

Q1 Key Terms (18 points)

Give a simple definition or an example for the following terms:

1. Referential Integrity
2. Primary Key
3. Foreign Key
4. Candidate Key
5. Strong and Weak Entity Type
6. Functional Dependency

Q2 Database Design (32 points)

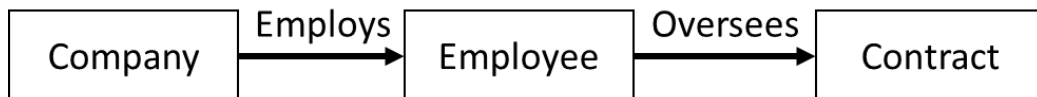
List 2 fact-finding techniques discussed in the class. For each, give 2 advantages and 2 disadvantages of this technique.

Technique	Advantages	Disadvantages
	1. 2.	1. 2.
	1. 2.	1. 2.

Q3 Data Model (30 points)

The following E-R diagrams each have traps (1 Fan, 1 Chasm). Note the trap and what a potential problem would be. Draw new E-R diagrams for each with the traps removed.

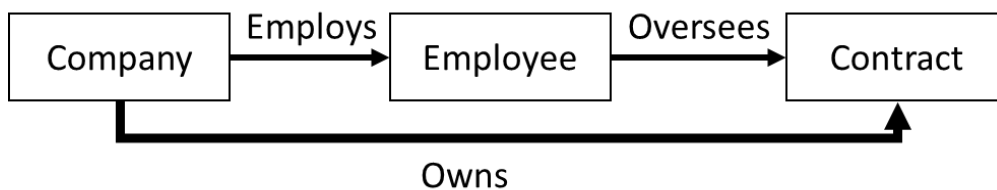
1. In this example, a company employs employees. When the company is awarded a contract, they will need to determine and assign an employee to oversee it. Hint: What if a contract has been awarded, but not yet assigned to an employee? What would be a problem?



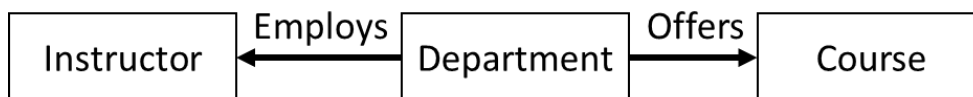
Circle the type of Trap: Fan Chasm

Potential Problem:

If a company owns a contract, but has not assigned it to an employee, we do not know which company owns it.



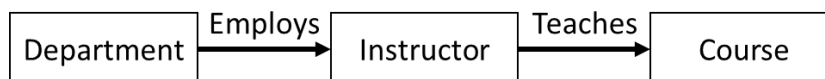
2. In this example, a university department employs instructors to teach the courses it offers. Hint: How can we determine which course(s) an instructor teaches?



Circle the type of Trap: Fan Chasm

Potential Problem:

We do not know which courses are taught by which instructors



Q4 Normalization (40 points)

Beginning with the following un-normalized dataset in a relation called ProjectMembers, produce a 3NF version of the database with the same data. You must show the following:

1. Identify a Candidate Key for the ProjectMembers relation (**Employee ID**)
2. Functional dependencies (For simplicity, you may use the lettered columns above the Column names for this part)
 $A \rightarrow B, C, D, E, F$
 $C \rightarrow D, E, F$
 $E \rightarrow F$
 $G \rightarrow A, B, C, D, E, F, H, I$
3. Identify transitive dependencies that exist
 $A \rightarrow C; C \rightarrow D$
 $A \rightarrow E; E \rightarrow F$
4. Identify any Candidate Keys, Primary Keys, and Foreign Keys in your final 3NF relations

ProjectMembers

A	B	C	D	E	F	G	H	I
Project ID	Project Name	Project Manager ID	Project Manager Name	Company ID	Company Name	Employee ID	Employee Name	Hourly Rate
PCS330	Database System	621	Joseph Ledet	123	AIU	331	John Smith	19
PCS330	Database System	621	Joseph Ledet	123	AIU	332	Kate Tucker	16
PCS330	Database System	621	Joseph Ledet	123	AIU	333	Tim Wylie	23
PCS201	Tax System	456	Can Muratoglu	457	Auburn	334	Jim Reynolds	15
PCS201	Tax System	456	Can Muratoglu	457	Auburn	335	Mehmet Dogan	18
PCS201	Tax System	456	Can Muratoglu	457	Auburn	336	Metin Gorur	22
PCS101	User Interface	789	Andy Bey	457	Auburn	337	Levent Yilmaz	18
PCS101	User Interface	789	Andy Bey	457	Auburn	338	Halit Oguztuzun	20
PCS101	User Interface	789	Andy Bey	457	Auburn	339	Alice Smith	21

Project PK (ProjectID)

Manager PK(Project Manager ID) Company

FK (ProjectManager ID, Company ID)

PK (Company ID)

A	B	C	E
Project ID	Project Name	Project Manager ID	Company ID
PCS330	Database System	621	123
PCS201	Tax System	456	457
PCS101	User Interface	789	457

