Prof. Dr. Gunter Saake
Department of Technical and Business Information Systems
Workgroup Databases & Software Engineering

Database Concepts

Exercise 11

1. Given the following example database from the appendix. Formulate following queries using relational algebra:

   (a) Query the names of employees, who work on all projects that "John Smith" is working on.

   (b) Query name and address of all employees, who work for the "Research" department.

   (c) Query the project number of the project that is located in "Stafford". Moreover, you should retrieve the number of the department that controls the project as well as as the responsible manager's name, address and birth day.

   (d) Query the names of employees, who work on all projects controlled by department 5.

   (e) List all project numbers of projects that involve an employee (including managers) whose last name is "Smith".

   (f) Find the names of all employees who have two or more dependents.

   (g) Find the names of all employees who have no dependents.

   (h) Find the names of all managers who have at least one dependent.

2. Given following relational schema:

Station:	(Name: string)
Train:	(Train_number: integer, Manufacturer: string)
Local_train:	(Train_number→Train, Bikes_allowed: boolean)
Distance_train:	(Train_number→Train, Dining_car: boolean, Label: string)
Car:	(Car_number: integer, Train_number→Train, Position: integer)
Seat:	(Car_number: integer→Car, Seat_number: integer, Category: integer, Smoker: boolean, Window:boolean)
Connection:	(Arrival: time, Departure: time, Day: date, starts_at: string→Station, goes_to: string→Station, Train_number: integer→Train)
Ticket:	(Price: integer, Ticket_nubmer: integer)
Reservation:	(Ticket_number→Ticket, (Arrival, Departure, Day, starts_at,

	goes_to, Train_number)→Connection, (Car_number, Seat_number)→Seat, Price: integer)
Valid_for:	((Arrival, Departure, Date, starts_at, goes_to, Train_number)→Connection, Ticket_number→Ticket)
Adds_discount:	(Label: string, Unit: string, Amount: integer requires: string→Adds_Discount)
Imputation:	(Ticket_number→Ticket, Label→Adds_discount)
Excludes:	(Excluder: string→Adds_discount, Excluded: string→Adds_discount)

Formulate following queries using the tuple calculus:

(a) Find all stations.

(b) Find the labels of all discounts and additions.

(c) Find all tickets that cost more than 100€.

(d) Find all departure times of all connections that go from Munich to Augsburg before noon (12 o'clock).

(e) Find all trains that have a connection from Munich to Augsburg.

(f) Find all discounts and additions that do not depend on others and do not exclude others.

3. Formulate the queries from task 2 using the domain calculus.

4. Trigger and Integrity:

   (a) Explain the ACID principle.

   (b) What are triggers used for in DBMS?

   (c) What possibilities do you know to ensure integrity using triggers?

5. Given following relation:

   $$exams \quad (course\_of\_studies, course, student, examiner, date, mark)$$

   Define the following views using SQL:

   (a) The computer science faculty can only view data of students that are registered in *computerscience*.

