

QUESTION 1

(10 MARKS)

- a) Describe **THREE (3)** main advantages of the database approach and contrast it with the file-based approach. (6 marks)
- b) Discuss **FOUR (4)** of the roles from the following personnel in the database environment:
- i) Data Administrator
 - ii) Database Administrator
 - iii) Logical Database Designer
 - iv) Physical Database Designer
 - v) Application Developer

(4 marks)

QUESTION 2**(20 MARKS)**

Given the following tables (**student**, **enrolledIn** and **subject**) in Figure 1, answer ALL questions in (a) and (b):

student		enrolledIn		subject	
id	name	id	code	code	lecturer
1234	joe	1234	cs1500	cs1500	curtis
4000	hector	1234	cs1200	cs2001	dave
2000	ling	1234	cs2001	cs3010	curtis
		4000	cs3010	cs2001	olivier
		4000	ma3000	ma3000	roger

Figure 1: Tables For Question 2

- a) For each of the following queries in Relational Algebra, construct the output table.
- $\Pi_{lecturer}(subject)$ (2 marks)
 - $\sigma_{lecturer=curtis}(subject)$ (2 marks)
 - $(\sigma_{name=hector}(student)) \bowtie enrolledIn \bowtie subject$ (3 marks)
- b) Formulate the specified queries in Relational Algebra.
- List the codes where there are students enrolled or lecturers assigned to. (3 marks)
 - List the lecturer who teaches ‘cs2001’ or ‘ma3000’. (3 marks)
 - List the names of all students in ‘cs1500’. (3 marks)
 - List the names of students taking the subject taught by ‘Roger’. (4 marks)

QUESTION 3

(15 MARKS)

- a) Describe each of the following concepts in the context of the relational model:

 - i) Relation
 - ii) Attribute
 - iii) Domain
 - iv) Tuple
 - v) Degree
 - vi) Cardinality

(3 marks)

b) Draw a complete table that shows (i.e. labels) the concepts in Question 3(a).

(3 marks)

c) Define “views” and their importance in database approach.

(2 marks)

d) Read the case in Figure 2.

The following relations form part of a database held in a relational DBMS:-

Hotel (hotelNo, hotelName, city)

Room (**roomNo, hotelNo, type, price**)

Booking (**hotelNo**, **guestNo**, **dateFrom**, **dateTo**, **roomNo**)

Guest (**guestNo**, **guestName**, **guestAddress**)

where

Hotel contains hotel details and **hotelNo** is the primary key;

Room contains room details for each hotel and (roomNo, hotelNo) forms the primary key;

Booking contains details of the bookings and (hotelNo, guestNo, dateFrom) forms the primary key;

and

Guest contains guest details and **guestNo** is the primary key.

Figure 2: Case Question 2(d)

- i) Identify the foreign keys in this schema. (2 marks)

ii) Explain how the entity and referential integrity rules apply to these relations. (2 marks)

- e) Consider the following relations for a database that keep track of student enrolment in courses and the books adopted for each course:

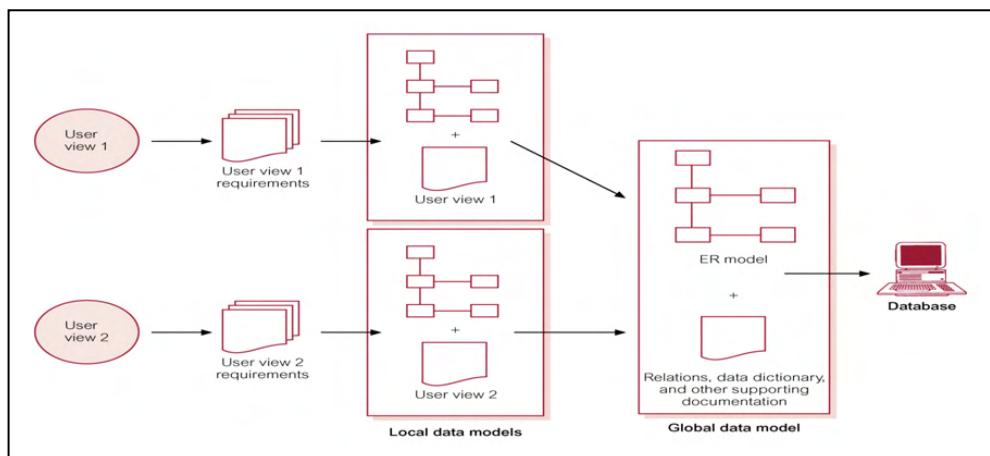
```
STUDENT (SSN, Name, Major, Bdate)
COURSE (Course#, Quarter, Grade)
ENROLL (SSN, Course#, Quarter, Grade)
BOOK_ADOPTION (Course#, Quarter, Book_ISBN)
TEXT (Book_ISBN, Book_Title, PublisherId, Author)
PUBLISHER (PublisherId, PublisherName, Address, Phone)
```

