Database Design and Implementation
HW 01

Team 08
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Abstract

An introductory/review homework on the topic of databases. Basic relational terminology and Entity Relationship Diagrams (ERDs) using the "Crow's Foot" notation are explored.

1. Refer to the data model for the Pine Valley Furniture Company in your Modern Database Management text. That data model is Figure 2-22 on on pg. 96 of the 10th edition of the text and pg. 94 of the 11th edition of the text. If you don't have your book yet, the data model is available on the link "Pine Valley Data Model" in the same cell on the schedule where you found this assignment. Answer the questions below about that data model.

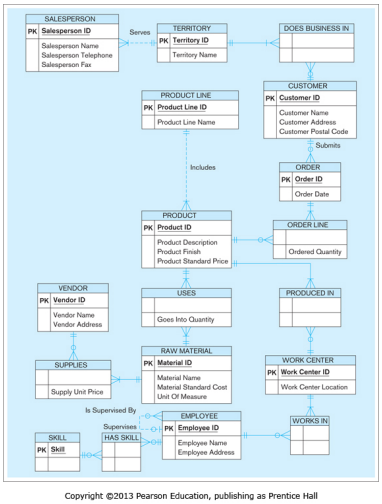

Figure 1: Figure 2-22 from the text.

(a) Identify a strong entity on the data model. Provide one reason why you think it is a strong entity.

Solution: A CUSTOMER is an example of a strong entity in this context because a CUSTOMER instance can exist on its own; it does not necessarily matter if a customer has made any orders/purchases. Other examples include SALESPERSON and TERRITORY because they can all exist independently of any other entities.

(b) Identify a weak entity on the data model. Provide one reason why you think it is a weak entity.

Solution: An ORDER LINE is an example of a weak entity in this context because an ORDER LINE instance cannot exist without being part of an order. Further, we could argue that an ORDER is a weak entity because an ORDER cannot be placed without a CUSTOMER to place it.

(c) What is the purpose of the WORKS IN entity?

Solution: WORKS IN is an Associative (or Intersection) Entity. It's purpose is to help store data that would not belong in either EMPLOYEE or WORK CENTER but that is specific to an employee-work center relationship instance, such as what responsibilities a certain employee has at a specific work center, for example.

(d) The WORKS IN entity has two binary relationships – one with the WORK CENTER entity and one with the EMPLOYEE entity. Look at the cardinalities of those two relationships and explain in words the meaning of those two binary relationships.

Solution:

WORKS IN and WORK CENTER Each WORKS IN instance has exactly one WORK CENTER instance it is related to, while a WORK CENTER instance can be related to many

WORKS IN instances. In other words, a WORK CENTER will require data about the 1 to many employees that work there (there must be at least one because it can't be a place of work if no one works there), but each WORKS IN instance can only describe work at one location.

WORKS IN and EMPLOYEE An EMPLOYEE could work in any number of work centers, thus needing any number of WORKS IN instances (maybe they are no longer employed, they work at one location exclusively, or they visit multiple locations); a WORKS IN instance can reference one and only one EMPLOYEE instance because it would describe the employee's work at one particular work location.

(e) What would be an appropriate primary key for the WORKS IN entity? Explain why you chose that primary key for the WORKS IN entity.

Solution: A concatenated key of the Work Center ID from WORK CENTER and the Employee ID from EMPLOYEE should suffice to uniquely identify a WORKS IN instance.

(f) The WORKS IN entity has no attributes on the data model. Name at least one non-key attribute that you believe might be stored in that entity.

Solution: The number of hours, percentage of work time, or frequency that an employee works at a particular location would be a good candidate attribute for the WORKS IN entity.

(g) Make up three sample rows of data each for the WORK CENTER, EMPLOYEE and WORKS IN entities. If you don't understand what I mean by "sample data," refer to the first week exercise, questions 8, 9, 10 that we completed in class. If you weren't in class, then look at figure 1-16 of your text.

Solution:

EMPLOYEE		
ID	NAME	ADDRESS
1	Terence H.	1580 Forever Lane
2	George S.	1581 Forever Lane
3	Raja S.	1582 Forever Lane

Figure 2: EMPLOYEE sample data.

WORK CENTER	
ID	LOCATION
1	1580 Evergreen Way
2	1598 Evercrest Way
3	1500 EverBrown Way

Figure 3: WORK CENTER sample data.

WORKS IN	
EMPLOYEE ID	WORK CENTER
1	3
2	1
3	1
2	2
2	3

Figure 4: WORKS IN sample data.

2. Use the business rules below to identify and write all attributes, relationships and cardinalities between the entities shown on the next page. Decide which attributes should be primary keys and foreign keys for each entity and put those in the diagram. Remember to include relationship verbs for all relationships. The application is for a charter airline company that flies planes for clients. The database will be owned by the charter airline company. There are no regularly scheduled flights; all flights occur when a charter client schedules and purchases a given flight. If you need to make assumptions about business rules other than the ones provided below, be sure to write those assumptions on your answer.

