

## QUESTION 1

(15 MARKS)

Enhanced Entity Relationship Diagram (EERD) is a high-level or conceptual data model incorporating extensions to the original entity–relationship (ER) model.

- a) What are the differences between specialization and generalization?

*(5 marks)*

- b) Draw a complete EERD based on the description given in Figure 1.1:

At Faculty of Computing, students can be categorized as undergraduate student, postgraduate student, research assistant and teaching assistant. Undergraduate students cannot fall into the other categories; however, postgraduate students can also be either research assistant or teaching assistant. Courses at the faculty can be categorized into Faculty Compulsory, Department Compulsory, University Compulsory and Elective. Students must register all categories of courses in order to get their degree.

**Figure 1.1 EERD Description**

*(10 marks)*

## QUESTION 2

(20 MARKS)

- a) Identify the steps used to build a logical ER model. (3 marks)
- b) Discuss the difference between local logical ER model and global logical ER model. (3 marks)
- c) Derive the relations from the conceptual ER model for PetShop System shown in Figure 2.1. (7 marks)

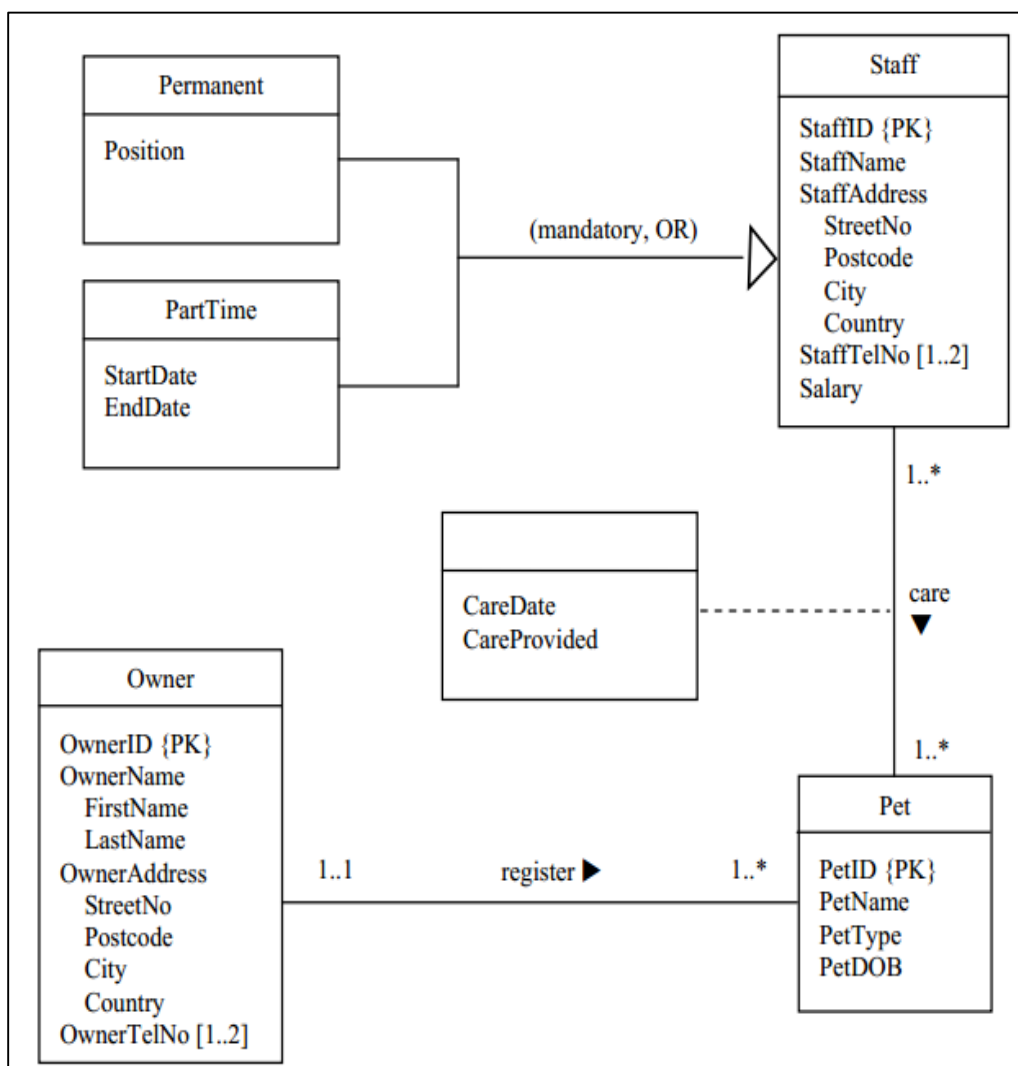
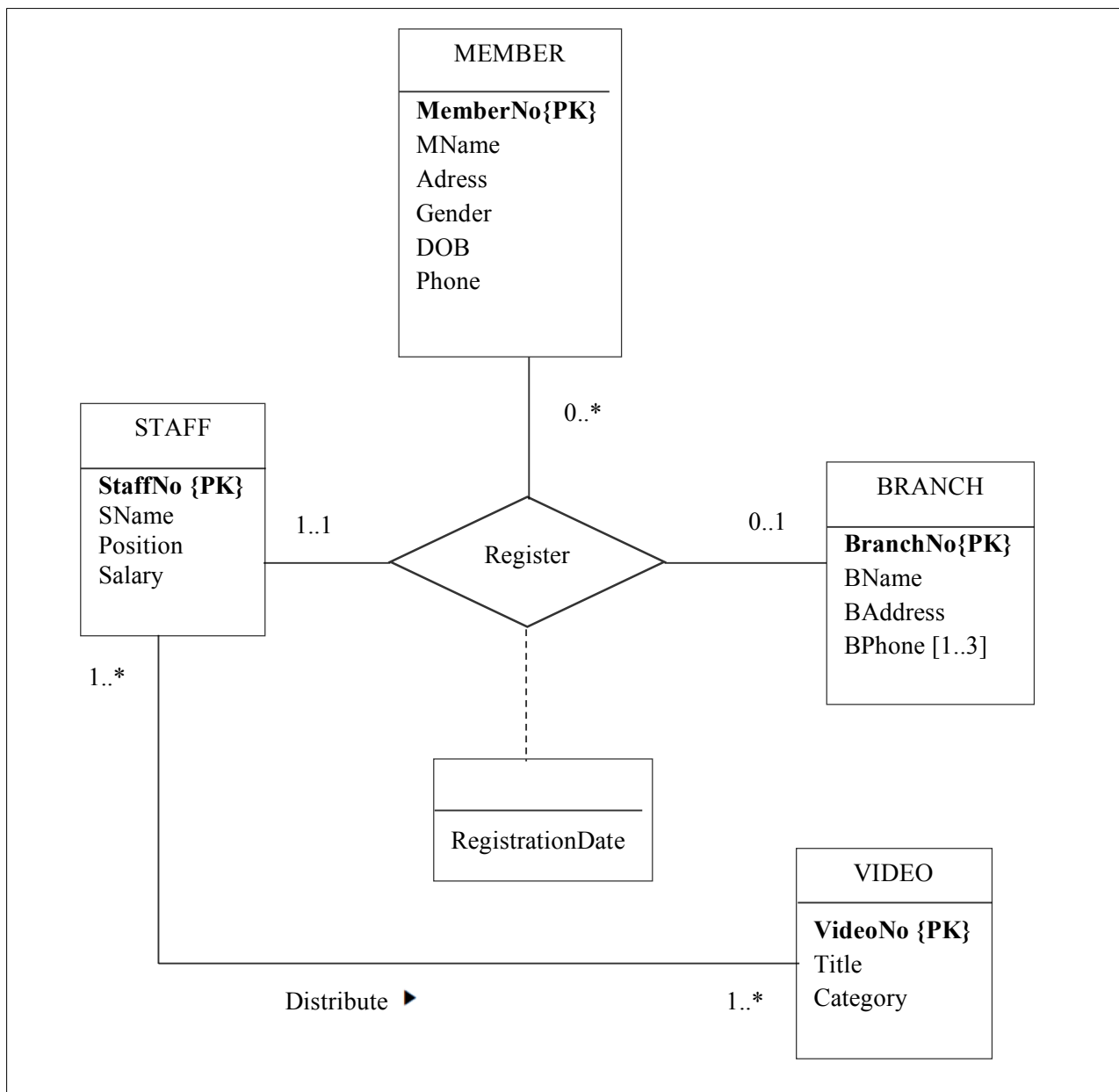


Figure 2.1: The Conceptual ER Model for PetShop System

d) Transform the conceptual ER Model shown in Figure 2.2 into a logical ER Model.

