

DFo_1_1_sg

Course Goals

- Describe purpose of a relational database
- Describe key business requirements when developing a database
- Use data modeling to architect a relational database
- Develop an entity relationship diagram to model data
- Use Oracle SQL Developer Data Modeler to build ERDs
- Map a physical model from an ERD
- Create a physical model from a logical model (ERD)
- Write, execute, and save SQL statements in Oracle Application Express

DFo_1_2_sg

- Data, collected facts about topic/item (Data is raw material)
- Information, result of combining/comparing/performing calculations on data
- Example,
 - Each student's test score is one piece of data.
 - Information is the class's average score or the school's average score
- Database, is a centralized and structured set of data stored on a computer system
- Relational Database, relational database stores information in tables with rows and columns
- DBMS is software that controls the storage, organization, and retrieval of data
- Important Terms
 - Hardware : physical parts of a computer
 - Software : instructions to tell hardware what to do
 - Operating system : software that directly controls the hardware
 - Application : performs specific task
 - Client : workstation used by end users
 - Server : accepts work requiring more power from clients
- Mainframe computing, centralized
- Desktop computing, localized
- Client/Server computing, centralized/local processing
- Grid computing, shared processing
- Cloud computing, internet based processing

Practice

Task 1, names, grade, student identifier,

Task 2, title, genre, author, due date

DFo_1_3_sg

- Database Models
 - Relational, collection of tables
 - Flat file, single table
 - Object Oriented, object
 - Hierarchal, tree like structure
 - Network, generalized graph structure

Practice

Task 1

A, hierarchical

B, network model

C, object oriented

D, relational model

E, relational model

DFo_1_4_sg

- Advantages of using a database rather than a simple file system:
 - Availability of data to a diverse group of users
 - Integration of data for easier access and modification when performing complex transactions
 - Data integrity and reduced data redundancy
- Important to identify/document business rules when designing a database*

Practice

Task 1, one business rule is that members pay the membership and the constraint could be that there is a lateness fee.

Task 2, patients can only have one UID, constraint is that there can be no repeats

DFo_2_1_sg

- Single table, flat file
- Relational database,
 - Less redundancy
 - Avoidance of inconsistency
 - Efficiency
 - Data integrity
 - Confidentiality

Practice

Task 1, some of the possible tables are one where there are books and the associated fields are the title, ISBN, year and price.

Task 2, one of the possible tables would be orders, and the associated fields could be customer names, stock status, price, dates, payments

DFo_2_2_sg

- Conceptual model, important entities (objects that become tables in database) and relationships among entities
- Logical model, includes all entities and relationships
- Physical model, defines table definitions, data types, and precision, identifies views, indexes, and other database objects

Practice

Task 1 Provide five reasons for creating a conceptual data model

- Includes all entities and relationships among them
- Relationship among entities
- Useful for tables

Task 2 List two examples of conceptual models and physical models.

- Conceptual models, library database,
- Physical models, entities and attributes in a table and columns

DFo_2_3_sg

- Entity, info that must be tracked
- Attributes, describe entities
 - Volatile, age
 - Nonvolatile, birthdate
 - Mandatory, must have value
 - Optional, may not have value
 - Single, cannot be divided into subparts
 - Composite, can be divided into subparts
 - Single-valued, student last name
 - Multi-valued, address
- Barker notation, Bachman notation, information engineering notation*

Practice

Task 1, the entities would be students, courses, departments, parent information, results, logins/logouts, and attendance

Task 2,

- Course, course ID, name, credits
- Department, courses offered, locations, faculty
- Student, names, DOB, major, GPA

- **Academic session, start date, end date, semester**
- **Parent information, name, address, contact info**
- **Exam, location, date, time, duration**

DFo_2_4_sg

- UID is a special attribute or group of attributes that uniquely identifies a particular instance of an entity
- Composite UID, if the UID is a combination of attributes
- Artificial UID is made from data that is assigned or generated by the system
- A primary key (PK) is a column or set of columns

Practice

Task 1

- **Lyrics**
- **Student ID**
- **Student ID, Title, Number**

Task 2

- **Course numbers**
- **Student ID**

DFo_2_5_sg

- A relationship is a bidirectional, significant association between two entities
- A foreign key (FK) is a column or a combination of columns in one table that refers to a primary key in the same table/another table
- Components of a relationship, name, cardinality(measures quantity), optionality
- Relationship types, 1 to 1, 1 to many, many to many
- Relationship matrix can be used to collect initial information about the relationships among a set of entities

