CS 353 Spring 2024
Homework 1
Due: February 15, Thursday till midnight
You will use the Moodle course page for submission of this assignment

Q.1 [88 pts, 8 pts each] Given the following relational schema for an employee database system:

employee(e-id, e-name, rank, e-dept, e-city)
rank is a foreign key to paying
project(p-id, p-name, p-dept, budget, p-city)
works(e-id, p-id, duty, since)
e-id is a foreign key to employee, p-id is a foreign key to project
paying(rank, salary)

For each of the following queries, give an expression in **Relational Algebra**.
(a) Find the employees (e-id and e-name) from the Construction department who are working in Ankara projects with a budget higher than 1 Million TL.
(b) Find the employees (e-id and e-name) with a rank higher than 5 and are working in the projects located in their cities.
(c) Find the employees (e-id and e-name) from the Construction department who are working in all the projects from Istanbul.
(d) Find the employees (e-id and e-name) from Ankara who are working as Technician since 2020 and have a salary higher than 100,000 TL.
(e) Find the projects (p-id and p-name) from Istanbul with all its employees having a salary higher than 100,000 TL.
(f) Find the salary of the employees with the highest rank.
(g) For each city, find the number of projects together with the total budget over all the projects in that city.
(h) Find the number of employees from Ankara for each rank who are working in the projects with a budget higher than 1 Million TL .
(i) Find the projects (p-id and p-name) from Istanbul with budgets that are higher than the budgets of all the projects from Ankara.
(j) Find the projects (p-id and p-name) from Ankara with budgets that are at least twice the total sum of the salaries paid to their employees.
(k) Find the employees and their salaries (e-id and salary) who are working in the Ankara project with the highest budget.

Q.2 [12 pts] Given relations R(A, B) and S(A, B). Prove or disprove the following:
$\prod_{R.A}(R) - \prod_{R.A}(R \cap S) = \prod_{R.A}(R) \cap \prod_{R.A}(R - S)$