00436

The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc. Degree Programme

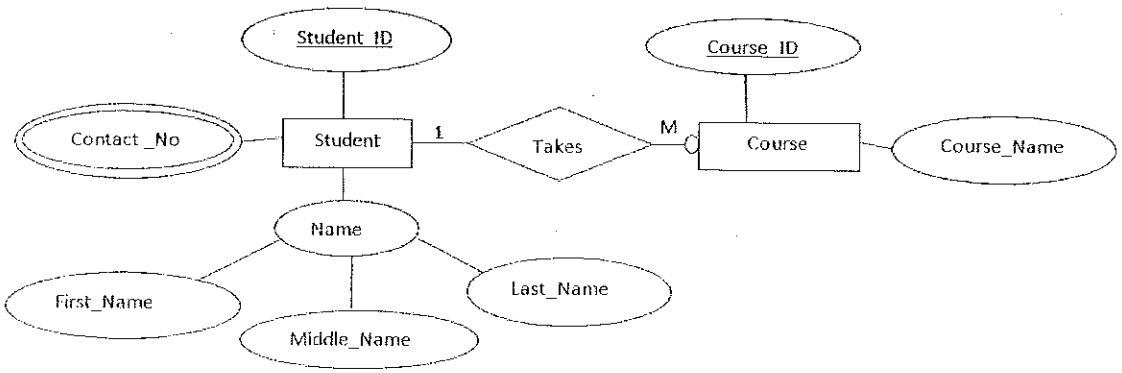
Department	: Computer Science
Level	: 3/4
Name of the Examination	: Final Examination
Course Code and Title	: CSU3301: Database Design & Implementation CSU4315: Database Management Systems
Academic Year	: 2020/2021
Date	: 12th March 2022
Time	: 1.30 pm – 3.30 pm

General Instructions:

1. Read all instructions carefully before answering the questions.
2. This questions paper consists of **06 questions** in **09 pages**.
3. Answer **FOUR (04)** questions only. All questions carry equal marks.
4. Answers for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary.
6. Involvement in any activity that is considered as an exam offense will lead to punishment.
7. Use blue or black ink to answer the questions.
8. Clearly state your index number in your answer script.

Question 1

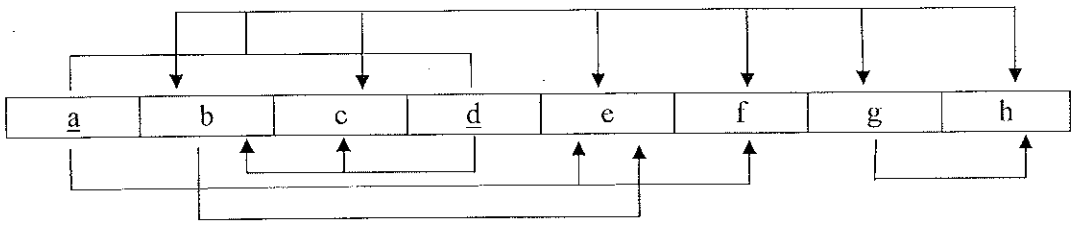
1) Briefly describe the difference between **Data** and **Information**.
2) What is a **Database**?
3) Briefly explain what is **Meta Data**.
4) What are the five types of users of a database system? Briefly describe the tasks of them.
5) What is **data redundancy**? Explain two issues cause due to uncontrolled data redundancy.
6) Briefly explain the following terms in the context of database systems.
   a) Composite Key
   b) Multi-valued attributes
   c) Composite attributes
   d) Ternary relationship
   e) Weak Entity
7) State whether the following statements are **true** or **false**. If only a statement is **false**, justify your answer.
   a) Fields qualified to be selected, but not selected as primary key are known as candidate keys.
   b) In the Network model, one child record can have only one parent.
   c) DML (Data Manipulation Language) is the language used for retrieving and storing data in a database.
   d) Conceptual model focuses on the logical nature of the data representation.
8) Draw the appropriate relational schema for the following ER diagram.



Question 2

1) What is Normalization in DBMS?

2) Consider the following diagram.



a) What is the Normal form that this table is currently in?

b) What is **Partial Dependency**? If there are any partial dependencies in the above diagram, identify and mark them.

c) What is **Transitive Dependency**? If there are any transitive dependencies in the above diagram, identify and mark them.

d) Normalize this table to conform to both Third Normal Form (3NF) and Boyce-Codd Normal Form (BCNF).
Clearly show the steps (1NF, 2NF, 3NF and BCNF) you follow and mark the primary keys.

3) Fill in the blanks with suitable words.

a) Database is a collection of ..... data.

