



# SLIATE

**SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION**

**(Established in the Ministry of Higher Education vide in Act No 29 of 1995)**

## **Higher National Diploma in Information Technology**

**Second Year, First Semester Examination – 2018**

### **IT3201: Advanced Database Management System**

#### **Marking Scheme**

#### **Question 1**

**(Total 20 marks)**

1. Define the term Database Management system. ( 2 marks )  
A software system that enables users to define, create, maintain, and control access to the database
  
2. State four Advantages of Database approach ( 4 marks )  
**1 \* 4 =4 marks for any four**
  - Minimum data redundancy
  - Consistency
  - Integration of data
  - Independence of data
  - Data Sharing
  - Enforcement of standards
  - Ease of application development
  - Uniform security, privacy and integrity control
  - Flexibility, data accessibility and responsiveness
  - Reduce program maintenance
  
3. Briefly explain the Components of DBMS Environment ( 8 marks )
  - **Hardware**  
Can range from a PC to a network of computers.
  - **Software**

DBMS, operating system, network software (if necessary) and also the application programs.

- **Data**

Used by the organization and a description of this data called the schema.

- **Procedures**

Instructions and rules that should be applied to the design and use of the database and DBMS.

- **People**

Data Administrator (DA), Database Administrator (DBA), Database Designers (Logical and Physical), Application Programmers, End Users (naive and sophisticated)

4. Discuss the differences between DDL and DML. What operations would you typically expect to be available in each language? (6 marks)

DDL statements are used for creating and defining the Database structure. // 1 mark

DML statements are used for managing data within Database. // 1 mark

DDL statements are CREATE, ALTER, DROP, TRUNCATE, RENAME etc //2 mark

DML statements are SELECT, INSERT, DELETE, UPDATE etc. // 2 mark

## Question 2

(Total 20 marks)

1. Filling the blanks with Equivalent Relational Terms (6 marks)

Informal Terms	Relational Terms
Table	a. Relation
Column	b. Attribute/Domain
Row	c. Tuple
Values in a column	d. Domain
Table Definition	e. Schema of a Relation
Populated Table	f. Extension

2. Consider the bellow relation and calculate (4 marks)
- a. Degree of the Relation - 7 //2 marks
  - b. Cardinality of the Relation - 5 //2 marks

### Student

<u>Reg No</u>	<u>Name</u>	<u>ContactNo</u>	<u>Address</u>	<u>Gender</u>	<u>Age</u>	<u>GPA</u>
1111	C.D. Perera	0372228222	Kurunegala	M	20	3.9
1112	C. Basnayake	0362255222	Awissawella	M	21	3.5
1114	N.S. Bandara	0812234567	Kandy	F	20	3.8
1115	K. Peris	0112876655	Colombo	M	21	3.0
1116	S. Menike	0253456654	Anuradhapura	F	21	2.6

3. Briefly explain the Three phases of database design ( 6 marks )

#### Conceptual database design ( 1 Mark )

Process of constructing a model of the data used in an enterprise, independent of *all* physical considerations. // 1 mark

#### Logical database design ( 1 Mark )

Process of constructing a model of the data used in an enterprise based on a specific data model (e.g. relational), but independent of a particular DBMS and other physical considerations. //1 mark

#### Physical database design. ( 1 Mark )

Process of producing a description of the database implementation on secondary storage. Tailored to a specific DBMS system. // 1 mark

4. Define the terms **entity integrity** and **referential integrity** constraints in relational model. ( 4 marks )

#### Entity integrity

- **Relational Database Schema:** A set  $S$  of relation schemas that belong to the same database.  $S$  is the *name* of the database.
- $S = \{R_1, R_2, \dots, R_n\}$
- **Entity Integrity:** The *primary key attributes* PK of each relation schema  $R$  in  $S$  cannot have null values in any tuple of  $r(R)$ . This is because primary key values are used to *identify* the individual tuples.
- $t[PK] \neq \text{null}$  for any tuple  $t$  in  $r(R)$

