Sri Lanka Institute of Information Technology

B. Sc. Special Honours Degree/ Diploma in Information Technology

Final Examination
Year 1, Semester 2 (2015)

IT103 - Database Management Systems I

Duration: 3 hours

October 2015

Please read the following information prior to beginning work on this exam:

Instructions to Candidates:

♦ Answer all questions.

♦ The paper consists of 8 pages including the cover page.

♦ There are 6 questions. Answer ALL questions clearly and to the point. Make sure the answers are neatly written, readable and clear.

Question 1 (20 marks)

PART A

'Safe Journey' is a transport system which provides public transportation. You are recruited as a Database designer to model their transport application. Your first task is to design a database according to the requirements given below.

The organization needs to store information about drivers, buses, bus-stops (identified by name and routes. Drivers are identified by Empid and described by name, birthday and LicenseNo as attributes. Buses are identified by RegistrationNo and described by make, model, features and capacity. A bus may also have many features (e.g. air-conditioned, disabled access, video screens, etc.). Driver are assigned for buses by considering their availability. A bus-stop (normally abbreviated to simply stop) is a defined place where a bus may stop to pick up or set down passengers. A route describes a sequence of one or more stops that a bus will follow. Bus-stop is identified by name and described by location and type as attributes. Each route is identified by a Route number and has a direction and duration. For each stop on a route, we note how long it should take to reach that stop from the first stop. The time to reach the first stop on a route is zero stops may be used on several routes; some stops may not (currently) be used on any route. A schedule specifies an instance of a route (e.g. the 372 departing Circular Quay at 10:05am) and schedules are used to produce the timetables displayed on bus-stops.

After talking to the different divisions of the 'Safe Journey' organization, it was revealed that the maintenance engineer needs a report on buses, their facilities and service details. The HR department wants to get the personal and salary details of all the drivers. The operational department needs to track the schedule information along with the respective routes and buses. The IT manager of the organization has indicated that he wishes the files to be indexed by bus registration number and route number. He is very much concerned about the design, security, integrity and the performance of the data base. He also requires the passwords to access the database to be changed every 6 weeks and also states that any query should not take more than 30 seconds.

28/08/2015

Read the scenario given above and provide answers to the following questions.

 a) Suggest a suitable candidate key for the driver table. (1 mark)

 b) Identify multivalued attributes if any. (1 mark)

 c) Write the schema for the Bus table. (2 marks)

 d) What is the degree of the Bus table? (1 mark)

 e) Show an instance of the Bus table. (2 marks)

 f) What is the cardinality between Route and Bus-Stop in the passes relationship? (2 marks)

 g) Identify 3 different users of the company database system. List 3 different external schemas for these users. (3 marks)

 h) Identify the information that can be used in the physical schema. (2 marks)

 i) Identify and categorize 2 database administration tasks recognized in requirement analysis. (2 marks)

PART B

Few records of the STUDENT table is given below. The primary key of the table is Student-id.

STUDENT				
STUDENT_ID	STUDENT_NAME	CLASS_ID	CLASS_TITLE	FEE
562321124	Anna Edri	IST-005	PROGRAMMING METHODS	$275.00
769017832	Kathy Browns	IST-250	ADVANCED COMPUTER PROCESSING	$295.00
989832423	David Simson	OST-223	DATA PROCESSING	$265.00
908769987	Tammy Green	IST-189	BASIC COMPUTER PROCESSING	$245.00
179077643	Edward Balan	IST-220	BASIC PROGRAMMING	$205.00

 a) Identify 2 different anomalies associate in this table. (1 mark)

 b) The student 'David Simson' drops the course and leave the institute. The table needs to be updated accordingly by deleting the 'David Simson' record in the table.

   i. Does any other information get lost by deleting the last record? (0.5 marks)

   ii. If so, what type of an anomaly is created? (1 mark)

 c) The institute introduces a new course 'Database Management Systems'.

   i. Can the data be added to the table? (0.5 marks)

   ii. If not explain the reason by referring to the anomaly created. (1 mark)

28/08/2015

Question 2 (15 marks)

Map the ER diagram given below to a relation schema.