   - An aircraft is uniquely identified by an AircraftID. For each aircraft, the database should keep track of the type of plane it is and the quantity of seats.

   - A client is uniquely identified by a ClientID. For each client, the database should keep track of the client name and phone number.

   - A pilot is uniquely identified by a PilotID. The database should keep track of the name and phone number for each pilot.

   - One instance of a flight is assigned to only one aircraft, one pilot and one client. An aircraft could potentially be used on multiple flights. A client could potentially contract with the charter airline company for multiple flights.

   - For each flight, the charter airline company wants to store the start date and time of the flight, the aircraftID for the flight, the pilotID, and the clientID for the flight. You need to determine which attribute(s) should compose the primary key for the flight entity.

   Solution:

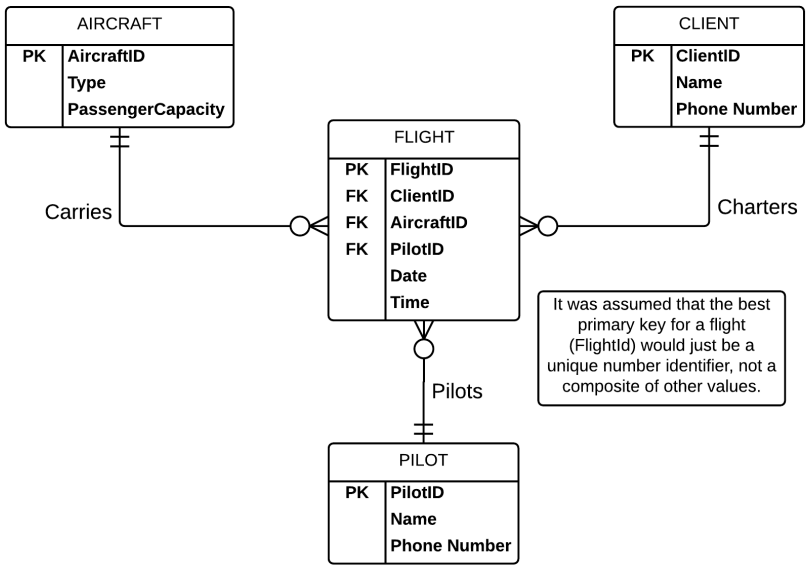

Figure 5: The ERD for the charter airline company's database (Problem 2).

3. Create a logical ERD for each of the problems below using the crowsfoot notation discussed in class. Be sure that each entity is a box with the name of the entity at the top of the box, the primary key attribute or attributes in the middle of the box, and the non-primary key attributes in the bottom of the box. Lines should separate each part of the entity box. Each entity must have a primary key defined. A primary key may consist of one of more attributes.
   The final ERD submitted for grading should not include any M:N relationships and all attributes should be placed within an entity. Each relationship should have at least one relationship verb or verb phrase. Please include all required foreign keys and denote the foreign key(s) with the notation (FK) on the ERD.
   Do not use Visio for this assignment, but please make sure the ERDs are readable. I recommend using a ruler/straight-edge for the entities and relationships. For the first problem – problem (a) - I provide some sample data to help you understand the type of data that would be stored in the database. I recommend that you do the same thing for the other two problems. It is always easier to figure out how you are going to store the data once you know what types of data will be stored. You do not have to turn in sample data – the only required deliverable is one ERD per problem.

   We did not use Visio to create our ERDs - we used a software called Lucidchart. We hope that this was not against any rules, but our need for high productivity mixed with a little OCD led us to use a software that we were already familiar with to produce a clean product.

(a) A college course is taught by many instructors, and an instructor may teach many courses. An instructor teaches a section of a course. A course may have one or more scheduled sections, or may not have a scheduled section. Attributes of COURSE include courseID, coursename, and credits. A courseID is a unique value for a given course. Attributes of a SECTION of a course include courseID, sectionID, semesternumber, year, and instructorID. A given section of a course is taught by only one instructor. An INSTRUCTOR is identified by an instructorID. Additional information we want to store about an instructor includes the lastname, firstname, and officenumber. We want to store the quantity of students registered for a course. Sample data for this application system is provided below.

CourseID	Course Name	Credits	SectionID	Semester	Year	Instructor ID	Last Name	First Name	Office	# Students Registered
IS201	Computer Applications	3	1	SP	2015	4902	Smith	James	AB222	41
IS201	Computer Applications	3	2	SP	2015	4902	Smith	James	AB222	41
IS201	Computer Applications	3	3	SP	2015	6531	Ng	Ngyuen	AB231	43
IS201	Computer Applications	3	1	SU	2015	4902	Smith	James	AB222	12
IS201	Computer Applications	3	2	SU	2015	4902	Smith	James	AB222	14
IS475	Database Design	3	1	FA	2014	7811	Edberg	Dana	AB314	52
IS201	Computer Applications	3	4	FA	2014	7811	Edberg	Dana	AB314	42
IS482	Data Resource Mgmt	3	1	SP	2015	7811	Edberg	Dana	AB314	23

Figure 6: Sample data for problem 3-a.

