CS 353 Fall 2023
Homework 3
Due: October 18, Wednesday till midnight
You will use the Moodle course page for submission of this assignment

Q.1 [80 pts, 8 pts each] Given the following relational schema for a course enrollment database:

Course(c-id, c-name, c-dept, credits)
Prereq(c-id, p-id)
c-id and p-id are foreign keys to Course
Student(s-id, s-name, s-dept, s-year)
Enroll(s-id, c-id, semester, year, grade)
s-id is a foreign key to Student, c-id is a foreign key to Course

For each of the following queries, give an expression in **SQL**.

(a) Find the id, name and year of "CS" students who have taken a 4 credit course offered by the MATH department in Spring 2023.
(b) Find the id and name of fourth year students who have never received "F" from any course.
(c) Find the id and name of the first year "CS" students who have received "A" from "CS101" in Spring 2023. Order the resulting list by student names ascending.
(d) Find the id and name of "CS" students who have received an "A" in Spring 2023 from a course which has the prerequisite "MATH101".
(e) Find the id, name and department of the students who have received "F" from "MATH101" in both Spring and Fall semesters of 2022. Sort the resulting list first by department and then by student names both in ascending order.
(f) Find the id and name of the fourth year "EE" students who have taken all the courses from the "MATH" department which have the prerequisite "MATH101".
(g) Find the id and name of the "CS" students who have taken "PHYS101" exactly once.
(h) Find the id and name of the "CS" students who have taken at least 3 "A"s in Spring 2023.
(i) For each department, find the number of students who have received "A" in "MATH101" in Spring 2023.
(j) For each department, find the courses with the maximum number of prerequisite courses.

Q.2 [20 pts] Consider the following relational database for a bookstore:

books(isbn, title, authors, publisher, publish-year, price)
customers(cid, cname, address)
purchase(cid, isbn, purchase-year)
cid is a foreign key to customers, isbn is a foreign key to books

Translate the following **Relational Algebra** expressions into **SQL** queries.

(a) [6 pts] $\prod_{\text{cname}} ((\sigma_{\text{publisher = "ABC"}} (\text{books}) \bowtie \text{purchase}) \bowtie \text{customers})$

(b) [6 pts] $\text{publish-year } \mathcal{G}_{\text{distinct-count(isbn) as book-count}} (\sigma_{\text{publisher = "ABC"}} (\text{books}))$

(c) [8 pts] $\text{Temp} \leftarrow \text{cid } \mathcal{G}_{\text{distinct-count(isbn) as book-count}} (\sigma_{\text{publisher = "ABC"}} (\text{books}) \bowtie \text{purchase})$
$\prod_{\text{cname}} (\sigma_{\text{book-count > 10}} (\text{Temp}) \bowtie \text{customers})$