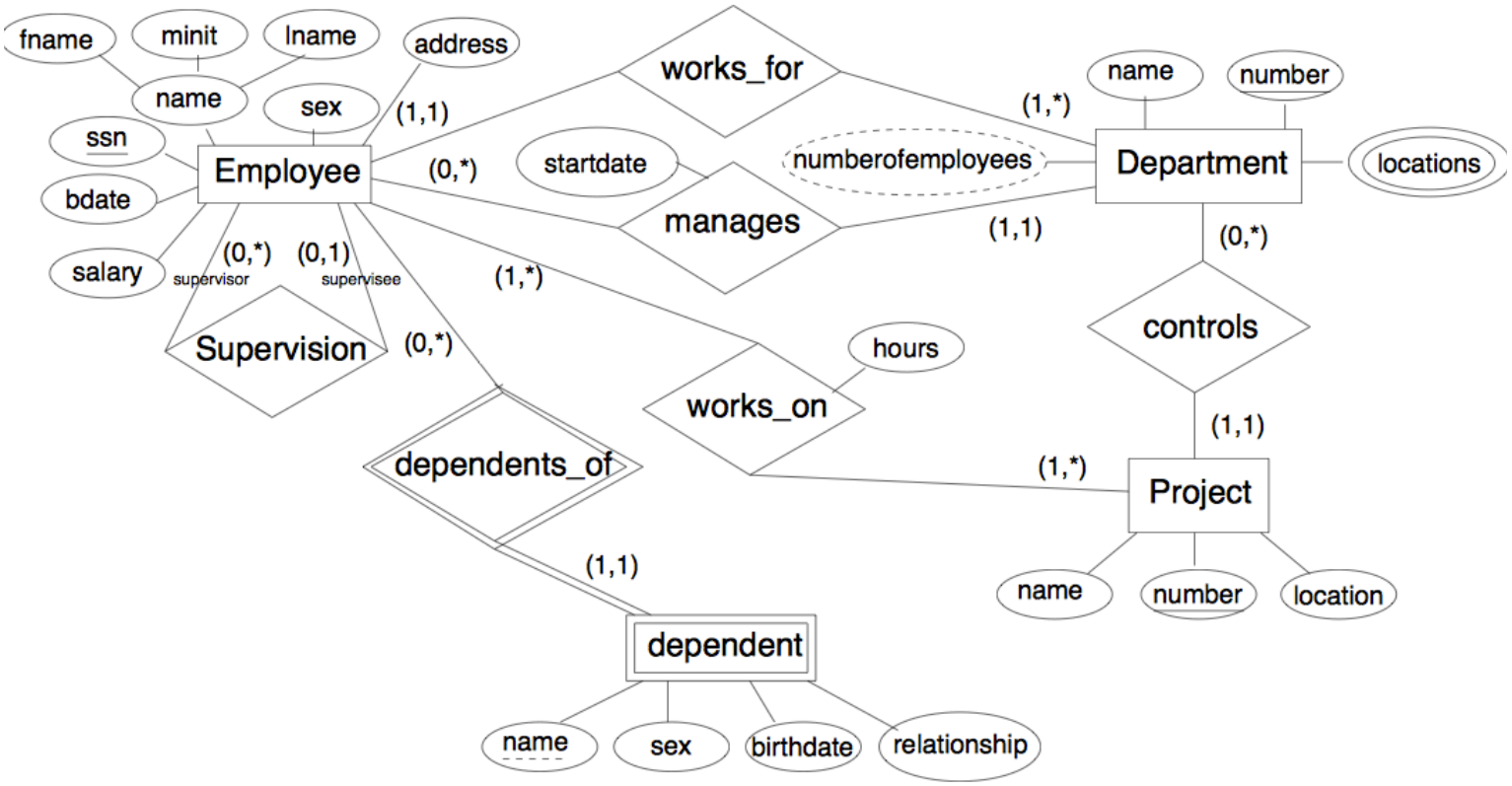
   (b) The examination office can view all data.

   (c) The scholarship commission can only view average marks of every student.

   (d) The dean can only view data about exams of the last year for statistical purposes (i.e., the relationship to students and examiners must be removed).

Good Luck!

Appendix:



1. Employee(fname, minit, lname, ssn, bdate, address, sex, salary, superssn → Employee, dno → Department)
2. Department(dname, dnumber, mgrssn → Employee, mgrstartdate)
3. Dept_locations(dnumber → Department, dlocation)
4. Project(pname, pnumber, plocation, dnum → Department)
5. Works_on(essn → Employee , pno → Project, hours)
6. Dependent(essn → Employee, dependent_name, sex, bdate, relationship)

EMPLOYEE									
FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
John	B	Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
Franklin	T	Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
Alicia	J	Zelaya	999887777	1968-07-19	3321 Castle, Spring, TX	F	25000	987654321	4
Jennifer	S	Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
Ramesh	K	Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
Joyce	A	English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
Ahmad	V	Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
James	E	Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	null	1

DEPARTMENT			
DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
Research	5	333445555	1988-05-22
Administration	4	987654321	1995-01-01
Headquarters	1	888665555	1981-06-19

DEPT_LOCATIONS	
DNUMBER	DLOCATION
1	Houston
4	Stafford
5	Bellaire
5	Sugarland
5	Houston

WORKS_ON		
ESSN	PNO	HOURS
123456789	1	32,5
123456789	2	7,5
666884444	3	40,0
453453453	1	20,0
453453453	2	20,0
333445555	2	10,0
333445555	3	10,0
333445555	10	10,0
333445555	20	10,0
999887777	30	30,0
999887777	10	10,0
987987987	10	35,0
987987987	30	5,0
987654321	30	20,0
987654321	20	15,0
888665555	20	null

DEPENDENT				
ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP
333445555	Alice	F	1986-04-05	DAUGHTER
333445555	Theodore	M	1983-10-25	SON
333445555	Joy	F	1958-05-03	SPOUSE
987654321	Abner	M	1942-02-28	SPOUSE
123456789	Michael	M	1988-01-04	SON
123456789	Alice	F	1988-12-30	DAUGHTER
123456789	Elizabeth	F	1967-05-05	SPOUSE

PROJECT			
PNAME	PNUMBER	PLOCATION	DNUM
ProductX	1	Bellaire	5
ProductY	2	Sugarland	5
ProductZ	3	Houston	5
Computerization	10	Stafford	4
Reorganization	20	Houston	1
Newbenefits	30	Stafford	4