National University of Computer and Emerging Sciences
FAST School of Computing   Spring-2023   Islamabad Campus
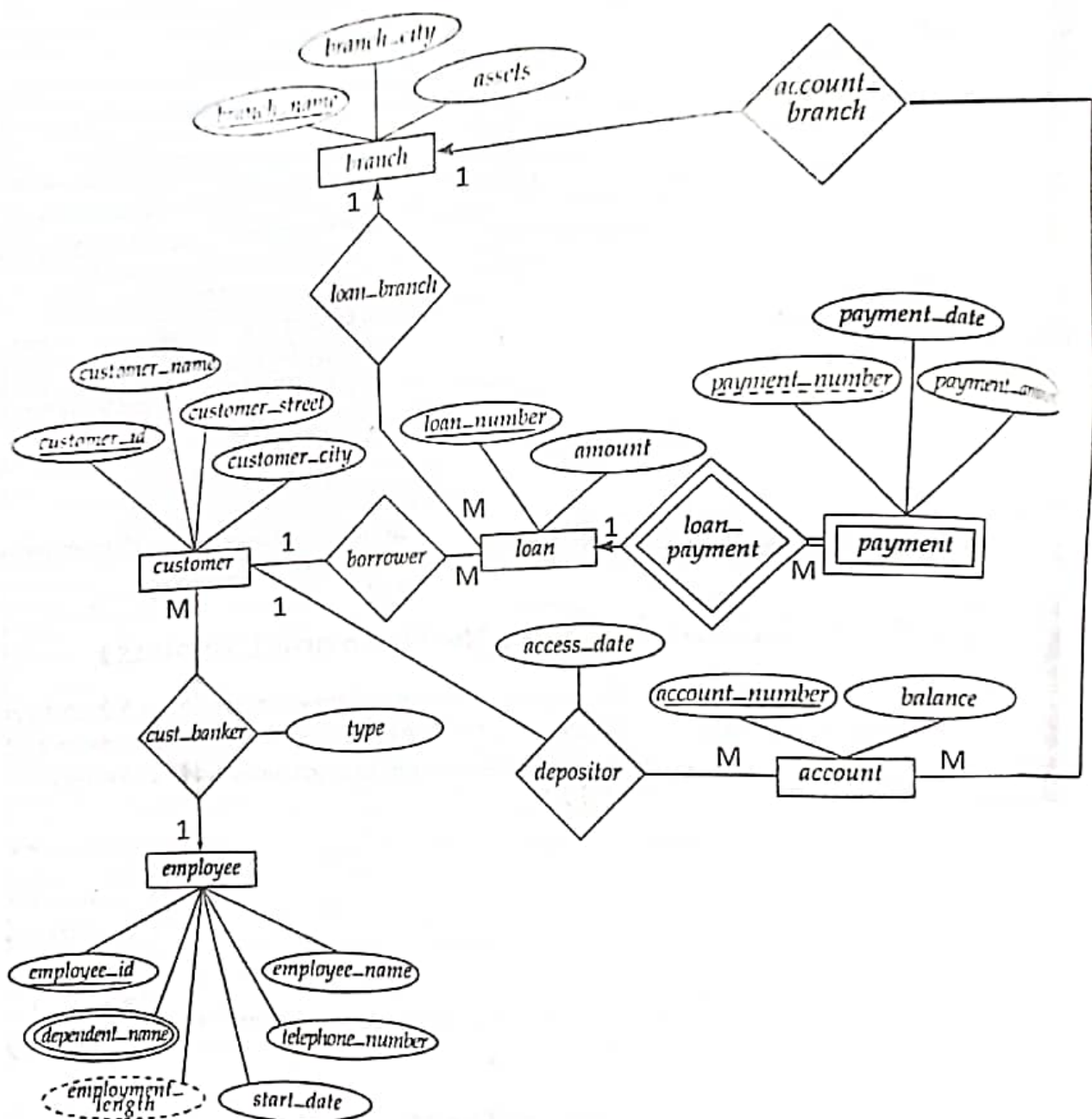
Question 1 [10 Marks]

Draw an EER diagram based on the requirements below. Write down assumptions (if any) you make in your answer. Do not forget to underline the keys and mention the cardinalities.

