# Assignment 2

## Pure SQL

In this assignment, you will practice working with Pure SQL. Your solutions, containing PostgreSQL statements for solving the problems, should be submitted to IUCanvas in a file Assignment2.sql. It is advised that you also include comments in this file to elaborate on your solutions. You should also submit in a separate file, named Assignment2.txt, the results of running the Assignment2.sql through the PostgreSQL interpreter.

**Restrictions on SQL code**: You can use views but you can not use the `GROUP BY` clause and aggregate functions. You can also not use the `INNER JOIN` (or other joins) operators. In other works, only statements in Pure SQL are permitted. Solutions with SQL statements that do not obey these requirements will not receive credit. Also, do not use the COPY command to populate relations.

Use file data.txt which contains the Student, Book, Buys, Cites, and Major relations.

Consider the following relation schemas about students and books.

$$\begin{aligned}&\text{Student}(\underline{Sid}, Sname)\\&\text{Major}(\underline{Sid, Major})\\&\text{Book}(\underline{BookNo}, Title, Price)\\&\text{Cites}(\underline{BookNo, CitedBookNo})\\&\text{Buys}(\underline{Sid, BookNo})\end{aligned}$$

The relation Major stores students and their majors. A student can have multiple majors, but we also allow that a student can have no major. A tuple $(b, c)$ in the relation Cites indicates that the book with book number $b$ cites the book with book number $c$. Note that a book may cite multiple other books. Also, a book does not have to cited.

The primary keys of the relations are the underlined attributes and we assume the following foreign keys:

| Attribute in Relation | References Primary Key of Relation |
|---|---|
| Sid in Major | Sid in Student |
| BookNo in Cites | BookNo in Book |
| CitedBookNo in Cites | BookNo in Book |
| Sid in Buys | Sid in Student |
| BookNo in Buys | BookNo in Book |

Furthermore, assume the following domains for the attributes:

| Attribute | Domain |
|---|---|
| Sid | INTEGER |
| Sname | VARCHAR(15) |
| Major | VARCHAR(15) |
| BookNo | INTEGER |
| Title | VARCHAR(30) |
| Price | INTEGER |
| CitedBookNo | INTEGER |

To do this assignment, you will have to create the above relations, including the primary and foreign keys, using the given domain types. Use INSERT INTO statements to populate these relations using the data provided in the file data.txt.

Write the following queries in Pure SQL.

1. (10 points) Find the bookno and title of each book that costs between \$10 and \$40 and that was bought by a student who majors in both CS and Math.

2. (10 points) Find the sid and name of each student who bought a book that is cited by a higher-priced book.

3. (10 points) Find the bookno of each book that cites another book $b$. Furthermore, $b$ should be a book cited by at least two books.

4. (10 points) Find the bookno of each book that was not bought by any student.

5. (10 points) Find the sid of each student who did not buy all books that cost more than \$50.

6. (10 points) Find the bookno of each book that was bought by a student who majors in CS but that was not bought by any student who majors in Math.

7. (10 points) Find the sid and name of each student who has at single major and who only bought books that cite other books.

8. (10 points) Find the sid and majors of each student who did not buy any book that cost less than \$30.

9. (10 points) Find each $(s, b)$ pair where $s$ is the sid of a student and $b$ is the bookno of a book whose price is the highest among the books bought by that student.

10. (10) Without using the `ALL` predicate, list the price of the next to most expensive books.

11. (10 points) Find the triples (s,b1,b2,s) where s is the sid of a student who if he or she bought book b1 the here or she also bought book b2. Furthermore, b1 and b2 should be different.

    In other words, in the case where (s,b1) is in the buys relation then (s,b2) must also be in the buys relation. However, if (s,b1) is not in the buys relation then (s,b1,b2) should be in the answer for each possible book b2, since in this case there is not a violation of what is requested by the query.

    To solve this query, you might first try to determine the triples (s,b1,b2) that violate the condition of the query, i.e., the case where (s,b1) is in the buys relation, but (s,b2) is not in the buys relation.

    Since the result of this query has a very large answer, you don't need to include it in the Assignment2.txt file.

12. (10 points) Find the sid of each student who bought none of the books cited by book with bookno 2001.

13. (10 points) Find the tuples (b1,b2) where b1 and b2 are the booknos of two different books that were bought by exactly one CS student.

14. (10 points) Find the sid of each student who only bought books whose price is greater than the price of any book that was bought by all students who majors in 'Math'.