#### Referential integrity

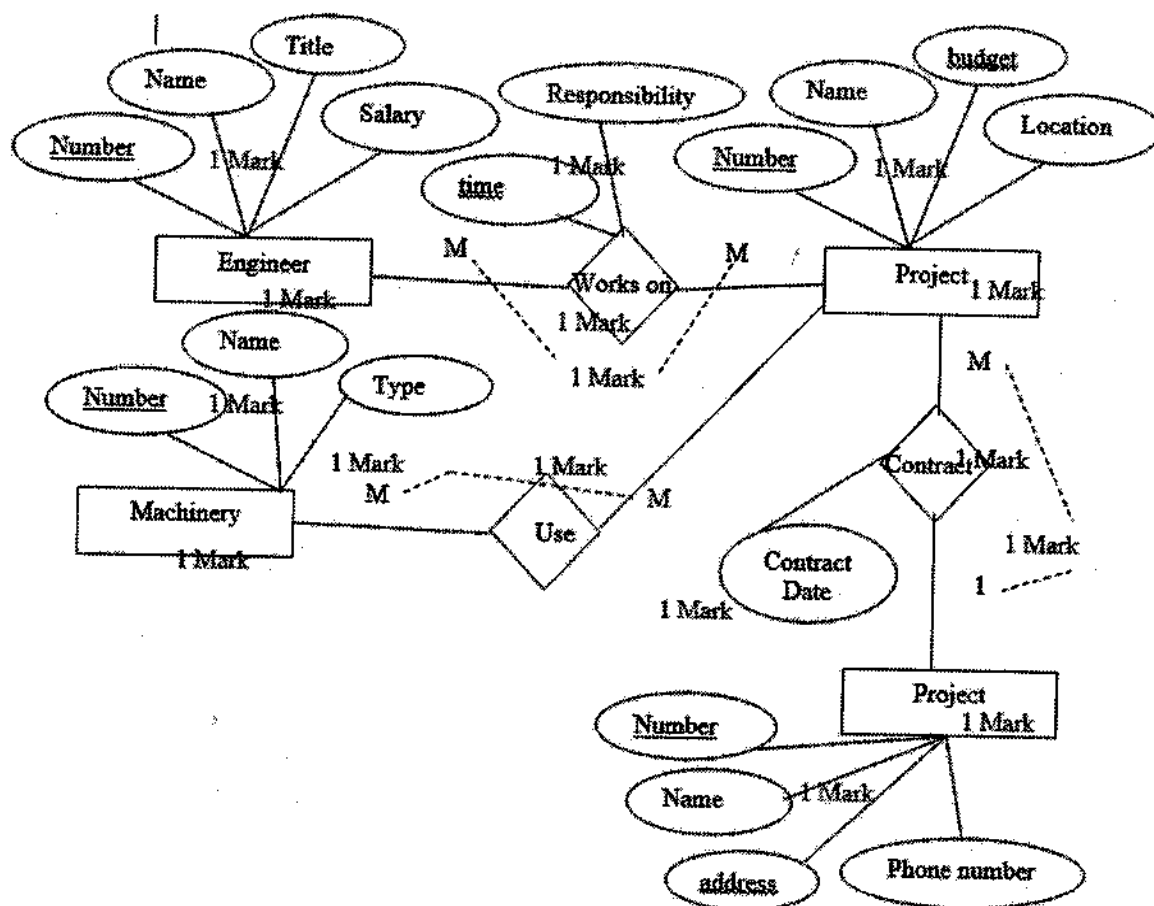
- A constraint involving *two relations* (the previous constraints involve a *single relation*).
- Used to specify a *relationship* among tuples in two relations: the **referencing relation** and the **referenced relation**.

### Question 3

(Total 20 marks)

Consider the following information about an Engineering enterprise.

- Each engineer works on a number of projects. For every engineer a record is kept of his/her number, name, title and salary. The number is used to identify an engineer uniquely.
  - For every project a record is kept of its unique number, name, budget and location. Additionally, the responsibility each engineer has on a particular project and the amount of time spent on the project is noted. Each project has number of engineers working on it.
  - Clients contract these projects. The clients name, address and phone number must be recorded. A client is identified using the unique client number.
  - The contract date, i.e. the date at which the client signs the contract for a specific project is also noted. A client can contract multiple projects and a given project can be contracted by only one client.
  - A record is also kept of the machinery being used for a particular project. The name, model and machine number is recorded and the machine number is used to identify an machine uniquely..
  - A project can use many number of machineries and given machinery can be used in multiple projects.
1. Draw an Entity Relationship (ER) diagram to capture the above information. Indicate primary keys and key constraints. ( 16 marks )



2. Royal Company uses the following table to record details of its departments.

DNAME	<u>DNUMB</u>	DMGR	DLOCATIONS
	<u>ER</u>	SSN	
Research	5	33344	{Mathara Kandy}
Adminis	4	98765	{Jaffna}
Headquarters	1	88866	{Metro}

Is this Department relation in 1NF? If not convert above table in to 1 NF ( 4 marks)

No. 1 mark

DNAME	DNUMBER	DMGRSSN	DLOCATION
Research	5	333445555	Mathara
Research	5	333445555	Kandy
Research	5	333445555	Metro
Administration	4	987654321	Jaffna
Headquarters	1	888665555	Metro

3 marks

**Question 4****(Total 20 marks)**

Reader

RNo	RName	Address	Phone
10	Janani	Wellawatte	0798654321
12	Methmi	Nugegoda	0778458217
13	Ruwan	Colpetty	0712345678