An organization depends on a number of different types of persons for its sufficient operation. The organization is interested in the following attributes for all of these persons: SSN, Name, Address, and Telephone. A person may have multiple telephone numbers. Three types of persons are of greatest interest: employees, volunteers, and donors. Employees only have a Date Hired attribute, and volunteers only have a Skill attribute. Donors only have a relationship (named Donates) with an item that has a number and name. A donor must have donated one or more items, and an item may have no donors or one donor. There are persons other than employees, volunteers, and donors who are of interest to the organization so a person need not belong to any of these groups. On the other hand, at a given time a person may belong to two or more of these groups (for example, employees and donors).
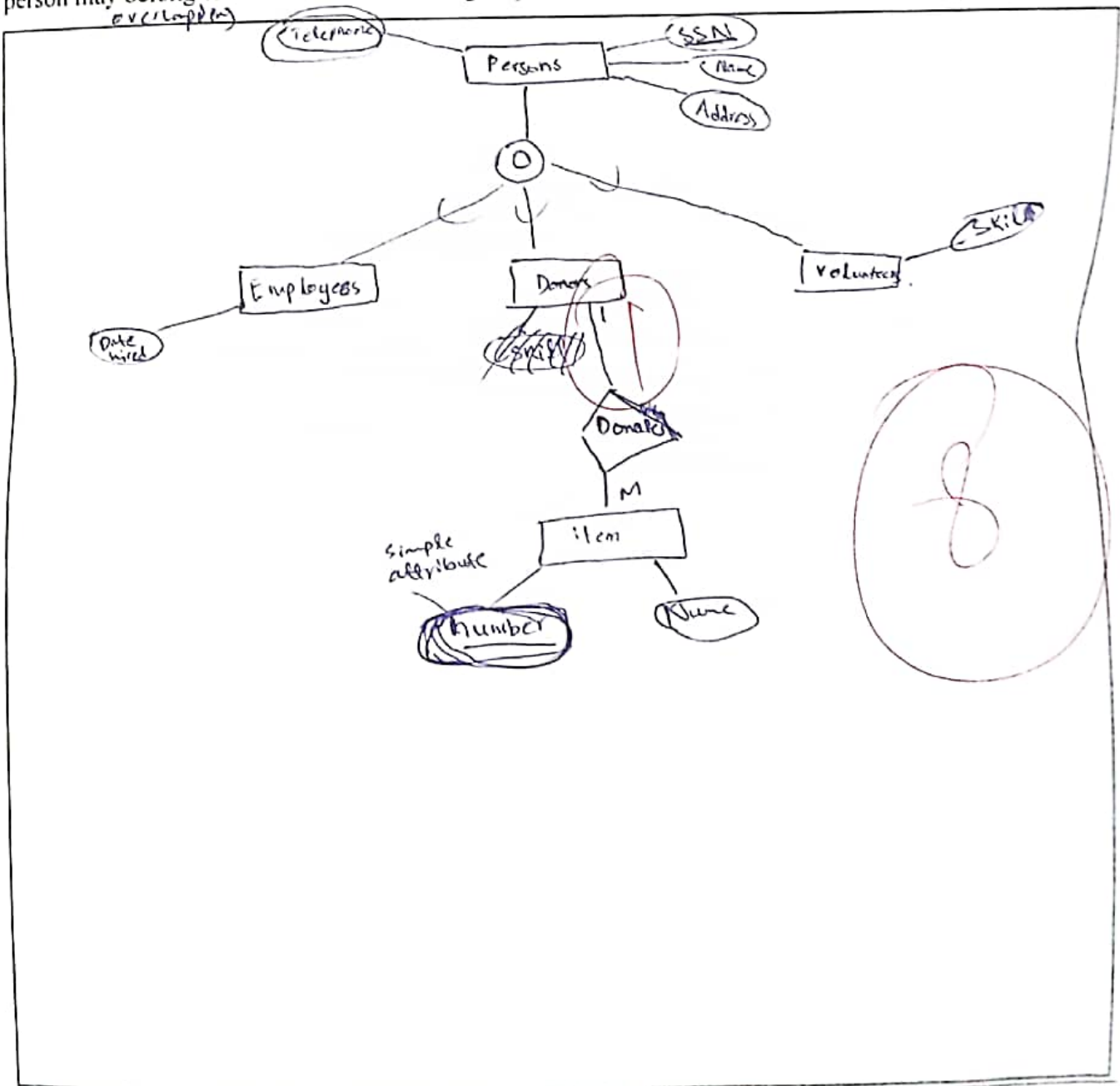
Question 2 [15 Marks]

