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**Metropolitan State University**

**ICS 311 —Database Management Systems**

**Homework #1**

Due: Sep-9 2020

**Homework #1 Total: 20 Points**

**Question 1 (5 Points):**

List three applications you have used that most likely employed a database system to store data. For each application, explain what data view each of the following would like to see:

1. Someone at company leadership:

Banking: for accounts, customer information, and banking transaction.

Credit card transactions: purchasing with credit and generation of monthly statements.

Finance: for sales, storing information about holdings, also storing market data to enable online trading and automated.

1. Someone at middle management:

Enterprise Information: sales, accounting, human resources, manufacturing, online retailers.

1. Someone facing customers:

Telecommunication - For calls made, keep records, generate the bills every month, and storing information about communication network.

**Question 2 (4 Points):**

Given the table structure shown below, answer the following questions:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| project\_cde | project\_manager | manager\_phone | manager\_address | project\_bid | manager\_pay |
| 21-5Z | Holly B. Parker | 904-338-3416 | 3334 Lee Rd., Gainsville, FL 37123 | 1683346.00 | 75000.00 |
| 25-2D | Jane D. Grant | 615-898-9909 | 218 Clark Blvd., Nashville, TN 36362 | 1250000.00 | 78000.00 |
| 25-5A | George F. Dorts | 615-227-1245 | 124 River Dr., Franklin, TN 29185 | 3251242.00 | 77000.00 |
| 25-9T | Holly B. Parker | 904-338-3416 | 3334 Lee Rd., Gainsville, FL 37123 | 2156323.00 | 75000.00 |
| 27-4Q | George F. Dorts | 615-227-1245 | 124 River Dr., Franklin, TN 29185 | 1031454.00 | 77000.00 |
| 29-2D | Holly B. Parker | 904-338-3416 | 3334 Lee Rd., Gainsville, FL 37123 | 2555999.00 | 75000.00 |
| 31-7P | William K. Moor | 904-445-2719 | 216 Morton Rd., Stetson, FL 30155 | 5685000.00 | 79000.00 |
| 43-3R | William K. Moor | 904-445-2719 | 216 Morton Rd., Stetson, FL 30155 | 3458769.00 | 79000.00 |

1. How many tuples does the table contain? How many attributes are there per tuple?

8 tuples, and 6 attributes.

1. What data redundancies can you detect in the table? The project manager’s named Holly B. Parker occurs three times, indicating that she manages three projects coded 21-5Z, 25-9, and 29-2D. And her Phone and Address also occurred three times. Also, George F. Dorts and William K. Moor, their name, phone, and address, occurred two times.
2. Give an example of update anomaly: when we have more than 3 columns in a table and out of which two are called student name and student address. If one student changes it’s location then we would have to update the table. But if the table is not normalized one employee can have multiple entries and while updating all of those entries one of them might get missed.
3. Give an example of delete anomaly: we have employee’s information and duties they have taken as follows, ID Name, Address. If any employee leaves the company then the entry related to that employee will be deleted. However, that deletion will also delete the duty’s information even though duty depends upon the company and not the employee.

**Question 3 (6 Points):**

Given the following database instance, answer questions 1.1 through 1.3:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Employee** |  |  |  | **Plan** |  |
| emp\_code | emp\_lname | job\_code |  | plan\_code | plan\_description |
| EC14 | Rudell | JC2 |  | 1 | Term Life |
| EC15 | McDade | JC1 |  | 2 | Stock Purchase |
| EC16 | Ruellardo | JC1 |  | 3 | Long-term disability |
| EC17 | Smith | JC3 |  | 4 | Dental |
| EC20 | Smith | JC2 |  |  |  |
|  |  |  |  |  |  |
| **Job** |  |  |  | **Benefit** |  |
| job\_code | job\_description |  |  | emp\_code | plan\_code |
| JC1 | Clerical |  |  | EC15 | 3 |
| JC2 | Technical |  |  | EC16 | 1 |
| JC2 | DBA |  |  | EC17 | 1 |
| JC3 | Manager |  |  | EC17 | 3 |
|  |  |  |  | EC17 | 4 |
| **Extra\_Benefit** |  |  |  | EC20 | 3 |
| job\_code | plan\_code |  |  |  |  |
| JC3 | 2 |  |  |  |  |