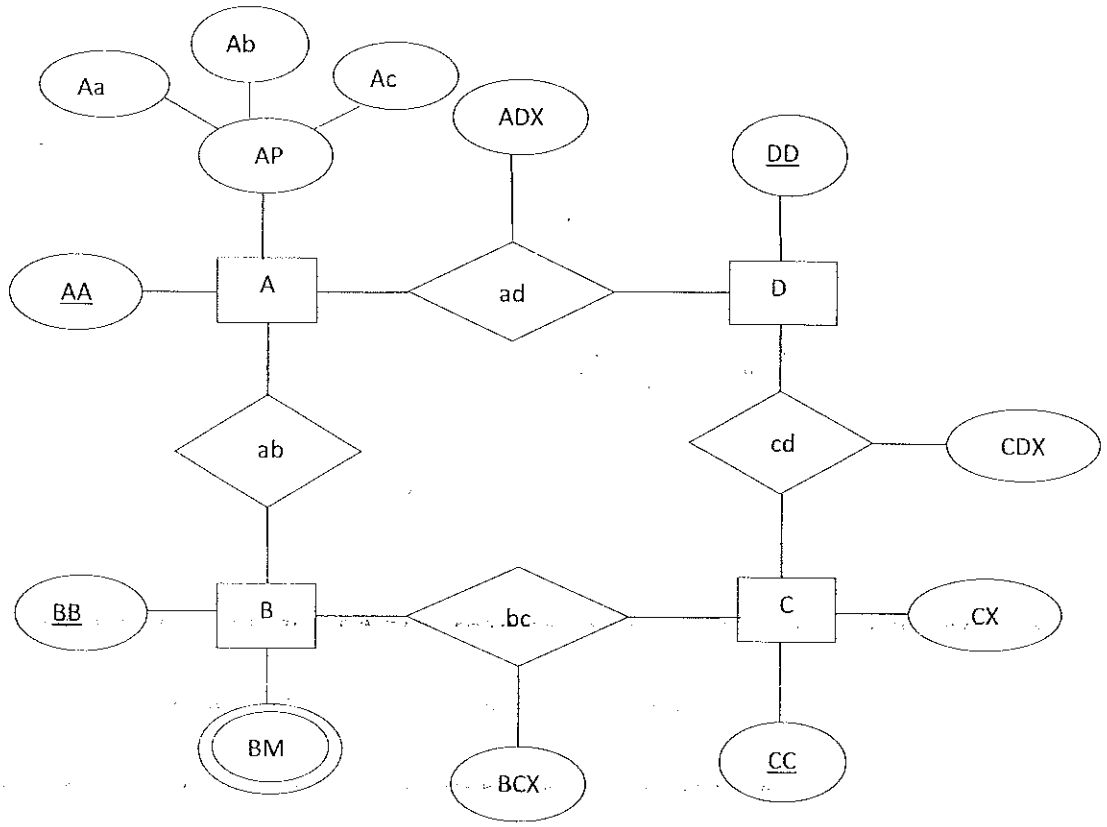
b) We call a database and the ..... together as a database system.

c) A DBMS that supports a database located at a single site is called as ..... DBMS.

d) A ..... is the language used to describe the content of the database.

e) A ..... relationship exists, when two entities are associated.

4) Draw the appropriate relational schema for the following ER diagram.



Question 03

1)

Medi-Care hospital situated in Nugegoda depends on a large number of persons for its continued success. This hospital wishes to construct a database for its operations. The requirements are given as follows:

- The hospital mainly depends on three groups of persons. They are employees, physicians and patients. All these persons have an identification number, name, address, birthdate and a phone number. In addition, employees have a hire_date, physicians have a specialty and patients have a contact date. Some persons in the hospital community do not belong to any of these groups. However, a particular person may belong to two or more of these groups at a given time.

- Each patient has only one physician responsible for that patient. At a given time, a physician may or may not be responsible for one or more patients. There are two groups of patients. They are in-patients and out-patients. Each in-patient has a date admitted. Each out-patient visits the hospital one or more time(s). For each visit, date and comments are recorded. An instance of a visit cannot exist without an out-patient.
- There are three groups of employees. They are nurses, staff and technicians. Qualification, job type and skills are recorded for each nurse, staff and technician respectively. Each nurse is assigned to one ward. For each ward the name (unique) and the location is recorded. A ward may have one or more nurses assigned to it. In addition, for each ward one of the nurses is appointed as a nurse in charge. A ward may have 10 or more beds. For each bed an identification number is recorded. The bed identification consists of the bed number and room number. Each in-patient is assigned to a bed. A bed may or may not have an in-patient assigned to it, at a given time.
- Each technician is assigned to one or more laboratories. A laboratory has a name (unique) and location. A laboratory must have at least one or more technicians assigned to it.

a) Identify the entities that could be used for the above requirements.

b) Identify suitable attributes and the primary key, if any, for each of the entities that you have identified. List one composite attribute.

c) Is/Are there any weak entity(s)? Justify your answer.

d) Identify a list of likely superclass/subclass relationship. Justify your answer.

e) Draw a suitable ER diagram for the above given requirements. State any assumptions you make.