Borrows

Reader	ISBN	BorrowedDate	ReturnedDate	ReturnedStatus
12	234567	12/2/2011	12/3/2011	Yes
13	234567	23/5/2011		
12	123234	4/9/2011		

Books

ISBN	Title	authorID	publisher
234567	Database Management Systems	A1	McGraw Hill
123234	Introduction to Java	A2	McGraw Hill

Write SQL statements to

1. To create the above tables including all primary and foreign key constraints. ( 14 marks)

```
CREATE TABLE Reader(
    RNo int primary key,
    RName varchar(50) ,
    Address varchar(50) ,
    Phone int
);
```

//3 marks

```
CREATE TABLE Books(
    ISBN int primary key,
    Title varchar(50) ,
    authorID varchar(2) ,
    publisher varchar(50)
);
```

// 3 marks

```
CREATE TABLE Borrows(
    Reader int , FOREIGN KEY(Reader)REFERENCES Reader (RNo), 2 mark
```

```

ISBN int , FOREIGN KEY (ISBN) REFERENCES Books (ISBN), 2 mark
BorrowedDate datetime ,
ReturnedDate datetime , // 1 marks
ReturnedStatus varchar(10)
CONSTRAINT [PK_Borrows] PRIMARY KEY CLUSTERED // 2 marks
(
    Reader ,
    ISBN,
    BorrowedDate
)
)

```

2. List all the books written by author A1 (2 marks)

```
select * from books where authorID='A1'
```

3. Select readers name, address and phone those who have not returned the books on time.

(4 marks)

```
select r.* from borrows b, reader r where b.ReturnedDate > (SELECT
DATEADD(month, 1, b.BorrowedDate)) and r.rno=b.reader
```

### Question 5

(Total 20 marks)

1. Define the term transaction in a database (2 marks)

A **transaction** is a unit of program execution that accesses and possibly updates various data items.

2. Briefly explain ACID Property of transaction (8 marks)

**Atomicity** - Either all operations of the transaction are properly reflected in the database or none are.

**Consistency** - Execution of a transaction in isolation preserves the consistency of the database.

**Isolation** - Although multiple transactions may execute concurrently, each transaction must be unaware of other concurrently executing transactions.

**Durability** - After a transaction completes successfully, the changes it has made to the database persist, even if there are system failures. (2\*4 = 8 marks)

3. What are the states in a transaction? Explain them briefly. (10 marks)

- **Active**, the initial state; the transaction stays in this state while it is executing

- **Partially committed**, after the final statement has been executed.
- **Failed**, after the discovery that normal execution can no longer proceed.
- **Aborted**, after the transaction has been rolled back and the database restored to its state prior to the start of the transaction.

1) Restart the transaction – only if no internal logical error

2) kill the transaction

- **Committed**, after *successful completion*.. ( 2 \* 5 =10 marks )

### Question 6

(Total 20 marks)

1. State the different between Object-relational database systems and Object-oriented database systems. ( 4 marks)

#### **Object-oriented database systems**

is a database management system in which information is represented in the form of objects as used in object-oriented programming.

#### **Object-relational database systems**

is a database management system (DBMS) similar to a relational database, but with an object-oriented database model: objects, classes and inheritance are directly supported in database schemas and in the query language.

2. Define the term Mandatory Access Control (MAC) in database system. ( 4 marks)

Some commercial DBMSs provide an approach to access control called Mandatory Access Control (MAC), which is based on system-wide policies that cannot be changed by individual users.

In this approach each database object is assigned a security class and each user is assigned a clearance for a security class, and rules are imposed on reading and writing of database objects by users.

The SQL standard does not include support for MAC.

3. Briefly explain the term Encryption? (2 marks)

The encoding of the data by a special algorithm that renders the data unreadable by any program without the decryption key.

4. What do you mean by well formed XML document? (2 marks)



An XML document with correct syntax is called "Well Formed".

5. Draw the XML tree structure for the following DTD document.

(8 marks)

```

<!ELEMENT VisitinCard (Person+)> //1 mark
<!ELEMENT Person (Name,Designation,Qualification?,Company,Contact)> //2 mark
<!ELEMENT Name (#PCDATA)>
<!ELEMENT Designation (#PCDATA)> // 1 mark
<!ELEMENT Qualification (#PCDATA)>
<!ELEMENT CompanyName (#PCDATA)>
<!ELEMENT Contact (Address,Telephone,Fax?)> // 2 marks
<!ELEMENT Address (Company,Residence?)> //1 mark
<!ELEMENT Company (#PCDATA)>
<!ELEMENT Residence (#PCDATA)>
<!ELEMENT Telephone (General*,Direct?,Mobil*)> // 1 mark
<!ELEMENT General (#PCDATA)>
<!ELEMENT Direct (#PCDATA)>
<!ELEMENT Mobil (#PCDATA)>
<!ELEMENT Fax (#PCDATA)>
  
```