Assume that the following attributes are the primary keys for the tables:

*emp\_code* is the primary key for **Employee** table

*job\_code* is the primary key for the **Job** table

*plan\_code* is the primary key for the **Plan** table

*emp\_code, plan\_code* is a composite primary key for the **Benefit** table

job\_code, plan\_code is the composite primary key for the **Extra\_Benefit** table

* 1. (2 Points) Do all tables exhibit entity integrity? Answer yes or no and then explain your answer for each table.

**Employee** table: **Yes**: emp\_code, the primary key is Unique and not Null.

**Plan** table: **Yes**: plan\_code, the primary key is Unique and not Null.

**Job** table: **No**: job\_code, the primary key is not Unique.

**Benefit** table: **Yes**: *emp\_code and plan\_code*, the composite primary key is Unique and not Null.

**Extra\_Benefit** table: **Yes**: job\_code and plan\_code, the composite primary key is Unique and not Null.

3.2 (2 Points) For each table in the database, identify foreign key(s) (if any). For each foreign key, state the referencing relation and the referenced relation.

**Employee** table: Have 1 foreign key: **job\_code**, relate to **Job** table’s primary key.

**Plan** table: Have **no** foreign key.

**Job** table: Have **no** foreign key.

**Benefit** table: Have 2 foreign keys: **emp\_code** relate to **Employee** table, and **plan\_code** relate to **Plan** table.

**Extra\_Benefit** table: Have 2 foreign keys: **job\_code** relate to **Job** table, and **plan\_code** relate to **Plan** table.

* 1. (2 Points) Do all tables exhibit referential integrity? Answer yes or no and then explain your answer for each table.

**Employee** table: Yes: where **job\_code**, relate to **Job** table’s primary key, and it is related by Benefit table.

**Plan** table: No: Have **no** foreign key, but it’s primary key is related by Benefit and Extra\_Benefit table.

**Job** table: No: Have **no** foreign key, but it’s primary key is related by Extra\_Benefit and Employee table.

**Benefit** table: Yes: the table is all foreign keys: **emp\_code** relate to **Employee** table, and **plan\_code** relate to **Plan** table.

**Extra\_Benefit** table: Yes: the table is all foreign keys: **job\_code** relate to **Job** table, and **plan\_code** relate to **Plan** table.

**Question 4 (5 Points):**

Given the following relational database schema (primary keys are bold and underlined). Answer questions 2.1 to 2.4:

*branch(****branch\_id****, branch\_name, branch\_city, assets)*

*customer(****customer\_id****, customer\_name, customer\_street, customer\_city, customer\_st, customer\_zip)*

*loan(****loan\_number****, branch\_id, amount)*

*borrower(****customer\_id****,* ***loan\_number****)*

*account(****account\_number****, branch\_id, balance)*

*depositor(****customer\_id, account\_number****)*

4.1 (3 Points) For each of the following queries, write a relational algebra expression to answer the query:

a) Find the names of all customers who live in Hopkins and have the name Brewster.

σcustomer\_city=  ’Hopkin’ ˄ customer\_name = ‘Brewster’ (customer)

b) Find the names and zip codes of all customers who have loans.

Πcustomer\_name, customer\_zip(σcustomer.customer\_id=borrower.customer\_id(customer X borrower) )

c) Find the names, cities of residence, and state for all depositors who have accounts with balance that is less than $3500

Πcustomer\_name, customer\_city, customer\_st(σcustomer.customer\_id = depositor.customer\_id (σaccount.account\_number = depositor.account\_number ((σbalance < 3500(account) X depositor ))) X customer))

4.2 (2 point) For each of the following relational algebra expressions, explain the output of the expression in words:

1. Πbranch\_name(σbranch\_city=’chicago’( branch)

Find all of the branch’s names where branch’s city is ‘chicago’

1. Πloan\_number(σbranch\_name=’mankato 1st ave’( branch  loan):

Find all of loan numbers of branch where the branch name is ‘mankato 1st ave’