Identify primary key for each relation in the schema.

(3 marks)

QUESTION 4**(15 MARKS)**

- a) View integration is one of the main approaches in requirements collections and analysis from multiple users. In this approach, requirements for each user view are used to build a separate data model. Based on Figure 3, differentiate local data model and global data model.

**Figure 3: View Integration Approach**

(5 marks)

- b) Database design is the process of creating a design for a database that will support the enterprise's operations and objectives. Explain **TWO (2)** main approaches to the design of a database. Your answers should include relevant techniques/tools used for each approach.

(6 marks)

- c) Figure 4 shows the three-level ANSI-SPARC architecture. Identify the correspondence between the architecture levels with the **THREE (3)** main phases of database design.

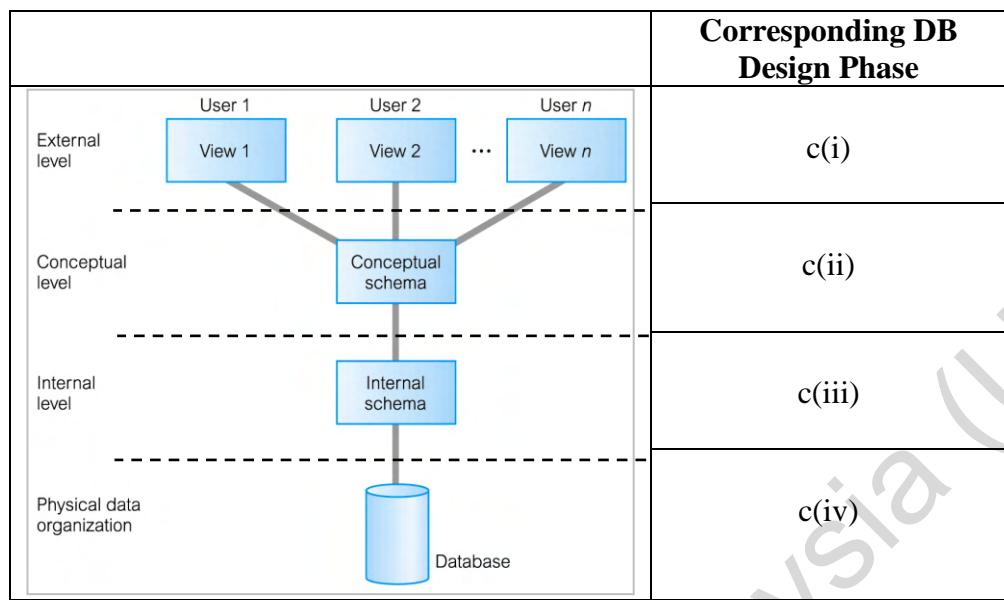
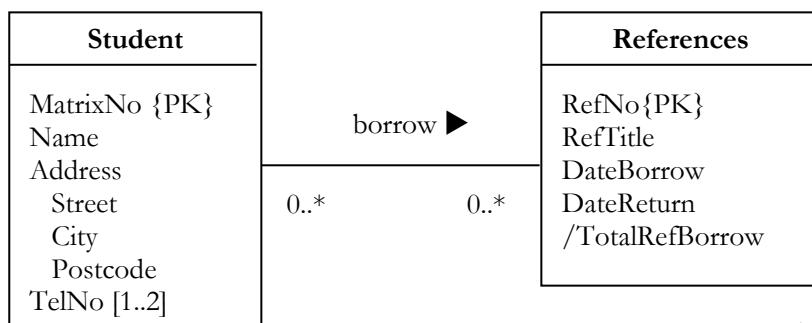