(7 marks)



**Figure 2.2: The Conceptual ER Model For Video Rental System**

**QUESTION 3****(20 MARKS)**

- a) Given a relation schema **Employee(empID, name, job, salary)**.

Construct a SQL statement to query all of the employee names, jobs, and salaries where their salary is more than 10% of the total company paid salary.

(3 marks)

- b) Given the instances of a table named PC as shown in Table 3.1. Show the output for following query:

```
SELECT DISTINCT speed, ram
FROM PC
WHERE price<500 ORDER BY 2 DESC;
```

1..\*

**Table 3.1 PC Table Instances**

| price | speed | hd | ram | cd  | model | code |
|-------|-------|----|-----|-----|-------|------|
| 600.0 | 500   | 5  | 64  | 12x | 1232  | 1    |
| 850.0 | 750   | 14 | 128 | 40x | 1121  | 2    |
| 600.0 | 500   | 5  | 64  | 12x | 1233  | 3    |
| 850.0 | 600   | 14 | 128 | 40x | 1121  | 4    |
| 850.0 | 600   | 8  | 128 | 40x | 1121  | 5    |
| 950.0 | 750   | 20 | 128 | 50x | 1233  | 6    |
| 400.0 | 500   | 10 | 32  | 12x | 1232  | 7    |
| 350.0 | 450   | 8  | 64  | 24x | 1232  | 8    |
| 350.0 | 450   | 10 | 32  | 24x | 1232  | 9    |
| 350.0 | 500   | 10 | 32  | 12x | 1260  | 10   |
| 980.0 | 900   | 40 | 128 | 40x | 1233  | 11   |

(5 marks)

- c) Differentiate the result produced by these two SQL statements: "**SELECT speed, ram FROM PC;**" and "**SELECT DISTINCT speed, ram FROM PC;**"

(2 marks)

**Questions 3(d) – 3(f) refer to following description:**

A database schema for a computer house is shown in Figure 3.2. The PRODUCT relation holds information on a product which consists of the model number (modelNo), the maker, and the type (which can be a 'PC', 'Laptop', or 'Printer'). A model number is unique for all product type. The PC relation holds further information of a PC, including the PC's code (pcCode), speed (pcSpeed), RAM size (pcRAM), hard disk drive capacity (pcHDD), CD-ROM speed (pcCDR), and price (pcPrice). The LAPTOP relation holds further information of a laptop which is similar to a PC, minus the CD-ROM speed. The PRINTER relation holds detail information of printer, including the printer's code (prCode), whether the printer is a color or a non-color printer (prColor), the printer's type (prType) and the printer's price (prPrice).

|  |
|--|
| PRODUCT (modelNo, maker, type)<br>Primary key: modelNo   |
| PC (pcCode, pcModelNo, pcSpeed, pcRAM, pcHDD, pcCDR, pcPrice)<br>Primary key: pcCode<br>Foreign key: pcModelNo references PRODUCT(modelNo) |
| LAPTOP (ltCode, ltModelNo, ltSpeed, ltRAM, ltHDD, ltPrice)<br>Primary key: ltCode<br>Foreign key: ltModelNo references PRODUCT(modelNo)    |
| PRINTER (prCode, prModelNo, prColor, prType, prPrice)<br>Primary key: prCode<br>Foreign key: prModelNo references PRODUCT(modelNo)         |

**Figure 3.2 Computer House Database Schema**

- d) Construct a SQL statement to list the model number, the model maker, the speed and the hard drive capacity for all PCs with prices above \$500.  
(5 marks)
- e) Construct a SQL statement to display group of PC models that have same speeds and RAM. Information to be displayed is PC model, speed and RAM.  
(2 marks)

- f) Construct a SQL statement to point out the maker and speed of the laptops having hard drive capacity more or equal to 10 GB.

*(3 marks)*

**QUESTION 4****(20 MARKS)**

Table 4.1 lists patient appointment data with the dentists. A patient is given an appointment with a dentist at a specific time, date and a surgery room. On each day of patients' appointment, a dentist is allocated to a specific surgery room (i.e. column surgeryNo) for that day.

