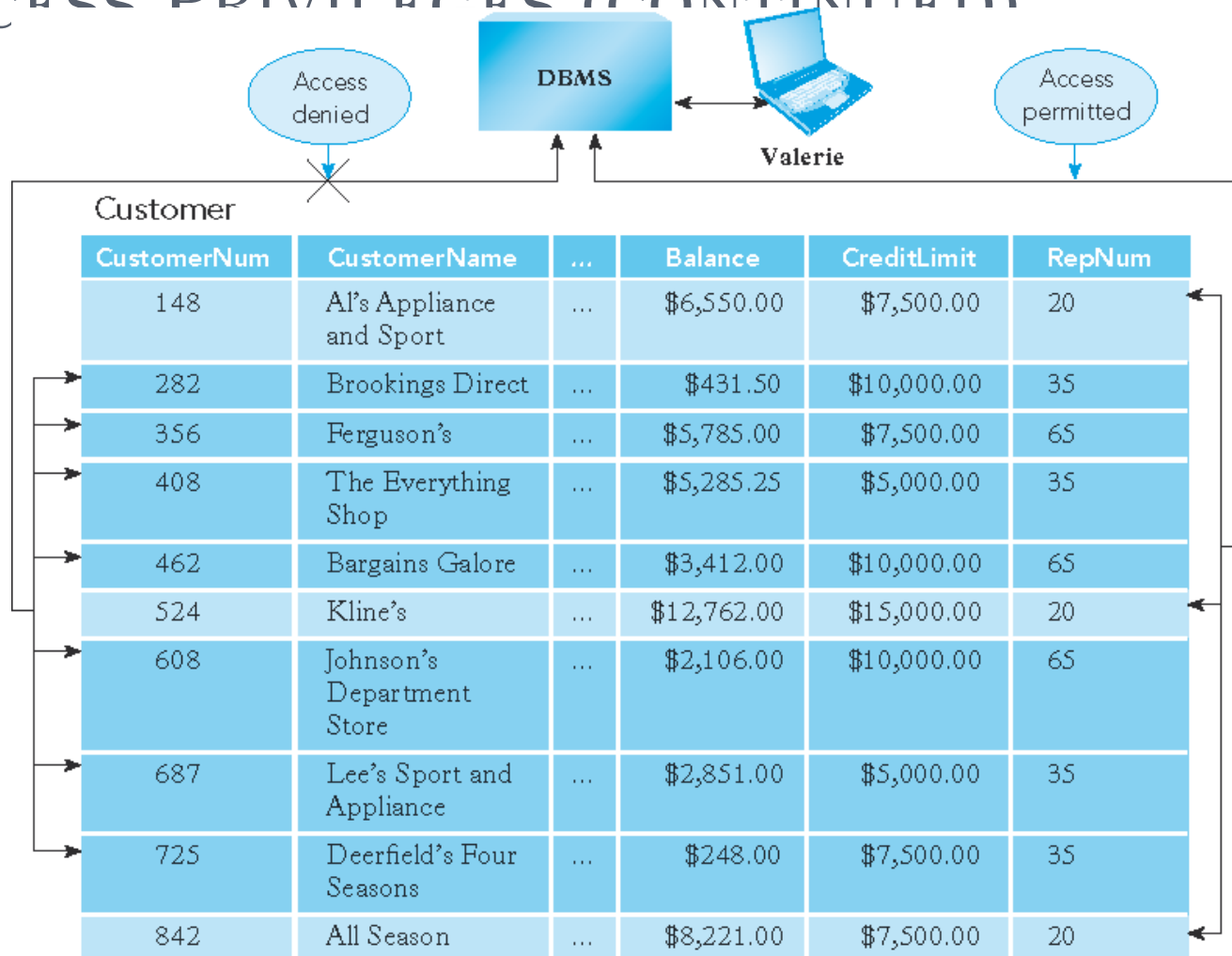


# ACCESS PRIVILEGES (CONTINUED)



**FIGURE 8-2: Permitted and denied access privileges for Sam**

# ACCESS PRIVILEGES (CONTINUED)



**FIGURE 8-4: Permitted and denied access privileges for Valerie**

# SECURITY

- Prevention of unauthorized access, intentional or accidental, to database
- DBA
  - Creates security policies and procedures
  - Obtains management approval of policies and procedures
  - Distributes policies and procedures to authorized users



