**CS4.301: Data and Applications** **Due: 10:00PM, $13^{th}$ September 2020**

# Group Assignment #3

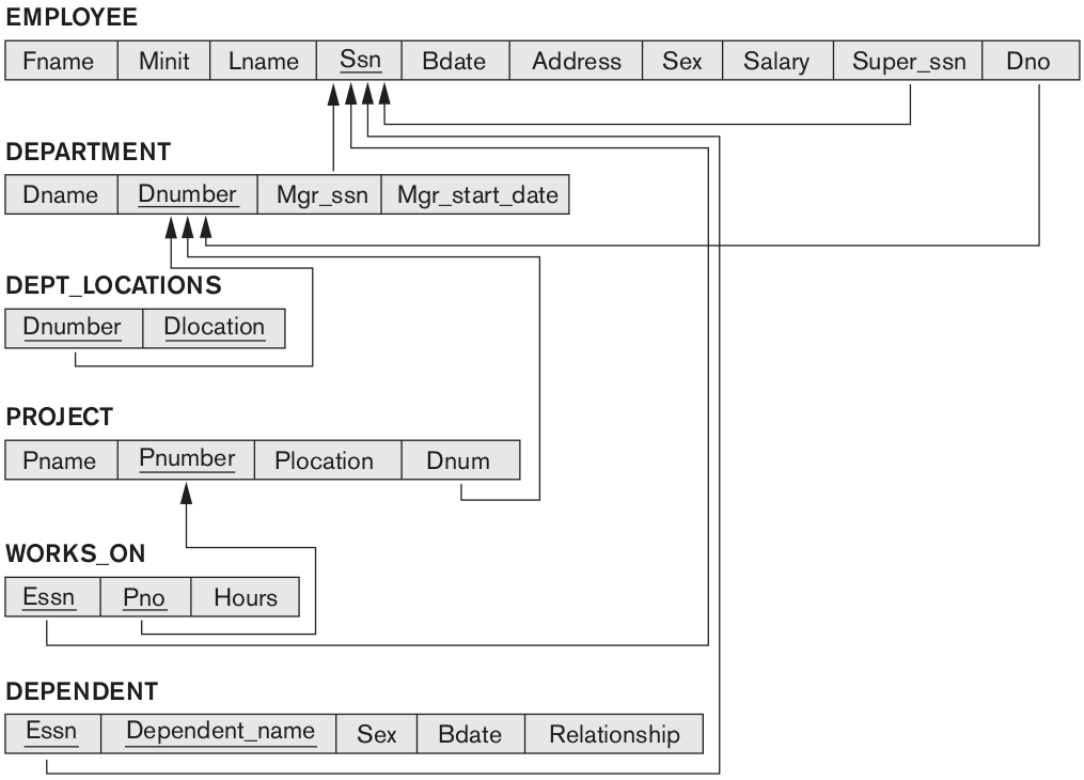
*Instructor:* Kamal Karlapalem *Released:* $11^{th}$ September 2020

## 1 Problem Statement

For Group Assignment 3, you have to write **relational algebra** expressions for a given set of queries. The goal of this assignment is to familiarize you with the relational algebra notations and understand how powerful such expressions are, while playing with database schemas.

Using the database given below, convert the queries that follow into meaningful relational algebra expressions. These could use a single or a combination of operators ranging from Projections, Selections, Aggregates, Joins etc.

## 2 The Given Database



# 3 Queries

## 3.1 Section 1

1. Display all departments (Name and Number) and the average salary of all the employees working in that particular department.
2. Display the locations of all departments with the manager's start date > 01.01.2019
3. Retrieve all employees who are managers as well as supervisors.
4. Retrieve the department number and number of employees earning more than 20K for each department with more than 10 employees.
5. List all the employees who are older than their supervisor
6. List all the employees whose supervisor works in the same department as the employee.
7. Display the department names in which at least 1 employee works for more than 20 hours.
8. Retrieve the names of all employees working on project number 1 or 2 or 3.
9. List all the female employees working in department X.
10. List the number of employees, and the average number of hours spent on each project.
11. Retrieve all employees who have 3 or more dependents, also include the supervisor names for such employees.

## 3.2 Section 2

Now assume that the database given to you (instead of the example database mentioned above) comprises of the relations that are **generated** using the following relational algebra expressions :

(a) **Relation ED**

$$\pi_{SSN,Fname,LName,Sex,Dno,DName} (EMPLOYEE \bowtie_{DNumber=Dno} DEPARTMENT)$$

(b) **Relation EDP**

$$\pi_{SSN,FName,LName,PName,PNo,DName,Hours} (EMPLOYEE \bowtie_{\mathbf{ESSN=SSN}} (DEPARTMENT \bowtie_{Dno=DNum} (PROJECT \bowtie_{PNo=PNum} WORKSON)))$$

(c) **Relation ES**

$$\pi_{SSN,FName,LName,SupSSN,SFName,SLName} ((EMPLOYEE \bowtie_{SuperSSN=SupSSN} (\rho_{FName=SFName,LName=SLName,SSN=SupSSN} (\pi_{FName,Lname,SSN} EMPLOYEE))))$$

(d) **Relation EDT**

$$\pi_{ESSN,FName,LName,DependentName}(EMPLOYEE \bowtie_{ESsn=Ssn} DEPENDENTS)$$

Write the altered expressions for the **queries 6-11** from **Section1**. These retrieval statements will be based on the relations that are generated using the relational algebra expressions mentioned in this section.

# 4 Submission Instructions

1. All answers must be written in **Latex.**
2. Your submission must include a single PDF named <**teamname**>**.pdf** (without the < and >) containing two sections :
   - Answers to Section 1
   - Answers to Section 2

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All the best!