Consider the E-R diagram below, which models a banking enterprise. Convert the E-R diagram to relational schema (tables and columns). Don't forget to mention primary and foreign keys.

Employee

(employee_id, Employee-Name, telephone, startdate 🕱🕱, ~~est body ty~~
   PK

Employee – Dependent. Name

(Employee _id, Dependaht Name)
   PK & FK   PK

~~Emplo~~
Customer

(Customer_id, Customer_Name, Customer street, city, employee id, cust-
   PK   FK   typ
                                                                     retr

Account

(account_no, balance, ~~customer_id~~, ~~branch name~~ access date)
   PK   FK customer   FK - branch

Branch

(Branch-Name, Branch_city, assets)
   PK

Loan

(Loan_number, amount, Customer_Id, branch name)
   PK   FK customer   FK bmysh

Payment

(Payment_number, Payment_date, Payment_mount, Loan_number)
   PK   FK Loan
   (self generated
    number/auto
    number)

                                              PK

12#

Question 3 [25 Marks] Short Questions

Question 3-a: (1 Mark) This Query can be replaced by which one of the following?

```
SELECT name, course_id
FROM instructor i, teaches t
WHERE i. teachers_ID= t.teachers_ID;
```

     a) Select name, course_id from teaches, instructor where teachers_id=course_id;

     b) Select name, course_id from instructor natural join teaches;

     c) Select name, course_id from instructor;

     d) Select course_id from instructor join teaches;

Question 3-b: (1 Mark) The subclass which has more than one super class is called

     a) Partial subclass

     b) Shared subclass

     c) Shared super class

     d) Joint super class

Question 3-c: (1 Mark) By default, the order by clause lists items in _____ order

```
ELECT name
FROM instructor
WHERE dept name = "Physics"
ORDER BY name;
```

     a) Descending

     b) Any

     c) Same

     d) Ascending

Question 3-d: (1 Mark) _____ operator is used for appending two strings.

     a) &

     b) %

     c) ||

     d) _

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Question 3-e: (1 Mark) Constraints ensure that a value that appears in one relation for a given set of attributes also appears for a certain set of attributes in another relation

    a) Logical Integrity

    (b) Referential Integrity

    c) Domain Integrity

    d) Data Integrity

Question 3-f: (1 Mark) Consider attributes ID, CITY, and NAME. Which one of these can be considered a super key?