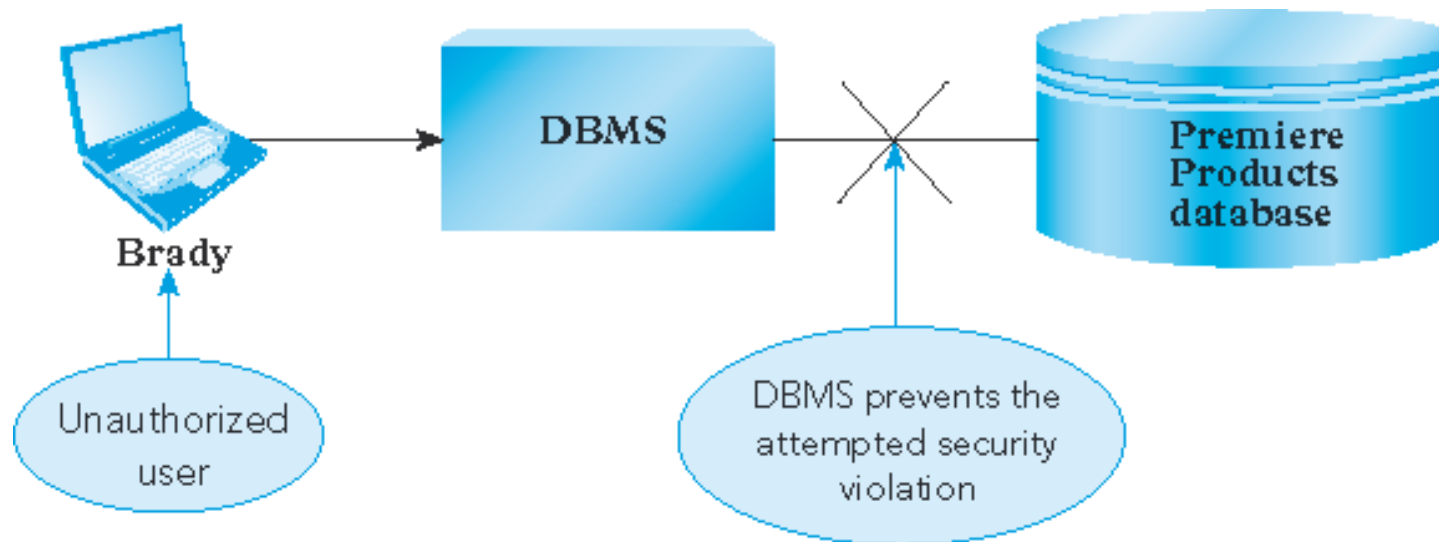
# SECURITY (CONTINUED)

- DBMS's security features
  - Encryption
  - Authentication
  - Authorizations
  - Views
- Additional security programs may be created or purchased
- Monitoring of database usage to detect security violations



