

1) **True/False (20 pts)**

Indicate whether each of the following statements is true or false (T/F):

☐T_____A weak entity set can participate in more than one relationship set

☐F_____If we define a foreign key in relation R, the DBMS checks the foreign key constraint whenever a tuple in R is deleted.

☐T_____A weak entity set might have derived attributes

☐F_____ER diagrams are used to model the physical schema of a database

☐T_____An entity set E can be associated with a relationship set R more than once.

☐F_____In the WHERE clause of a SQL query, the condition 'Smith' = NULL is evaluated to be false

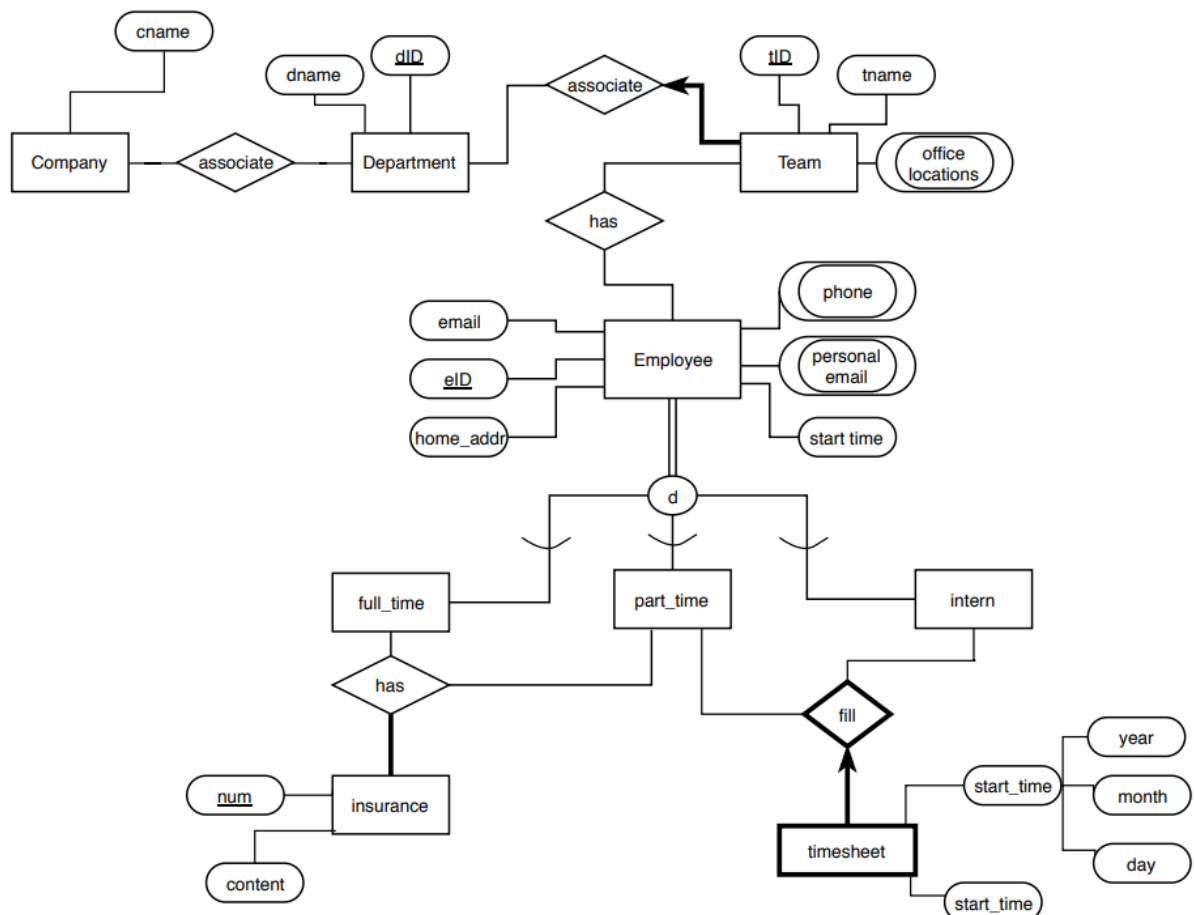
☐F_____If we define a foreign key in relation R, the DBMS checks the foreign-key constraint whenever a tuple in R is deleted.