    a) NAME

    b) ID

    c) CITY

    (d) CITY, ID

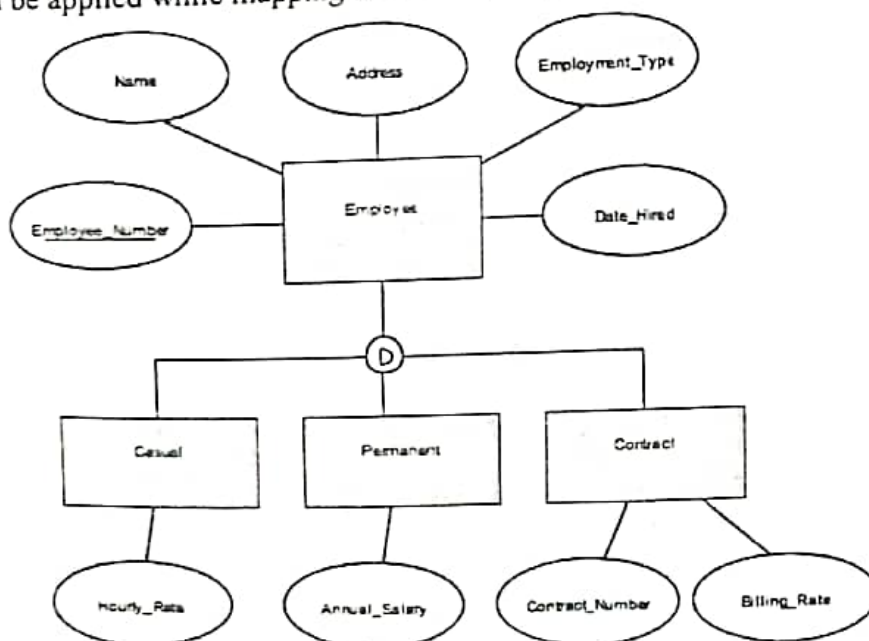**Question 3-g: (1 Mark)** The subset of a super key is a candidate key under what condition?

    a) No proper subset is a super key

    b) All subsets are super keys

    c) Subset is a super key

    (d) Each subset is a super key

Question 3-h: (2+2 Marks) Consider EERD below and write down any two conversion rules (with reason) that can be applied while mapping this EERD to a relational schema.

Option Rule 1 , Create the table of super class with all its attributes and other classes' table with Primary of super class and their own attributes. (Because universal rule, can be applied to all scenarios).

2: Create its table with flag or type column in which type will be mentioned in each row and all attributes (in whole diagram) will be columns. (Null values generated mostly many)

Newson ?

Question 3-i: (2 Marks) Consider the following relations for a database that keeps track of student enrollment in courses and the books adopted for each course:

STUDENT(Ssn, Name, Major, Bdate)

COURSE(Course#, Cname, Dept)

ENROLL(Ssn, Course#, Quarter, Grade)

BOOK_ADOPTION(Course#, Quarter, Book_isbn)

TEXT(Book_isbn, Book_title, Publisher, Author)

Specify the primary and foreign keys for this schema, stating any assumptions you make

Student : Pk = SSN

Course : Pk = Course#

Enroll : Pk = (SSN, Course#), Fk = Quarter
M-M
of student & course

Book_Adoption: Fk₁ = Course#, Fk₂, Quarter Pk is ist
M-M of course, enroll

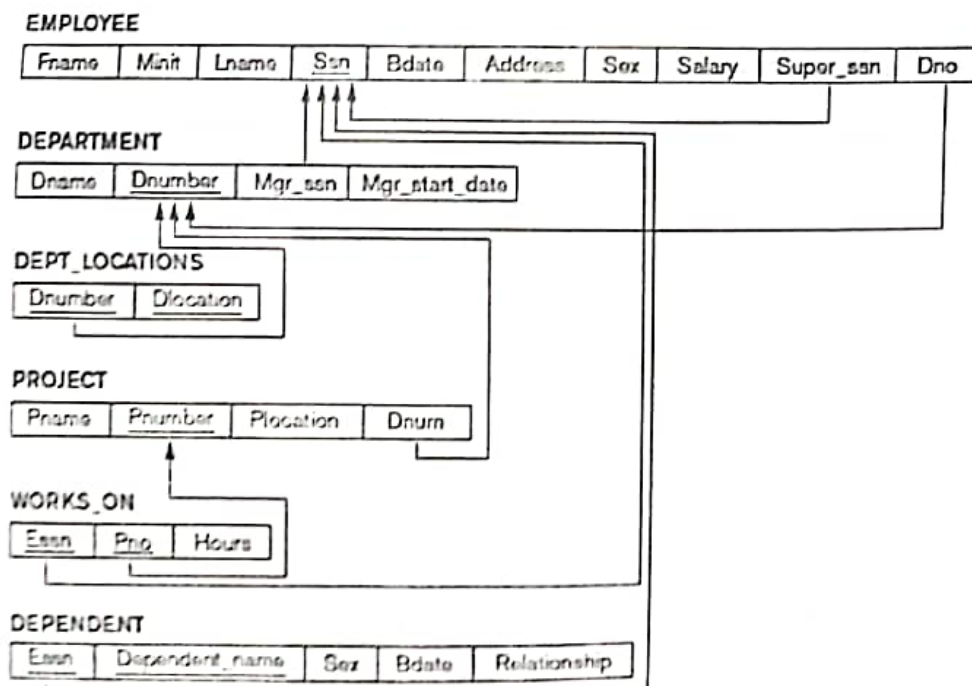Text : Pk = (Book_title, author), Fk = Book_isbn