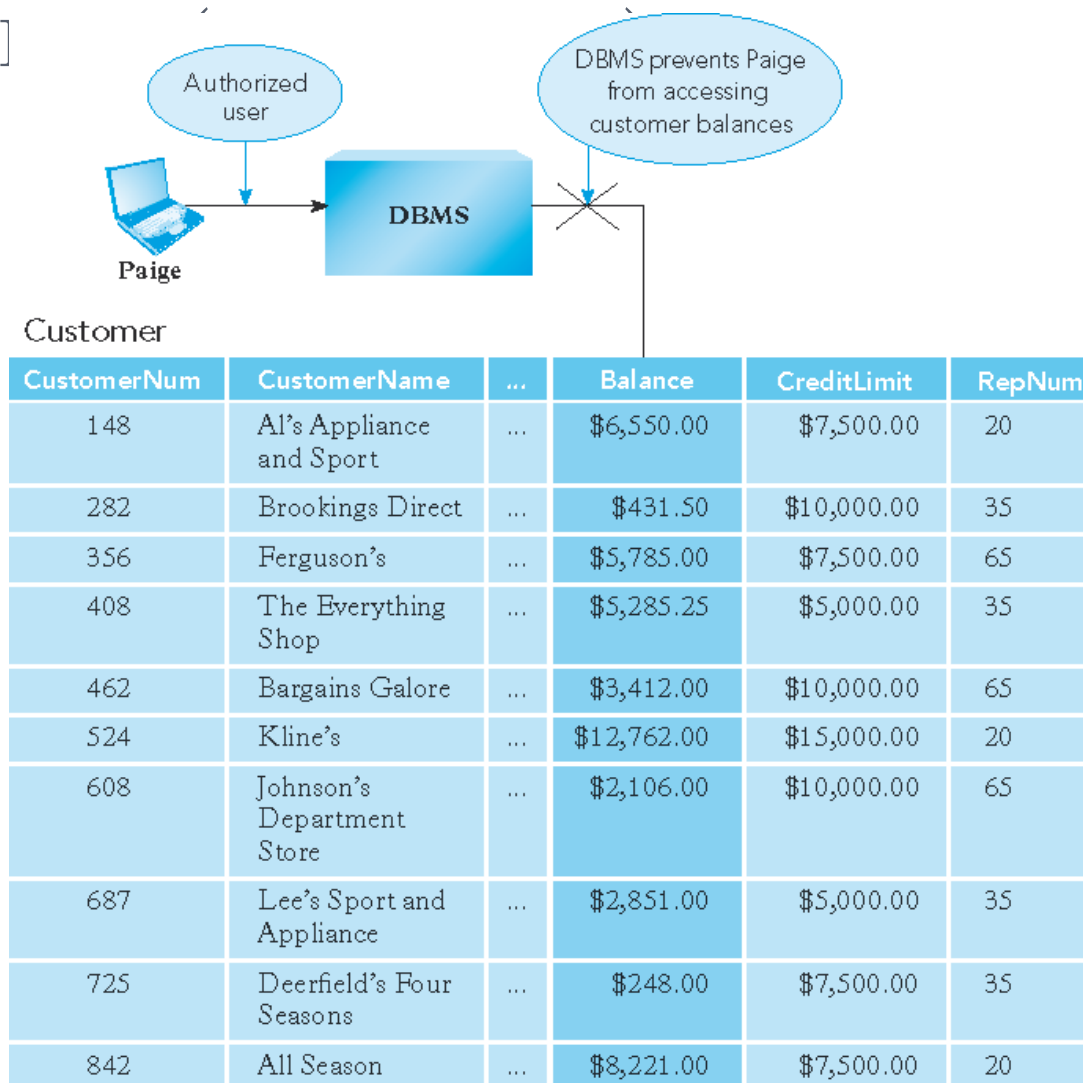


## SECURITY (CONTINUED)



**FIGURE 8-5: Attempted security violation by Brady, who's not an authorized user**

# SECURITY



**FIGURE 8-6: Attempted security violation by Paige, who's authorized to access some customer data but is not authorized to access customer balances**

# DISASTER PLANNING

- Damage from physical incidents
  - Software/hardware/electrical
  - Natural disasters
- **Disaster recovery plan:** ongoing and emergency actions and procedures to ensure data availability if a disaster occurs
- Hard drive failures
  - **Redundant array of inexpensive/independent drives (RAID):** database updates replicated to multiple hard drives



# DISASTER PLANNING (CONTINUED)

- Electrical power loss
  - **Uninterruptible power supply (UPS):** power source and power generator
- Duplicate backup systems
  - **Hot site:** completely equipped with duplicate hardware, software, and data
    - Can switch to hot site in minutes or hours
  - **Warm site:** duplicate hardware and software but not data
    - Takes longer to start processing