Solution:

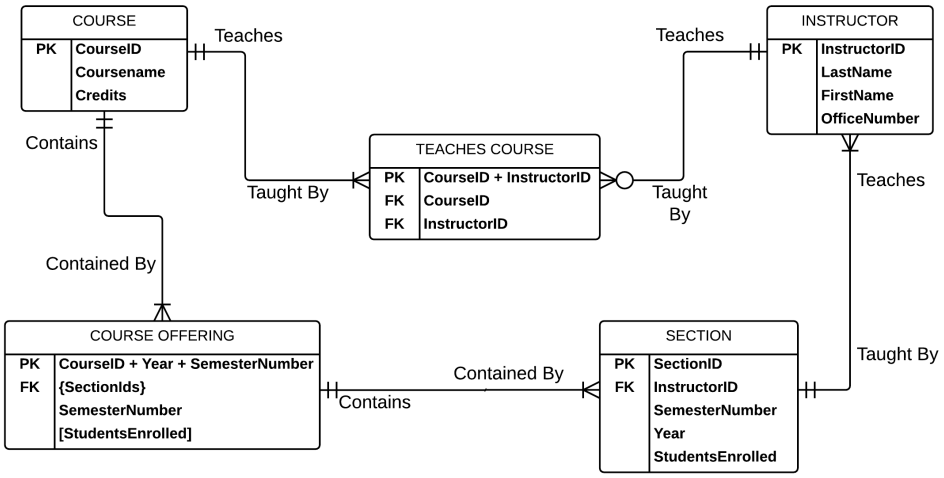

Figure 7: The logical ERD for the college (Problem 3-a).

(b) A corporation owns a series of shopping malls. A shopping mall has one or more stores; a shopping mall isn't a shopping mall unless there is at least one store at the mall. Each shopping mall has similar stores (examples are: Footlocker, Walking Company, Jones New York, Abercrombie and Fitch) but each store is physically different at each mall. Each shopping mall is identified by a MallID. For each shopping mall, we want to keep track of the name of the mall, the address, zip code, and main telephone number. A shopping mall can have multiple stores, a store can be in multiple shopping malls. Each store is identified by a StoreID. For each store, we want to keep track of the name of the store and a long description of the type of the store. The corporation needs to associate a specific instance of a store with a shopping mall. For a specific instance of a store at a given shopping mall, the corporation wants to keep track of the date the store opened at the mall, the name of the manager for the store, and the telephone number for that specific instance of a store in that mall. If you were viewing the data for this application in a spreadsheet format, it would look like the data shown below:

MallID	Mall Name	Mall Address	Mall Zip Code	Mall Telephone #	StoreID	Store Name	Store Description	Date Opened	Manager Name	Store Phone
123	Gilroy Outlets	123 Garlic Street, Gilroy, CA	90456	800-233-4929	1793	Jones New York	Women's professional attire, mid-range	9/12/1997	Joanne Brown	560-493-4403
123	Gilroy Outlets	123 Garlic Street, Gilroy, CA	90456	800-233-4929	5644	FootLocker	Athletic Shoes, Men, Women, Family	8/16/2010	Bill Targenson	560-495-3939
123	Gilroy Outlets	123 Garlic Street, Gilroy, CA	90456	800-233-4929	6781	New York and Company	Women's casual attire, bargain	3/15/2014	Ahmad Cedersill	560-667-3341
677	Sacramento Outlets	8922 Oak Street, Roseville, CA	93201	450-223-9392	1793	Jones New York	Women's professional attire, mid-range	9/16/2014	Willie Masters	890-451-5861

Figure 8: Sample data for problem 3-b.

Solution:

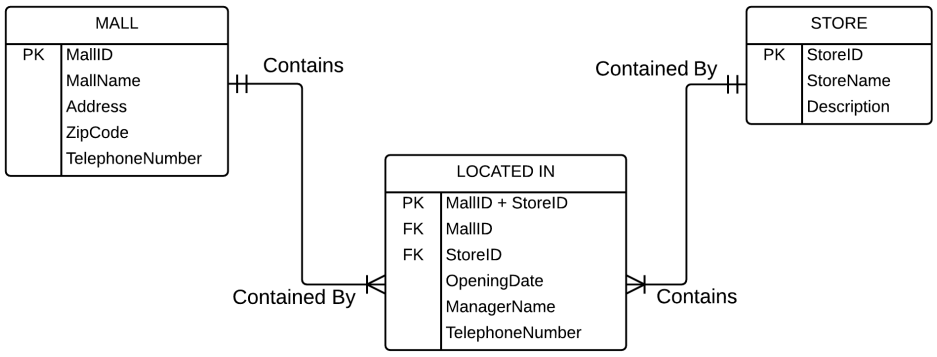

Figure 9: The logical ERD for the mall corporation (Problem 3-b).