

**Metropolitan State University**  
**ICS 311 — Database Management Systems**  
**Homework #2**

**Question 1 (5 Points):**

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

**Employee**

emp_code	emp_lname	job_code
14	Rudell	2
15	McDade	1
16	Ruellardo	1
17	Smith	3
20	Smith	2

**Plan**

plan_code	plan_description
1	Term Life
2	Stock Purchase
3	Long-term disability
4	Dental

**Job**

job_code	job_description
1	Clerical
2	Technical
3	Manager

**Benefit**

emp_code	plan_code
15	2
15	3
16	1
17	1
17	3
17	4
20	3

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

1.1 (1 Point) Do all tables exhibit entity integrity? Answer yes or no and then explain your answer.

1.2 (3 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.

1.3 (1 Point) Do all tables exhibit referential integrity? Answer yes or no and then explain your answer.

## **Question 2 (11 Points):**

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

```
Branch(branch_id, branch_name, branch_city, assets)
Customer(customer_id, customer_name, custome_street,
customer_city)
Loan(loan_number, branch_id, amount)
Borrower(customer_id, loan_number)
Account(account_number, branch_id, balance)
Depositor(custome_id, account_number)
```

2.1 (3 Points) List all possible foreign keys. For each foreign key list both the referencing and referenced relations.

2.2 (2 Points) Devise a reasonable database instance by filling the tables with data of your choice. Make sure to have at least 3 tuples in each table. Make sure that all tables exhibits entity integrity and referential integrity constraints.

2.3 (4 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 Minneapolis.
- b) Find the names and cities of residence of all customers who have loans.
- c) Find the names, street address, and cities of residence for all depositors who have accounts with balance that is more than \$10000

2.4 (2 point) For each of the following relational algebra expressions, explain the output of the expression in words:

- a)  $\Pi_{\text{branch\_name}}(\sigma_{\text{branch\_city}='chicago'}(\text{Branch}))$
- b)  $\Pi_{\text{loan\_number}}(\sigma_{\text{branch\_city}='chicago'}(\text{Branch} \bowtie \text{Loan}))$