# ARCHIVING

- Governmental laws and regulations, for example:
  - Sarbannes-Oxley Act
  - Patriot Act
  - HIPAA
- Auditing and financial requirements
- **Data archive** or **archive**: place where record of certain corporate data is kept
  - Stored on mass storage devices
- Copies of archives and database backups must be stored off-site



# ARCHIVING (CONTINUED)

DATABASE

Orders

OrderNum	OrderDate	CustomerNum
21608	10/20/2013	148
21610	10/20/2013	356
21613	10/21/2013	408
21614	10/21/2013	282
21617	10/23/2013	608
21619	10/23/2013	148
21623	10/23/2013	608

ARCHIVE

Orders

OrderNum	OrderDate	CustomerNum
21617	10/23/2013	608

OrderLine

OrderNum	PartNum	NumOrdered	QuotedPrice
21608	AT94	11	\$21.95
21610	DR93	1	\$495.00
21610	DW11	1	\$399.99
21613	KL62	4	\$329.95
21614	KT03	2	\$595.00
21617	BV06	2	\$794.95
21617	CD52	4	\$150.00
21619	DR93	1	\$495.00
21623	KV29	2	\$1,290.00

OrderLine

OrderNum	PartNum	NumOrdered	QuotedPrice
21617	BV06	2	\$794.95
21617	CD52	4	\$150.00

**FIGURE 8-7: Movement of order 21617 from the database to the archive**

# OTHER DATABASE ADMINISTRATION FUNCTIONS

- DBMS evaluation and selection
- DBMS maintenance
- Data dictionary management
- Training



# DBMS EVALUATION AND SELECTION

- Data definition
- Data restructuring
- Nonprocedural languages
- Procedural languages
- Data dictionary
- Concurrent update
  - **Shared lock**





# DBMS EVALUATION AND SELECTION (CONTINUED)

- Backup and recovery
- Security
- Integrity
- Replication and distributed databases
- Limitations
  - **Local area network (LAN)**
- Documentation and training
  - **Context-sensitive help**



# DBMS EVALUATION AND SELECTION (CONTINUED)

- Vendor support
- Performance
- Portability
  - **Intranet**
- Cost
- Future plans
- Other considerations



# DBMS MAINTENANCE

- Installation of DBMS
- Configuration changes
- Upgrades for new releases
- Problem resolution
- Special one-time processing needs



# DATA DICTIONARY MANAGEMENT

- Data dictionary is like database catalog, but with wider range of information
- Establishes naming conventions for tables, fields, indexes, etc.
- Creates data definitions for tables
- Creates data integrity rules and user views
- Updates data dictionary
- Creates and distributes reports from data dictionary



# TRAINING

- Training in using DBMS and accessing database
- Training of technical staff responsible for developing and maintaining database applications
- If training is provided by vendor of DBMS, DBA handles scheduling of training



# TECHNICAL FUNCTIONS

- Database design
- Testing
- Performance tuning



# DATABASE DESIGN

- Establishes sound methodology for database design
- Does physical-level design
- Creates documentation standards
- Reviews changes to requirements and manages modifications to database