**Table 4.1: Dentist/Patient Appointment Data**

| staffNo | dentistName    | Patient No | PatientName   | appointment Date | appointment Time | surgeryNo |
|---------|----------------|------------|---------------|------------------|------------------|-----------|
| S1011   | Ahmad Zulhilmi | P101       | Foon Yew      | 09 Nov 2014      | 8.30 am          | S15       |
| S1011   | Ahmad Zulhilmi | P105       | Saodah Hathim | 09 Nov 2014      | 9.30 am          | S15       |
| S1022   | Plevin Cruze   | P108       | Winstor Yee   | 09 Nov 2014      | 8.30 am          | S10       |
| S1022   | Plevin Cruze   | P108       | Winstor Yee   | 11 Nov 2014      | 2.00 pm          | S10       |
| S1030   | Mary Anne      | P105       | Saodah Hathim | 11 Nov 2014      | 3.00 pm          | S15       |
| S1030   | Mary Anne      | P105       | Siti Sabariah | 12 Nov 2014      | 4.00 pm          | S13       |

Based on the above explanation, answer the following questions:

- Table 4.1 is susceptible to update anomalies. Provide **ONE** example for each of insertion, deletion, and update anomalies.  
(3 marks)
- Identify in what level of Normal Form the Table 4.1 is in. Justify your answer.  
(2 Marks)
- Identify the Primary Key (PK) for Table 4.1.  
(2 Marks)
- Identify all functional dependencies that can be derived from the Table 4.1.  
(6 Marks)
- Illustrate the process of normalizing Table 4.1 up until Boyce Codd Normal Form (BCNF) level. State any assumptions you make about the data shown in the table.  
(7 Marks)

## CASE STUDY

(25 MARKS)

An art museum wants to keep track of its collection. The following requirements describe the information it wants to keep:

- The museum has a collection of ART\_OBJECTS. Each ART\_OBJECT has a unique Id\_No, an Artist (if known), a Year (when it was created, if known), a Title, and a Description. The art objects are categorized in several ways, as discussed in the following requirements.
- ART\_OBJECTS are categorized based on their type. There are three main types: PAINTING, SCULPTURE, and STATUE, plus another type called OTHER to accommodate objects that do not fall into one of the three main types.
- A PAINTING has a Paint\_Type (oil, watercolor, etc.), material on which it is Drawn\_On (paper, canvas, wood, etc.), and Style (modern, abstract, etc.).
- A SCULPTURE or a STATUE has a Material from which it was created (wood, stone, etc.), Height, Weight, and Style.
- An art object in the OTHER category has a Type (print, photo, etc.) and Style.
- ART\_OBJECTS are categorized as either PERMANENT\_COLLECTION (objects that are owned by the museum) and BORROWED. Information captured about objects in the PERMANENT\_COLLECTION includes Date\_Acquired, Status (on display, on loan, or stored), and Cost. Information captured about BORROWED objects includes the Collection from which it was borrowed, Date\_Borrowed, and Date\_Returned.
- Information describing the country or culture of Origin (Italian, Egyptian, American, Indian and so forth) and Epoch (Renaissance, Modern, Ancient, and so forth) is captured for each ART\_OBJECT.
- The museum keeps track of ARTIST information, if known: Name, Date\_Born (if known), Date\_Died (if not living), Country\_of\_Origin, Epoch, Main\_Style, and Description. The Name is assumed to be unique.
- Different EXHIBITIONS occur, each having a Name, Start\_Date, and End\_Date. EXHIBITIONS are related to all the art objects that were on display during the exhibition.
- Information is kept on other COLLECTIONS with which the museum interacts (i.e. to borrow objects), including Name (unique), Type (museum, personal, etc.), Description, Address, Phone, and current Contact\_Person.



Based on the given description, answer the following questions:

- a) Identify all entities together with its attributes.

*(5 marks)*

- b) Produce a LOGICAL entity relationship diagram (ERD) to represent the museum's database design.

*(10 marks)*

- c) Based on your answer in (b), produce the relational schema for the database. Specify all primary keys and foreign keys (if any) for each relation.

*(10 marks)*