Figure 4: Three level ANSI-SPARC

(4 marks)

QUESTION 5**(20 MARKS)**

a)

**Figure 5:** Conceptual Entity Relationship Diagram

Attributes can be classified as being: simple or composite, single-valued or multi-valued and so forth. Identify **FIVE (5)** types of these attributes (with the example) from Figure 5. (5 marks)

- b) Based on the case study in Figure 6, answer **ALL** questions in (i) and (ii).

Suppose you are involved in developing the database system for the Sales Department of AtoZ Furniture Company. The operation of this department can be described as follows:

- The company provides products to their customers. Each product is described by product name, description, cost and price, and is uniquely identified using the product number. The number of the product in stock and the number allocated are updated regularly. When the number in stock decreases to the reorder level, the product is reordered in a pre-decided quantity.
- Each customer is described by his or her name that consist of their first name and last names, and customer addresses composed of street, city and postcode, and the customer telephone number. A customer may have a minimum of a single telephone number to a maximum of three telephone numbers.
- A customer may place zero, one or more orders at a time, and an order is always placed by one customer alone. Each order is identified by a unique order number. Other information as to orders includes date order, quantity and total price.
- An order may involve one or more than one type of products, and a type of products may be involved in more than one order. For each product being ordered in an order, its status (an order may be outstanding, partially delivered, or fully delivered and invoiced) and date update are recorded and updated regularly.

Figure 6: AtoZ Furniture Case Study

- i) Identify ALL entities and attributes involved. Write your answer in the format given in Table 2.

Table 2: Answer Format

ENTITY	ATTRIBUTE

(5 marks)

- ii) Based on the answer in (i), produce a complete conceptual entity relationship diagram (ER model). (10 marks)

QUESTION 6**(15 MARKS)**

Given the “**Customers**” table in Table 3, construct a Structured Query Language (SQL) for each question (a) to (j).

Table 3: Customers Table

CustomerID	CustomerName	ContactName	Address	City	PostalCode	State
101	Majlis Perbandaran Kulai	Mohd Rofiki Shamsudin	Jalan Pejabat Kerajaan	Kulai Jaya	81000	Johor
102	Perbadanan Taman Negara Johor	Mohammed Shakib Ali	Bangunan Dato' Mohamad Saleh Perang, Kota Iskandar	Nusajaya	79576	Johor
103	Johor Petroleum Development Corporation Bhd	Mohd Yazid Ja'afar	Menara MSC Cyberpor, Jalan Bukit Meldrum	Johor Bahru	80300	Johor
104	Twin Systems Sdn Bhd	Alishamudin Enjom	UTM-MTDC Technology Centre 2	Skudai	81300	Johor
105	Iskandar Regional Development Authority	Ismail Ibrahim	Danga Bay, Jalan Skudai	Johor Bahru	80200	Johor

- a) Create the table **Customers**. Use the most appropriate data type for each attribute. (3 marks)
- b) Create a PRIMARY KEY constraint on the “CustomerID” column. (2 marks)
- c) Insert a new row in the “**Customers**” table using the following data:
(106, ‘Kolej Yayasan Pelajaran Johor’, ‘Mohd Asmadi Alias’, ‘Jalan Ahad, Kampung Ungku Mohsin’, ‘Johor Bahru’, ‘80350’ ‘Johor’) (2 marks)
- d) Delete the customer "Twin Systems Sdn Bhd" from the "**Customers**" table. (2 marks)

- e) Update the customer "Majlis Perbandaran Kulai" with a new contact person ("Mohd Masni Wakiman") and city ("Kulai").
(2 marks)
- f) Add a column named "Country" in the "**Customers**" table.
(2 marks)
- i) Rename the table to "**Customer**".
(2 mark)