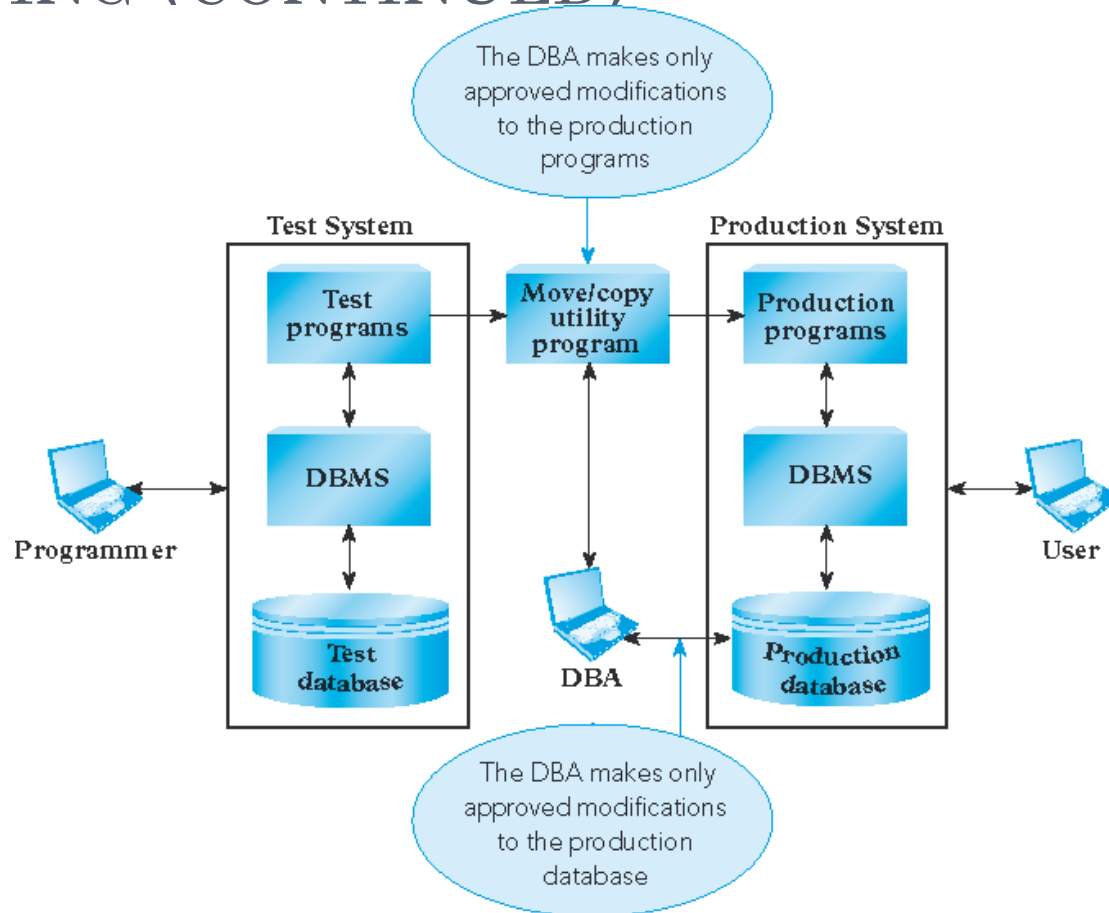
# TESTING

- **Production system or live system:** hardware, software, and database for users
- DBA grants access to production system only to authorized users, except for:
  - Troubleshooting a problem
  - Addition of new or modified programs
- **Test system or sandbox:** used by programmers to develop new programs and modify existing programs





# TESTING (CONTINUED)



**FIGURE 8-9: DBA controls the interaction between the test and production systems**

# PERFORMANCE TUNING

- DBA attempts to get best performance within funding constraints
- Creating and deleting indexes
- Splitting tables
- Changing table design
- **Denormalizing** converts a table in third normal form to a table not in third normal form
  - Improved performance



# PERFORMANCE TUNING (CONTINUED)

Customer

CustomerNum	CustomerName	Street	City	State	Zip	Balance	CreditLimit	RepNum
148	Al's Appliance and Sport	2837 Greenway	Fillmore	FL	33336	\$6,550.00	\$7,500.00	20
282	Brookings Direct	3827 Devon	Grove	FL	33321	\$431.50	\$10,000.00	35
356	Ferguson's	382 Wildwood	Northfield	FL	33146	\$5,785.00	\$7,500.00	65
408	The Everything Shop	1828 Raven	Crystal	FL	33503	\$5,285.25	\$5,000.00	35
462	Bargains Galore	3829 Central	Grove	FL	33321	\$3,412.00	\$10,000.00	65
524	Kline's	838 Ridgeland	Fillmore	FL	33336	\$12,762.00	\$15,000.00	20
608	Johnson's Department Store	372 Oxford	Sheldon	FL	33553	\$2,106.00	\$10,000.00	65
687	Lee's Sport and Appliance	282 Evergreen	Altonville	FL	32543	\$2,851.00	\$5,000.00	35
725	Deerfield's Four Seasons	282 Columbia	Sheldon	FL	33553	\$248.00	\$7,500.00	35
842	All Season	28 Lakeview	Grove	FL	33321	\$8,221.00	\$7,500.00	20

