1. Define the following terms and then create an example.
2. **Superkey**: - A superkey is either a single or a combination of attributes that can be used to uniquely identify a database record. A table might have many combinations that create superkeys.

Example: A table with the fields CWID, Name, Age, Address, Major, Contact Number and SSN. This Table has many possible superkeys. Three super keys are <CWID>, <CWID, Contact Number> and <CWID, Contact Number, SSN>.

1. **Candidate Key: -** The minimal set of attributes which can uniquely identify a tuple is known as candidate key. The value of Candidate Key is unique and non-null for every tuple.

Example: - A table name student with the fields CWID, Name, Age, Address, Major, Contact Number and SSN. Here CWID in student relation.

1. **Primary Key: -** The primary key constraint uniquely identifies each record in a database table. Primary keys must contain unique values and cannot contain null values.

Example: - A table name student with the fields CWID, Name, Age, Address, Major, Contact Number and SSN. Here CWID is primary key, because it is unique for each student and this field doesn’t contain null value.

1. **Foreign Key: -** Foreign keys are the columns of a table that points to the primary key of another table. They act as a cross-reference between tables.

Example: -: A table with the fields CWID, Name, Age, Address, Major, Contact Number and SSN and Second Table with fields Course\_ID, Course\_Name and Subjects. Now third table has primary keys of both tables and CWID is foreign key in this table.

1. Look at the time\_slot relation. In this relation the primary key is made up of 3 attributes. The only attribute not in the key is end\_time. Try to tell me why this is the case.

Answer:

One of the candidate keys of a relation is chosen as its primary key. So if we includes end\_time in the primary key, this key should be a candidate key. But clearly that end\_time is not necessary to be included. In fact, if a course’s day and start\_time is fixed, then the end\_time is fixed, but in reverse end\_time could not uniquely identify which day and time, therefore it cannot be a primary key

1. What is the result of the following compound relational algebra statement? Make sure you base it on the textbook data and show your work (using the textbook data) not just the answer. (5 points) a. σs\_id=ID(student x advisor)

Answer:

In this example, it selects student and advisor attributes where s\_id matches, Natural join is performed by both the relation and result are:

1. Every student who has an advisor, the student attribute along with his s\_id and the advisor ID for that student will be displayed.
2. For Students who have more than one advisor, a new record will be displayed for each advisor along with the student attribute.

From the textbook:

4. Consider the following expressions, which use the result of a relational algebra operation as the input to another operation. For each expression, explain in words what the expression does.

a. year≥2009(takes) X student

b. year≥2009(takes X student)

c. ID,name,course id(student X takes)

Answer:

1. It selects students who take at least one course in 2009 also displays the information about student courses which he was enrolled.
2. This statement also selects the students who take at least one course in 2009 also displays information about student courses which he was enrolled, but all the selection can be done before the join operation.
3. It displays all student’s information including ID, name, course, who enrolled for any course.

5. Consider the relational database of Figure 2.14. Give an expression in the relational algebra to express each of the following queries:

a. Find the names of all employees who live in city “Miami”.

b. Findthenamesofallemployeeswhosesalaryisgreaterthan$100,000.

c. Find the names of all employees who live in “Miami” and whose salary is greater than $100,000.

Answer:

1. IIname (6scity = “Miami” (employee))
2. IIname (6salary > 100000 (employee))
3. c. IIname (6city = “Miami” ∧ salary>100000 (employee))

6. Consider the bank database of Figure 2.15. Give an expression in the relational algebra for each of the following queries.

a. Find the names of all branches located in “Chicago”.

b. Find the names of all borrowers who have a loan in branch “Downtown”.

Answer:

1. IIbranch name (6branch city = “Chicago” (branch))
2. IIcustomer name (6branch name = “Downtown” (borrower X loan))

7. Consider the advisor relation shown in Figure 2.8, with s id as the primary key of advisor. Suppose a student can have more than one advisor. Then, would s\_id still be a primary key of the advisor relation? If not, what should the primary key of advisor be?

Answer:

No, s\_id would not be a primary key, since there may be two (or more) tuples for asingle student, corresponding to two (or more) advisors. The primary key should then be s\_id,i\_id

8.Consider the relational database of Figure 2.14. Give an expression in the relational algebra to express each of the following queries:

a. Find the names of all employees who work for “First Bank Corporation”.

b. Find the names and cities of residence of all employees who work for “First Bank Corporation”.

1. Find the names, street address, and cities of residence of all employees who work for “First Bank Corporation” and earn more than $10,000.

Answer:

a. IIperson\_name(6company\_name=“First Bank Corporation”(*works* ))

b.IIperson\_name,city(employee X (6company\_name=”first Bank corporation”(works)))

c.IIperson\_name,street,city(6(company\_name=”First Bank Cooperation”^salary>10000) (worksXemployee))

9.Consider the bank database of Figure 2.15. Give an expression in the relational algebra for each of the following queries:

a. Find all loan numbers with a loan value greater than $10,000.

b. Find the names of all depositors who have an account with a value greater than $6,000.

c. Find the names of all depositors who have an account with a value greater than $6,000 at the “Uptown” branch.

Answer:

1. IIloan\_number(6amount>1000(loan)
2. IIcusomer\_name(6balance>6000(depositorXaccount))
3. IIcustomer\_name(6balance>6000^branch\_name=”uptown”(depositorXaccount))