Exercise 5 SQL-1 DBS

1. The schema of a database containing university-type data is given below.

Primary key is bold for each relation.

STUDENT(**Sid**, Sname, Sex, Age, Year, GPA)
DEPT(**Dname**, Numphds)
PROF(**Pname**, Dname)
COURSE(**Cno**, Cname, Dname)
MAJOR(**Dname, Sid**)
SECTION(**Dname, Cno, Sectno**, Pname)
ENROLL(**Sid**, Grade, **Dname, Cno, Sectno**)

Write the following queries in SQL.

(i) Find the names of professors who work in departments that have fewer than 50 PhD students.

(ii) Find the names and majors of students who have taken the 'Database System' course.

(iii) Find the ids, names, and GPAs of the students who have taken all courses from the 'Civil Engineering' department.

2. Suppose we are maintaining a database of articles published in our newspaper, the Straits Times. We have the following schema (where keys are underlined):

Article (issueID, articleID, author, title)

Citation (articleID, issueID, citedArticleID, citedIssueID)

WordAppears (wordID, issueID, articleID, position)

WordIs (wordID, wordText)

Issue (issueID, date, howManyDistributed)

Assume that dates can be compared using comparison operators (<, >, =). Assume that position is an index specifying where the word appears (1 = first word, 2 = second, etc.). Write the following query in SQL.

Find the documents in which the words "politician" and "corruption" appear.

Exercise 5 SQL-1 DBS

3. Consider the relation R(A,B,C,D) with candidate keys AC and D. What will be the output of the following query? Justify your answer.

```
SELECT A, B
FROM R
WHERE C > (SELECT D FROM R WHERE C = 3);
```

4. Let R=(A, B, C), S=(C, D, E) be two relational schema. Let q and r be relations (i.e., tables) on schema R; and s be a relation (i.e., a table) on schema S. Convert the following relational algebra queries to SQL.

(i) $q - r$

(ii) $\Pi_{A, C}(r) \bowtie \Pi_{C, D}(s)$

5. The schema of a database containing university-type data is given below.

Primary key is bold for each relation.

STUDENT(**Sid**, Sname, Sex, Age, Year, GPA)
DEPT(**Dname**, Numphds)
PROF(**Pname**, Dname)
COURSE(**Cno**, Cname, Dname)
MAJOR(**Dname, Sid**)
SECTION(**Dname, Cno, Sectno**, Pname)
ENROLL(**Sid**, Grade, **Dname, Cno, Sectno**)

Write the following query in SQL. Find the name(s) of student(s) with the lowest GPA.

6. Consider the following relational schema:

Reader(RDNR, Surname, Firstname, City, Birthdate)
Book(ISBN, Title, Author, NoPages, PubYear, PublisherName)
Publisher(PublisherName, PublisherCity)
Category(CategoryName, BelongsTo)
Copy(ISBN, CopyNumber, Shelf, Position)
Loan(ReaderNr, ISBN, Copy, ReturnDate)
BookCategory(ISBN, CategoryName)

BelongsTo refers to which parent categories the current category belongs to. Each book has a specific ISBN, and many copies of a book might be available under the same ISBN. A reader may borrow the same copy for multiple times, and each instance is recorded by its ReturnDate. All the parent categories that a book belongs to are stored in the table BookCategory.

Formulate the following queries in SQL.

(a) Which categories do not have any subcategories?

(b) For which of the books there is at least one copy available?

(c) Which books have more pages than twice the average of the number of pages of all books?

(d) What are the surnames of the readers from the city "New York"?

7. For the following relational schema:

employee (employee-name, street, city)

works (employee-name, company-name, salary)

company (company-name, city)

manages (employee-name, manager-name)

Give an expression in SQL for each of the following queries:

(a) Find the names of all employees who earn more than the average salary of all employees of their company. Assume that all people work for at most one company.

(b) Find the names of all employees in the database who live in the same cities and on the same streets as do their managers. Assume that all people work for at most one company. Each company has at most one manager, who is also an employee of the same company.

8. Consider the following schema containing airport flight information. Primary Keys are in bold.

FLIGHTS(**flno:integer**, from:string, to:string, distance:integer, departs:time, arrives:time)

AIRCRAFT(**aid:integer**, aname:string, cruisingrange:integer)

Exercise 5 SQL-1 DBS

CERTIFIED(**eid:integer**, **aid:integer**)

EMPLOYEES(**eid:integer**, ename:string, salary:integer)

Note that the Employees relation describes pilots and other kinds of employees as well; every pilot is certified for some aircraft (otherwise, he orshe would not qualify as a pilot), and only pilots are certified to fly.

Give an SQL expression for the following query. Your solution should be only one SQL statement.

Find the eids of employees who make the second highest salary