C	D
Project Manager ID	Project Manager Name
621	Joseph Ledet
456	Can Muratoglu
789	Andy Bey

E	F
Company ID	Company Name
123	AIU
457	Auburn

Employee PK (Employee ID)

G	H	I
Employee ID	Employee Name	Hourly Rate
331	John Smith	19
332	Kate Tucker	16
333	Tim Wylie	23
334	Jim Reynolds	15
335	Mehmet Dogan	18
336	Metin Gorur	22
337	Levent Yilmaz	18
338	Halit Oguztuzun	20
339	Alice Smith	21

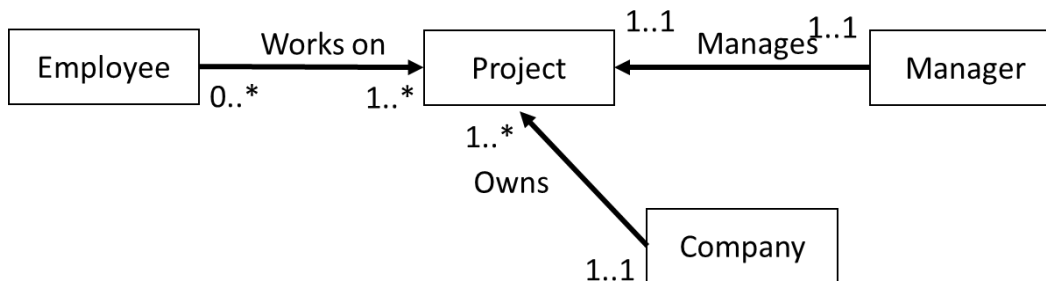
EmpProj PK (Employee ID), Project ID) FK

(Employee ID) FK (Project ID)

G	A
Employee ID	Project ID
331	PCS330
332	PCS330
333	PCS330
334	PCS201
335	PCS201
336	PCS201
337	PCS101
338	PCS101
339	PCS101

Q5 E-R Diagram (40 points)

For the 3NF database you produced in the previous question, draw the E-R diagram. Include in your diagram each of the relations (entities) and the relationship along with participation/cardinality (i.e. 1..*, 0..1, etc.).



Q6 SQL (40 points)

Using the 3NF database you produced in the previous questions, produce SQL queries to do the following:

- Identify how many employees work on Project PCS101.
 SELECT COUNT(*) as NumEmployees
 FROM EmpProj
 WHERE ProjID = "PCS101"
- Identify how many employees work for Auburn and have an hourly rate more than 20.
 SELECT COUNT(*) as NumEmployees
 FROM Employee e, EmpProj ep, Project p, Company c
 WHERE e.ID = ep.EmpID AND ep.ProjID = p.ID and p.CompanyID = c.ID and
 c.Name = "Auburn" and e.hr > 20
- Move Levent Yilmaz from his current project to the "Tax System" project.

- Update empProj set projID = "PCS201" where EmpID = 337
- Remove John Smith from the Company AIU and his current project.
Delete from empProj where empID = 331
 - Add Mehmet Dogan to the User Interface Project (do not remove him from the Tax System Project)
Insert into EmpProj values (335, "PCS101")
 - Give privilege to select from one of your tables to all users.
Grant SELECT On Project to PUBLIC;
 - Give privilege to remove records from one of your tables to a role called "Supervisor". Allow Supervisors to give this privilege to others.
GRANT DELETE on Company to SUPERVISOR
WITH GRANT OPTION
 - Create a view that gives the Project ID, Project Name, and Manager Name for the project with the greatest average hourly rate (average hourly rate for a project is the average of the hourly rates of all the employees on the project).

```
SELECT p.ID, p.Name, M.Name
FROM Project p, manager m
where p.ManagerID = m.ID and
      p.ID = (SELECT avRates.ID
              from (SELECT ep.projID ID, AVG(e.hourlyrate) avgHR
                    FROM Employee e, EmpProj ep
                    WHERE e.ID = ep.EmpID Group BY ep.projID) avRates
              WHERE avRates.avgHR = (SELECT MAX(avgHR) from
                                     (SELECT ep.projID ID, AVG(e.hourlyrate) avgHR
                                      FROM Employee e, EmpProj ep
                                      WHERE e.ID = ep.EmpID Group BY ep.projID)
                                     avRates2))
```

- Create a new table called OriginalData with the same columns as the original table.
CREATE TABLE OriginalData (ProjectID VARCHAR(6) NOT NULL, ProjectName VARCHAR(255) NOT NULL, ManagerID INT NOT NULL,)
- Put the data into this table by using a select query that joins all of your 3NF tables.
Hint: This will produce the original UNF table.
SELECT p.ID, p.Name, p.ManagerID, m.Name...
FROM Project p, Manager m, Company c, Employee e, EmpProj ep
WHERE e.ID = ep.EmpID AND ep.ProjID = p.ID and p.CompanyID = c.ID and
p.managerID = m.ID