28/08/2015
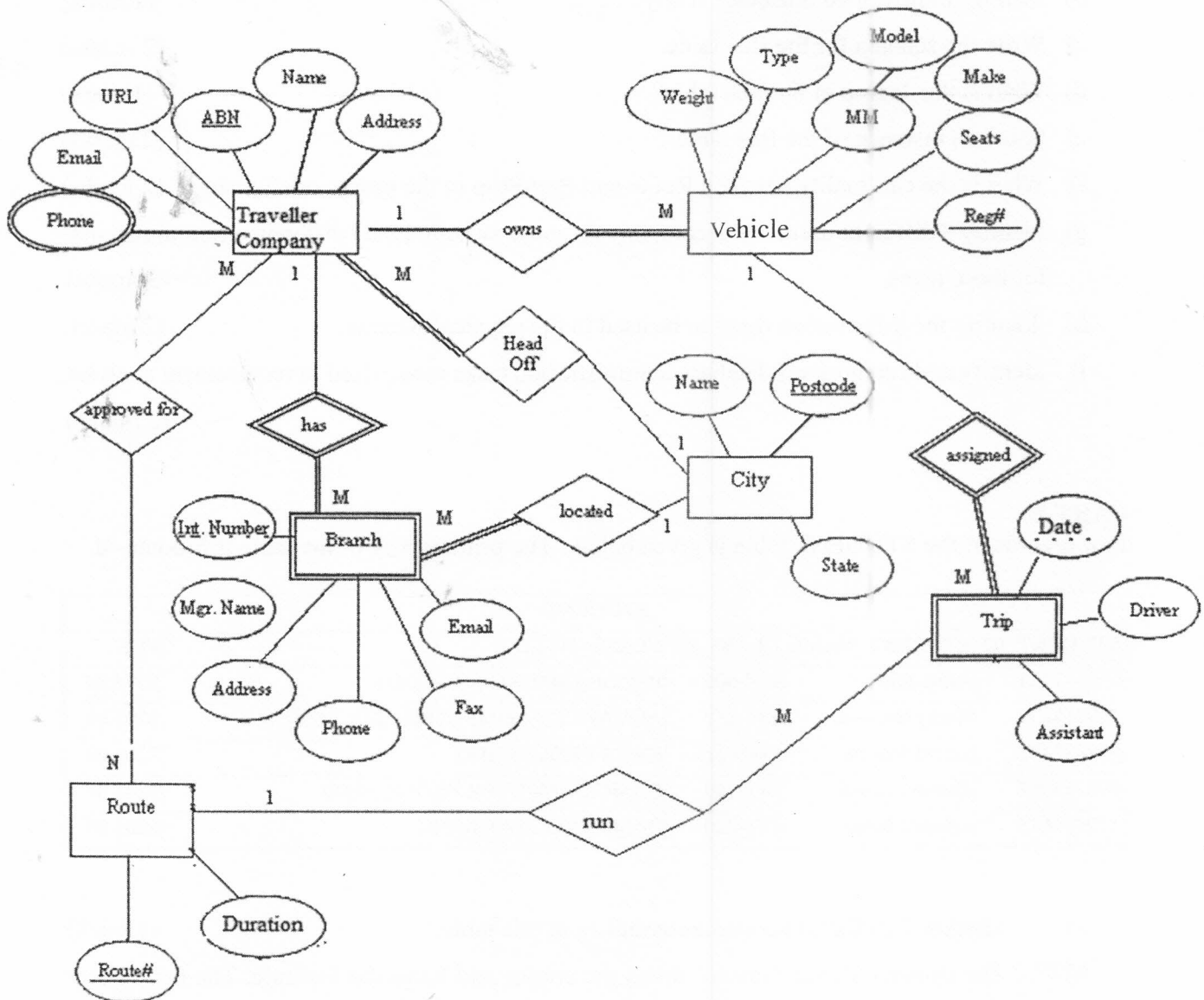
Question 3   **(15 marks)**

Draw the ER diagram to model the following real world situation. Your diagram should show entities, relationships along with the cardinality and suitable attributes including the primary keys.

