BMEG3120: Exercise List 1

Problem 1. Consider an empty table REPRESENTATIVE whose schema is

$$(pid, name, dept, rank, age).$$

The table has two candidate keys: {name} and {dept, rank}. Now, assume that we try to insert the following tuples in the top-down order. If an insertion is rejected by the database (for violation of the candidate key constraint), we ignore the tuple and move on to the next one. Then, eventually, what will be the content of the table?

$$(1, Adam, CS, asso, 43)$$
$$(2, Adam, EE, asst, 37)$$
$$(3, Bob, EE, full, 56)$$
$$(4, Calvin, CS, asso, 45)$$
$$(5, Emily, EE, asst, 28)$$

    Answer.
(1, Adam, CS, asso, 43)
(3, Bob, EE, full, 56)
(5, Emily, EE, asst, 28)

Problem 2. Consider table LOAN whose schema is

$$(cid, bid, amount, year)$$

where *cid* is the id of a customer borrowing the loan, *bid* is the id of the branch issuing the loan, *amount* is the loan's dollar amount, and year is the loan's issuance year.

    (i) If we want to enforce the constraint that *every customer can borrow only one loan in history*, how would you designate a candidate key to prevent tuples violating the constraint from co-existing in the table?
    Answer. {cid}.

    (ii) What if the constraint is *every branch can issue only one loan per year*?
    Answer. {bid, year}.

    (iii) What if the constraint is *a customer can borrow only one loan per year*?
    Answer. {cid, year}.

    (iv) What if the constraint is *a customer can borrow only one loan from the same branch per year*?
    Answer. {bid, cid, year}.

Problem 3. Consider the LOAN table in Problem 2. Give the relational algebra queries to retrieve the tuples satisfying each of the following conditions. Your queries should use only selection and/or projection.

    (i) Find the bids of all the branches that ever issued a loan.
    Answer. $\Pi_{bid}(\text{LOAN})$.

    (ii) Find the amounts of the loans borrowed by the customer with cid $c100$.
    Answer. $\Pi_{amount}(\sigma_{cid=\text{``}c100\text{''}}(\text{LOAN}))$.

(iii) Find the amounts of the loans borrowed by the customers with cids $c100$ and $c101$.
Answer. $\Pi_{\text{amount}}(\sigma_{\text{cid}=\text{``}c100\text{''} \ \vee \ \text{cid}=\text{``}c101\text{''}}(\text{LOAN}))$.

(iv) Find the year in which the branch with bid $b1$ issued at least one loan.
Answer. $\Pi_{\text{year}}(\sigma_{\text{bid}=\text{``}b1\text{''}}(\text{LOAN}))$.

(v) Find the cids of all the customers that have borrowed from branches whose bids are not $b1$.
Answer. $\Pi_{\text{cid}}(\sigma_{\text{bid} \ \neq \ \text{``}b1\text{''}}(\text{LOAN}))$.