CIS 420 Database Final Exam Fall 2020

Total 100 points
Time : 2 hours

1. [5 points] What are the advantages of using a database system and what are the disadvantages?

2. [5 points] What four main types of actions involve databases? Briefly discuss each.

3. [10 points] Fill in the tables below given R and T

A	B	C
1	2	3
6	7	8
9	7	8

Relation R

B	C	D
2	3	4
2	3	5
9	7	8

Relation T

a. $R \bowtie_{A < D} T$

A	R.B	R.C	T.B	T.C	D

b. $R \bowtie_{A < D \text{ AND } R.B \neq T.B} T$

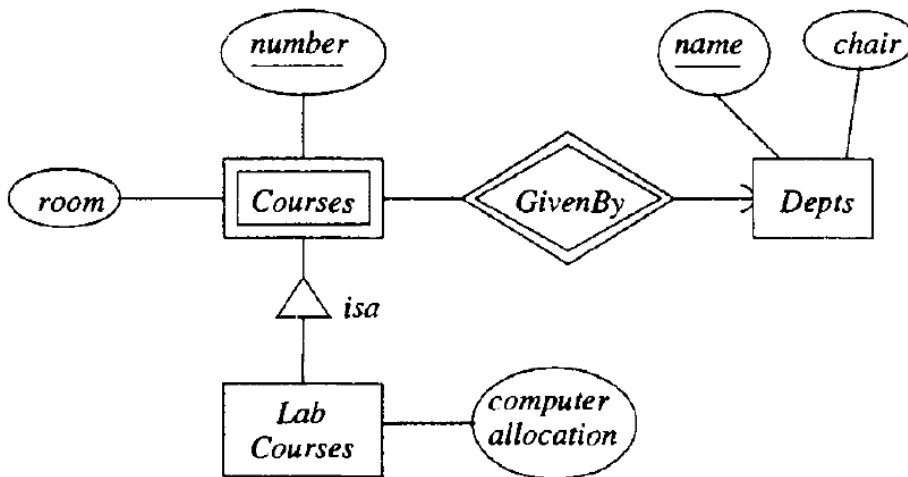| A	R.B	R.C	T.B	T.C	D

4. [10 points] Convert the E/R diagrams given below to a relational database schemas:

a.
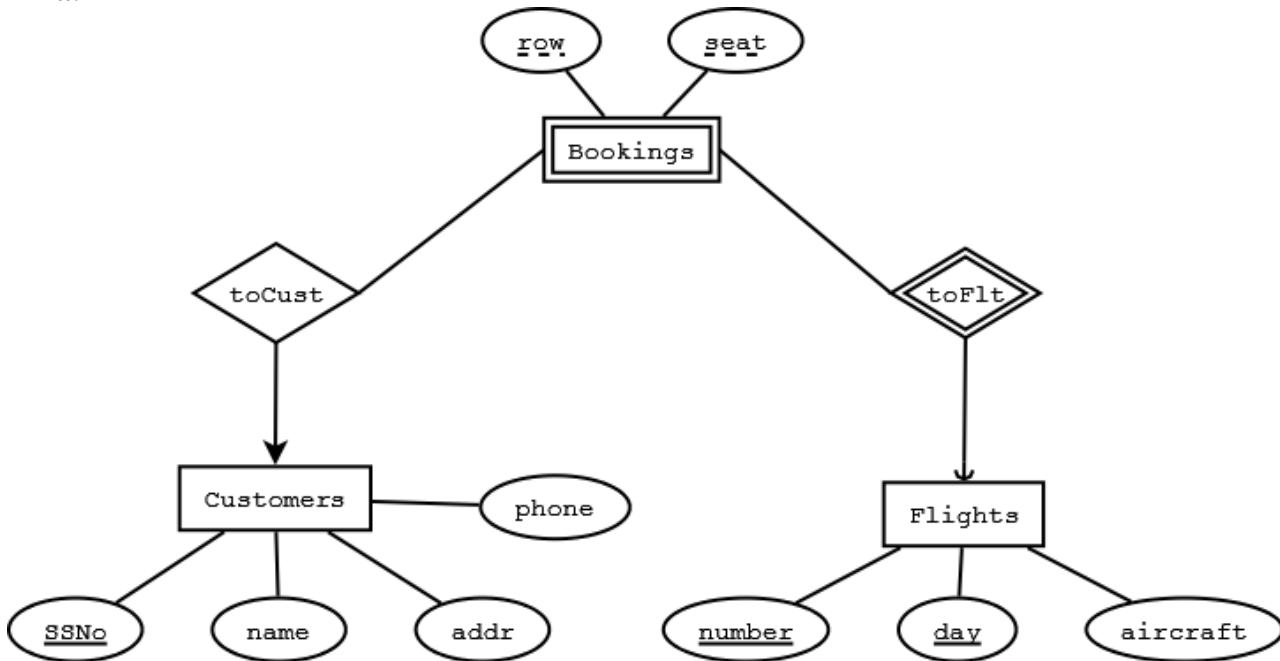
b.

5. **[40 points]** Specify the following queries in SQL on the COMPANY relational database given below.

One possible database state for the COMPANY relational database schema.

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	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	1968-01-19	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	Mgr_ssn	Mgr_start_date
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

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

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

a) Find names of all employees who are working in department 4 for more than 15 hours per week on Computerization project.

b) Find all employees who dependents share the same first name.

c) Find names of all employees whose supervisor's supervisor is James Borg.

d) For each department, find the department name, number of employees and average employee salary.

e) Create a view – for each project retrieve the department under which the project is launched, total number of employees working under that project and total number of hours worked per week on that project.

f) Delete department 4. Make sure you first delete all projects and its employees under the department before deleting the department itself.

6. [15 points] Consider the universal relation R = {A, B, C, D, E, F, G, H, I, J} and the set of functional dependencies
F = { AB → C, BD → EF, AD → GH, A → I, H → J }

   a) What is the key for R?
   b) Indicate all the violations of 3NF and then decompose R into 3NF.

7. [15 points] Consider the universal relation R = {A, B, C, D, E} and the set of functional dependencies

   F = { AB → C, B → D, DE → C }

   a) What is the key for R?
   b) Find all nontrivial FDs?
   c) Indicate if there are any FDs that violate BCNF.