1) Entity-Relationship (25 pts)

Suppose you want to design a database for your company. It will contain the following information:

1. The company has many departments. Every department has its name and a unique department id.
2. There are teams associated with each department. Every team has its name, team id, and office locations.
3. Every team has its employees. Employees could be associated with multiple teams.
4. Employees have such information as: a unique company-wide employee id, a company email address, personal email address(s), home address, start time, cell phone number(s).
5. Employees should belong to one of the three employee types: full-time, part-time, intern.
6. Full-time employees and part-time employees have insurance policy information, while interns do not have such information. Insurance policies contain a policy number that is used to identify the policy, and the content of the policy.
7. Part-time employees and interns have to fill out timesheets to record their working time. A timesheet contains records of start time and end time. Full-time employees do not need to fill out such timesheets.

- a) Draw a ER/EER diagram to show the conceptual design of the database. Indicate all subclasses, relationships, relationship cardinalities, total participation, attributes, primary keys if necessary. In addition, specify whether each attribute is single-valued or multivalued, stored or derived, and atomic or composite. State any assumption you make in your answer. (15pt)



- b) Map your conceptual design to the pure relational model. No SQL definitions .
Required. Be sure to identify all integrity constraints.

Department (name, id)

Team (department-id, name, t-id, office-locations)
department-id is a FK ^{that} references Department.
department-id is not NULL.

Employee (emp-id, team-id, cell-phones, corp_email,
personal_emails, employee-type)

Employee_start_time (emp-id, year, day, month)
emp-id is a FK that references Employee

Employee_home (emp-id, street, state, city)
emp-id is a FK that references Employee

Policy (policy-id, emp-id, content) emp-id is a FK
that references Employee

Time-sheet-record (emp-id, start-time, end-time)
emp-id is a FK that references Employee

2) SQL (25 pts)

Consider the following table schemas.

Company(company_name, year_founded)

HireStats (company_name, number_of_new_hire, year)

In the table company, year_founded stands for the year the company is founded.

HireStats tables record the statistics of the hiring for each company.

Company_name in HireStats is a foreign key which references the table Company.

Number_of_new_hire is not null, and is always a positive number.

Primary keys in tables are underlined.

a) Create the two tables (with required constraints). (10pt)

```
CREATE TABLE Company (company_name char(255),
                        year_founded integer NOT NULL,
                        year integer
                        Primary Key (company_name));
```

```
CREATE TABLE HireStats (company_name char(255),
                        number_of_new_hire integer,
                        Primary Key (company_name, year),
                        Foreign Key(company_name) References Company
                        ON DELETE CASCADE
                        ON UPDATE CASCADE,
                        CHECK (number_of_new_hire > 0));
```

b) Find the average hiring number for company name “Apple” between year 2011 and 2012. (5pt)

```
SELECT AVG(number_of_new_hire)
FROM HireStats
WHERE company=“Apple” AND ((year=2011) OR (year=2012));
```

c) Find the company names that were founded before 2000 and hired more than 60 people in 2012. (5pt)

```
SELECT C.company_name
FROM Company C, HireStats H
WHERE C.company_name= H.company_name AND
      H.number_of_new_hire>60 AND
      H.year=2012 AND
      C.year_founded<2000;
```

d) Find the total number of people hired for each company since it was founded. (5pt)

```
SELECT SUM(number_of_new_hire)
FROM Company C, HireStats H
WHERE C.company_name = H.company_name AND H.year>=C.year_founded
GROUP By C.company_name;
```