2) Answer briefly the following questions.

a) Define prime and non-prime attributes.

b) What are the attribute values permitted by a 1NF relation?

c) A 1NF relation, which has a single attribute as a primary key, is automatically in 2NF. Give reasons for this statement.

d) Suppose R (A, B, C) is a relation, if C→ B what is the highest normal form of this relation?

e) Identify all candidate keys in the following relations.

a. R(A,C,B,D,E)

- A→ B
- C→ D

b. R(A,C,B,D)

- D→B
- C,B→A

Question 04

1)

The **Computer Science Association (CSA)** of the Open University has decided to produce music albums of their student musicians. CSA is planning to maintain a database in order to store the required information that they need. The following requirements have been identified by CSA.

The students who have talent in music are named as 'Student musician'. All student musicians are capable to sing songs. In addition, some of them play instruments and some of them act as a producer when albums are produced. For each student musician a unique identification number, name and address are recorded. For those who play instruments, their specialization and the duration that they play should be stored. For each instrument a unique identification number and the name (Ex: guitar, violin, flute etc.) are recorded. Each student musician may play several instruments, and a given instrument may be played by one student musician. A student musician who plays instruments may supervise a number of other such student musicians.

Each album recorded has a unique identification number, the title, copying date and a format (Ex: CD or MC). Each album has one student musician who acts as its producer. A student musician may produce several albums. Each album has a number of songs on it and a song may appear on one album.

For each song, a unique identification number, the title and the author are recorded. Each song is sung by one or more student musicians, and a student musician may sing a number of songs. The number of times that a song is sung should be recorded. Each song may have a number of melodies. For each melody, the tempo, timing and the key for that song (Eg. C major, D minor) are recorded. Different songs may have the same key.

a) Identify the entities that could be used for the above requirements.

b) Identify suitable attributes and the primary key, if any, for each of the entities that you have identified.

c) Is there a recursive relationship? Justify your answer

d) Is/Are there any weak entity(s)? Justify your answer.

e) Identify a list of likely superclass/subclass relationships. Justify your answer.

f) Draw a suitable ER diagram for the above given requirements. State any assumptions you make.

2) Consider the following database instances.

Employee

Emp_ID	Emp_Name	Emp_Age	Emp_Salary	Department_No
100	Kasun	34	45000	1
101	Amal	45	55000	1
102	Nuwan	39	48000	2
103	Sarala	28	60000	2
104	Avishka	31	75000	3

Department

Department_No	Department	Location
1	Sales	Nawala
2	HR	Colombo
3	Management	Nugegoda
4	IT	Maharagama

Write suitable SQL queries to do the following tasks.

1) Retrieve all employees' names, whose age is greater than or equal to 35.
2) Retrieve the maximum and the minimum salary from the employee table.
3) Get the details of the departments, which are either located in Colombo or Nugegoda.
4) Retrieve all employees, whose name has character **'a'** as the second letter.
5) For each department, list the average salary, which are greater than the average salary of the Department No 2.

Question 05

A

Course_ID	CName
CS1224	C#
MA2561	Management Practice
ST1212	Operational Research
CS2134	Java
BT1331	Business Techniques

B

Course_ID
CS1224
CS2134

C

Lecturer	Course_Name
Ms.Geetha	Java
Mr.Kasun	C#
Mr.Sham	Management Practice
Ms. Thushari	Business Techniques
Ms.Ishara	Operational Research

D

Course_ID	Course_Name
ST1212	Operational Research
CS5221	Computer Architecture
BT1331	Business Techniques
MM2121	Mathematics for ICT
MT2141	Industrial training

E

Student_ID	Student_Name	Address
S1001	Mala	Kandy
S1002	Yamuna	Galle
S1003	Kamala	Badulla
S1004	Chathura	Colombo
S1005	Manula	Matara
S1006	Nimali	Anuradhapura
S1007	Pradeep	Matara
S1008	Chethana	Horana

1) What are the output tables you get, when you apply the following relational database operators to the above tables (A, B, C, D and E are table names)?

   a) A DIVIDE B

   b) C DIFFERENCE D

   c) C INTERSECT D

   d) E PRODUCT C

2) Write suitable SQL queries to do the following tasks.

   a) Select the **Course_Name** and the character length of the **Course_Name** from table **C**.

   b) Find the address of the student in table **E** starting with the letter "K".

   c) Retrieve the student names, who live in Colombo.

   d) Who is the lecturer of the Java Module?

   e) Find the number of records in table **E**