Easy-Buy is a leading company dealing with online sales. The details of their operations are listed below.
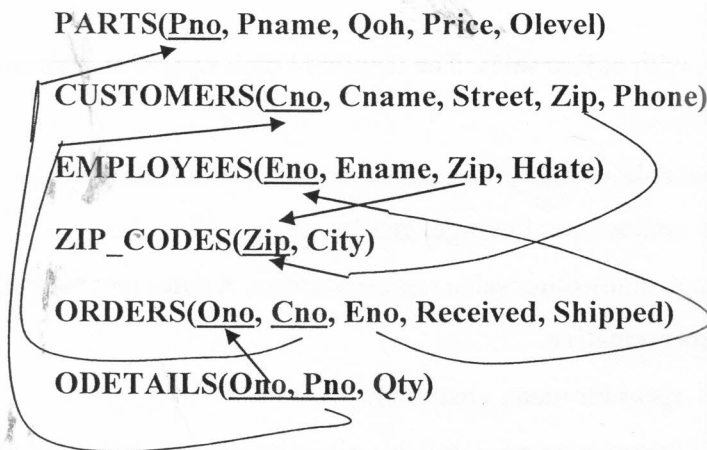
- Sales representatives play major role in this organization and they are identified by the SalesID and described by name, contact number, age, gender and e-mail address.
- A sales representative may manage many other sales representatives. A sales representative is managed by only one sales representative.
- A sales representative can be an agent for many customers.
- Customers are identified by the Customer number and described by name, contact number, address, e-mail and gender.
- A customer is managed by one sales representative.
- A customer can place many orders.
- An order has order ID and date.
- Orders can be delivered according to the customer request and the system keep track about the delivery information.
- The delivery information are described by the rider name, destination and delivery charges.
- An order lists many inventory items.
- An item is described by the itemNumber, item name, quantity and price.
- An inventory item may be listed on many orders.
- An inventory item is assembled from many parts.
- Parts are described by partNumber, name, size and type.
- A part may be assembled into many inventory items.
- Supplier supply many parts.
- Suppliers are described by SupplierID , name, contact number , address and rating.
- A part may be supplied by many suppliers.

State the assumptions you made during your design phase.

Question 4   **(15 marks)**

Consider the following MAILORDER relational schema describing the data for a mail order company.

        PARTS(Pno, Pname, Qoh, Price, Olevel)

        CUSTOMERS(Cno, Cname, Street, Zip, Phone)

        EMPLOYEES(Eno, Ename, Zip, Hdate)

        ZIP_CODES(Zip, City)

        ORDERS(Ono, Cno, Eno, Received, Shipped)

        ODETAILS(Ono, Pno, Qty)

Qoh stands for quantity on hand and the other attribute names are self-explanatory.

Write the following queries using the **Relational Algebra** on the MAILORDER database schema.

   a) Retrieve the names of parts that price less than $20.00.   **(2 marks)**

   b) Retrieve the names of customers who have ordered parts costing less than $20.00.

                                                                      (3 marks)

   c) Retrieve the names and cities of employees who have taken orders for parts costing more than $50.00.   **(3 marks)**

   d) Retrieve the names of customers who have not placed an order.   **(3 marks)**

   e) Retrieve the names of customers who have placed exactly two orders.   **(4 marks)**

(Fundamentals of Database Systems by Elmasri & Navathe)

Question 5 (15 marks)

The table below shows the different roles played by each employee towards various company projects.

Emp_Proj

EID	PNO	Employee Name	Project Name	Start Date	Role	Hours	Rate
E01	P1	John Smith	Alfa Sky	02.04.15	Engineer ,Coordinator	20	200,000
E02	P1	Keny Brown	Alfa Sky	02.04.15	Manager	5	50,000
E01	P2	John Smith	Energy Hub	06.07.15	Engineer	5	50,000
E04	P2	Alfred Joe	Energy Hub	06.07.15	Manger , Business analyst	15	150,000

Emp_Proj table Primary Key :- (EID, PNO)

The Functional Dependencies are:

EID → Employee_Name

PNO → Project_Name , Start_Date

Hours → Rate

Answer the following questions using the table and functional dependencies given above.

a) Which normal form is the relation in? Explain your answer. (2 marks)

b) Decompose the relation into 3NF. For each step of the decomposition procedure, state what functional dependency is based on, and give the relational schemas after the step has been carried out. (13 marks)

28/08/2015

Consider the following relational schemas of 'Gold' Supermarket database. Primary keys are underlined.

Customers (SSN: integer, name: string, address: string, city: string)

Accounts (AccntNo: integer, SSN: integer, balance: real)

Orders (AccntNo: integer, ProductId: integer, date: string, quantity: integer, amount: real)

Products (ProductId: integer, ProductName: string, cost: real)

Write **SQL statements** to answer the following questions.

a) Write a DDL statement to create the Orders table. (3 marks)

b) Retrieve the names of all customers living in 'Malabe' and whose names are starting with letter 'A'. (2 marks)

c) Make a list of Account Numbers (AccntNo) and the customers' names who have account balance above 5,000. (3 marks)

d) Display a list of products ordered by each customer. Print customer SSN, name and the number of products ordered in descending order of the number of products. (4 marks)

e) Retrieve the Names of the customers who have ordered more than 4 products. (5 marks)

f) Display the name and cost of all products which costs more than the cost of "Milky Way" products. (i.e., 'Milky Way.' is a ProductName). (3 marks)

*** End of Exam Paper ***