**FIGURE 8-10: Customer table for Premiere Products**



# PERFORMANCE TUNING (CONTINUED)

CustomerAddress

CustomerNum	CustomerName	Street	City	State	Zip
148	Al's Appliance and Sport	2837 Greenway	Fillmore	FL	33336
282	Brookings Direct	3827 Devon	Grove	FL	33321
356	Ferguson's	382 Wildwood	Northfield	FL	33146
408	The Everything Shop	1828 Raven	Crystal	FL	33503
462	Bargains Galore	3829 Central	Grove	FL	33321
524	Kline's	838 Ridgeland	Fillmore	FL	33336
608	Johnson's Department Store	372 Oxford	Sheldon	FL	33553
687	Lee's Sport and Appliance	282 Evergreen	Altonville	FL	32543
725	Deerfield's Four Seasons	282 Columbia	Sheldon	FL	33553
842	All Season	28 Lakeview	Grove	FL	33321

**FIGURE 8-11: Result of splitting the Customer table into two tables**



# PERFORMANCE TUNING (CONTINUED)

CustomerFinancial

CustomerNum	CustomerName	Balance	CreditLimit	RepNum
148	Al's Appliance and Sport	\$6,550.00	\$7,500.00	20
282	Brookings Direct	\$431.50	\$10,000.00	35
356	Ferguson's	\$5,785.00	\$7,500.00	65
408	The Everything Shop	\$5,285.25	\$5,000.00	35
462	Bargains Galore	\$3,412.00	\$10,000.00	65
524	Kline's	\$12,762.00	\$15,000.00	20
608	Johnson's Department Store	\$2,106.00	\$10,000.00	65
687	Lee's Sport and Appliance	\$2,851.00	\$5,000.00	35
725	Deerfield's Four Seasons	\$248.00	\$7,500.00	35
842	All Season	\$8,221.00	\$7,500.00	20

**FIGURE 8-11: Result of splitting the Customer table into two tables (continued)**

## PERFORMANCE TUNING (CONTINUED)

OrderLine

OrderNum	PartNum	Description	NumOrdered	QuotedPrice
21608	AT94	Iron	11	\$21.95
21610	DR93	Gas Range	1	\$495.00
21610	DW11	Washer	1	\$399.99
21613	KL62	Dryer	4	\$329.95
21614	KT03	Dishwasher	2	\$595.00
21617	BV06	Home Gym	2	\$794.95
21617	CD52	Microwave Oven	4	\$150.00
21619	DR93	Gas Range	1	\$495.00
21623	KV29	Treadmill	2	\$1,290.00

**FIGURE 8-12: Including part descriptions in the OrderLine table, which creates a first normal form table**

# SUMMARY

- Database administrator (DBA) is responsible for supervising the database and use of the DBMS
- DBA formulates and enforces policies about which users can access database, portions they may access, and the manner in which they can access it
- DBA formulates and enforces policies about security by using DBMS's security features, special security programs, and monitoring database usage
- DBA creates and implements backup and recovery procedures as part of a disaster recovery plan



## SUMMARY (CONTINUED)

- DBA formulates and enforces policies that govern management of an archive for data
- DBA leads evaluation and selection of new DBMS
- DBA installs and maintains DBMS
- DBA maintains data dictionary, establishes naming conventions for its content, and provides information from it to others
- DBA provides database and DBMS training and coordinates and schedules training by outside vendors





## SUMMARY (CONTINUED)

- DBA verifies all information-level database designs, completes all physical-level database designs, and creates documentation standards; also evaluates changes in requirements
- DBA controls production system, which is accessible only to authorized users; other than under exceptional situations, programmers access a separate test system
- DBA tunes database design to improve performance; includes creating and deleting indexes, splitting tables, and denormalizing tables