Practice

Task 1,

- **B, One employee to one department**
- **Born in Riverhead, living in riverhead, visitor of Southampton, Mayor of Stony Brook...**

DFo_2_6_sg

- Conceptual modeling, describes the things of significance to an organization(entities)
- Logical modeling, describes the data in as much detail as possible, without regard to how it will be physically implemented in the database

- ERD is a model that identifies the concepts or entities that exist in a system and the relationships between those entities
- Implementation free modeling, A good logical data model stays the same regardless of the type of database system that is eventually built—or implemented on

Practice

Task 1

- **Department, employee and supervisors**
- **Hair Stylist, name, address, phone number, salary**
- **Teacher, name, address, number email**
 - **Teacher-class (teaches)**
- **Course, name, description**
 - **Course-class (description)**
- **Class, course number, teacher, location, time**
 - **Class includes teacher and course**

DFo_3_1_sg

- Barred relationships
- Intersection entity, always mandatory
- Non transferable relationships, ability of the relationship between two instances of an entity to change over time
- Supertype, parent-child relationship with one or more subtypes
- Subtype, subgrouping of the entity in an entity type which has attributes that are distinct from those in other subgroupings
- Generalization, bottom-up approach where two or more lower level entities are combined to form a higher level entity based on the common feature
- Specialization, Specialization is a top-down approach where the higher level entity is broken down into lower level entities
- Recursive relationship, is one where an entity instance is related to another instance in the same entity
- Generic modeling, way to model a Bill of Materials recursive relationship
- Arc relationship, arc is an exclusive relationship group, which is defined such that only one of the relationships can exist for any instance of an entity

Practice

Task 1

- **Course-student additional attribute can be description**
- **Course-faculty additional attribute can be teacher/teaching method**

DFo_3_2_sg

- Add entities and relationships to the model to accommodate historical data*
- Create additional entities to track the attributes' values over time

Practice

Task 1

- **Can be modified to include grade_history**
- **Start time is added due to it being an exam**
- **Time related constraints are, exams must not last longer than allotted time, exams must not begin before start time, exams must not end before end time.**

DFo_3_3_sg

- Normalization, process of organizing the attributes and tables of a relational database to minimize redundancy
- Normal forms, first, second, third normal forms
- Business rule is a statement that defines or constrains some aspect of the business
- Structural business rules, indicate the types of information to be stored and how the information elements interrelate
- Procedural rules deal with the prerequisites, steps, processes, or workflow requirements of a business

Practice

Task 1,

- **Remove repeating groups and ensure columns only hold one piece of information**
- **Divide into two tables, with store ID and location and Supplier ID and store ID**
- **Divide into two tables, one being category and description**

Task 2

- **Misplaced attributes are full time and part time in faculty**

Task 3

- **Eliminate doubles and create separate tables, such as User ID and Username, Server ID and Servername**

Task 4

- **Business rules are books, authors, customers, orders, and publishers must have unique identifiers**

Task 5

- **All teachers in our school must possess a valid teaching certificate, structural**
- **Each Department must offer a Course, structural**
- **Approval of travel requests to an event must be signed by the project manager of the event, procedural**
- **A customer may make numerous payments on account, structural**
- **A machine operator may not work more than 10 hours in a day, procedural**

- The Rental amount in RENTAL is calculated from the Rental rate multiplied by the number of days, programmatic
- A Customer can have zero, one, or many ORDERS, structural
- The Total cost of the RENTAL is calculated from the sum of Insurance amount, Rental amount, and Late charge, programmatic
- A customer's debt must not exceed the customer's credit limit, procedural

DFo_3_4_sg

- Keep in mind naming conventions
 - Columns
 - Tables
- There are naming restrictions within oracle
- Relationships are mapped between primary keys and foreign keys to allow one table to reference another
- Barred relationships, mapped to a foreign-key column on the many side

Practice

Task 1

- Attribute to column
- Entity to table
- ER model to physical design
- Primary UID, primary key
- Relationship to foreign key
- Secondary UID to unique key

Task 2

- Primary key pk
- Foreign key fk
- Unique key uk
- * required
- O optional

Task 3

- AUTH
- PUB
- CUST

Task 4

Song	Event	Customer	
X	X		Title
X	X	X	Description
	X		Venue
		X	First Name
		X	Phone Number
X	X		Release date
		X	Last Name
X	X		Type