Question 3-j: (2 Marks) Recent changes in privacy laws have disallowed organizations from using Social Security numbers to identify individuals unless certain restrictions are satisfied. As a result, most U.S. universities cannot use SSNs as primary keys (except for financial data). In practice, Student_id. a unique identifier assigned to every student, is likely to be used as the primary key rather than SSN since Student_id can be used throughout the system.

Some database designers are reluctant to use generated keys for primary keys (such as Student_id) because they are artificial. Can you propose any natural choices of keys that can be used to identify the student record in a UNIVERSITY database?

PK:
i) Student_Name , Father_Name
ii) Student_CNIC
i) Student_name, Address

2

Question 3-k: (2+3+2 Marks) Specify the following queries in SQL on the COMPANY relational database schema shown below.

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

DEPT_LOCATIONS

Dnumber	Dlocation

PROJECT

Pname	Pnumber	Plocation	Dnum

WORKS_ON

Essn	Pno	Hours

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

a) Retrieve the names of all employees in Department 5 who work more than 10 hours per week on the ProductX project.

```
Select Fname, from employees
join Department on SSN = Dnumber
join workson on P.No = Dnumber
where hours    join project on Product Pnumber
```
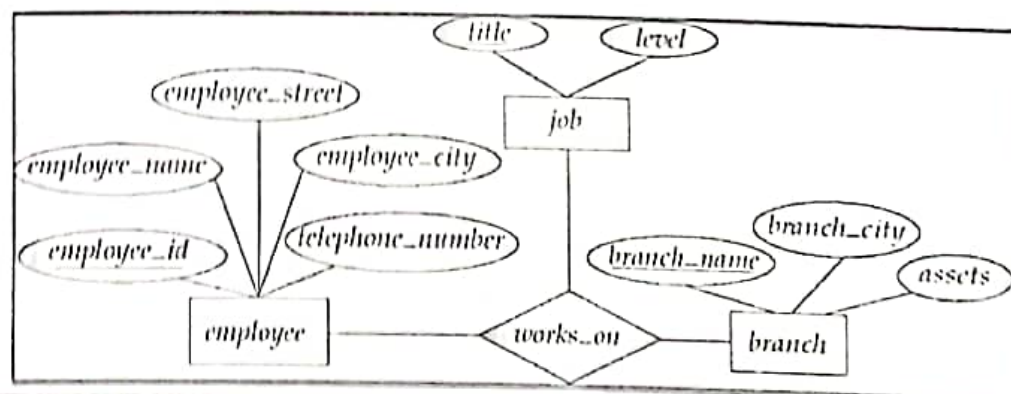
b) List the names of all employees who have a dependent with the same first name as themselves.

```
Select fname from employee
```

c) Find the names of all employees who are directly supervised by 'Franklin Wong'.

```
Select Fname from employee
join
```

Question 3-l: (3 Marks) Convert the following ER diagram with a ternary relationship into a relational schema.


```
employee
( employeeId , Name, street, city, telephone)
Branch
( branchName, City, assets)
Job
(level, title)
works_on
( employeeid, title, branch name)
```