UNIVERSITY OF GHANA

BACHELOR SCIENCE IN ENGINEERING

SECOND SEMESTER EXAMINATIONS: 2015/2016

DEPARTMENT OF COMPUTER ENGINEERING

CPEN 102: INTRODUCTION TO DATABASE SYSTEMS (3 CREDITS)

INSTRUCTIONS:
ANSWER ALL QUESTIONS

TIME ALLOWED: THREE (3) HOURS

1.

a. Give a brief definition of each of the following terms:
(i) Multivalued attribute
(ii) Derived attribute
(iii) Weak relationship
(iv) Disjoint subtypes
(v) Overlapping subtypes

[10 marks]

b. What is a Database Management System (DBMS)? List two advantages and two disadvantages in using DBMS.

[6 marks]

c. List four advantages and two disadvantages of Distributed Database Management System (DDBMS). **[6 marks]**

d. List and explain any three transparency features of a DDBMS.

[3 marks]

2.

Analyse the business rule of Royal Engineering Incorporated carefully and use it to answer the provided questions.

The Royal Engineering Incorporated, is an engineering firm with approximately 500 employees. A database is required to keep track of all employees, their skills, projects assigned, and departments worked in. Every employee has a unique number assigned by the firm, required to store his or her name and date of birth. If an employee is currently married to another employee of Royal Engineering, the date of marriage and who is married to whom must be stored. Each employee is given a job title (for example, engineer, secretary, and so on). An employee does only one type of job at any given time, and we only need to retain information for an employee's current job.

The firm has a number of different departments, each with unique name. An employee can report to only one department. Each department has a phone number. To produce various kinds of equipment, each department deals with many vendors. A vendor typically supplies equipment to many departments. We are required to store the name and address of each vendor and the date of the last meeting between a department and a vendor.

Many employees can work on a project. An employee can work on many projects. (For example, Massey Refinery, Hamilton Petrochemicals, and so on) but can only be assigned to at most one project in a given period of time. An employee can have many skills (preparing material requisition, checking drawings, and so on), but she or he may use only a given set of skills on a particular project. (For example, an employee KENNETH may prepare requisition for Massey Refinery project and prepare requisition as well as check drawings for Hamilton Petrochemicals.) Employees use each skill that they possess in at least one project. Each skill is assigned a number, and we must store a short description of each skill. Projects are distinguished by project numbers, and we must store the estimated cost of each project.

a. Based upon the provided information, draw an Entity-Relationship (ER) Diagram using the Crow's foot model symbols and include all attributes.

[8 marks]

b. In the ER diagram:
(i) Identify the main relationship types (connectivity) between the entities.
(ii) Determine the multiplicity constraints (cardinality) for each relationship.

[4 marks]

c. Determine primary key and foreign key attributes for each entity.

[4 marks]

d. Resolve all many-to-many relationships into one-to-many relationships.

[4 marks]

e. Using SQL statements, create a table for the EMPLOYEE entity. Specify all constraints, if any.

[5 marks]

3.

a. Explain briefly why a table whose primary key consists of a single attribute automatically is in the 2NF when it is in the 1NF.

[2 marks]

b. Table 1 shows the details of some rooms leased by students of the University flats. A place number (placeNo) uniquely identifies each single room in all the flats and is used when leasing a room to student.

Table 1:

leaseNo	bannerId	placeNo	fName	lName	startDate	finishDate	flatNo	flatAddress
10003	B017706	78	Jane	Watt	1/09/2010	30/06/2011	F56	34 High Stree, Paisley
10003	B012124	79	Karen	Black	1/09/2010	30/06/2011	F56	34 High Stree, Paisley
10259	B017706	88	Jane	Watt	1/09/2011	30/06/2012	F78	111 Storrie Road, Paisley
10364	B013399	89	Tom	Jones	1/09/2011	30/06/2012	F78	111 Storrie Road, Paisley
10566	B012124	102	Karen	Black	1/09/2011	30/06/2012	F79	120 Lady Lane, Paisley
11067	B034511	88	Steven	Smith	1/09/2012	30/06/2013	F78	111 Storrie Road, Paisley
11169	B013399	78	Tom	Jones	1/09/2012	30/06/2013	F56	34 High Stree, Paisley

(i) The table shown above is susceptible to update anomalies. Provide examples of how insertion, deletion, and modification anomalies could occur on this table.

(ii) Identify the functional dependencies that exist between the columns of the table and primary key (PK) and any alternative key(s) (if present for the table).

(iii) Using the functional dependencies identified in *3.b.(ii)*, convert the table to 3NF. In each of the **derived tables** in (3NF) indicate the primary keys and the foreign keys.
[Note: Show tables with values]

[18 marks]

c. List and briefly discuss the five transaction properties.

[5 marks]

4.

a. TinyVideo is a small movie rental company with a single store. TinyVideo needs a database system to track the rental of movies to its members. TinyVideo can own several copies (VIDEO) of each movie (MOVIE). For example, the store may have 10 copies of the movie "Twist in the Wind". "Twist in the Wind" would be one MOVIE and each copy would be a VIDEO. A rental transaction (RENTAL) involves one or more videos being rented to a member (MEMBERSHIP). A video can be rented many times over its lifetime, therefore, there is a M:N relationship between RENTAL and VIDEO. DETAILRENTAL is the bridge table to resolve this relationship.
The complete ERD and populated tables are provided in Figure 1.

Write the SQL statements for the following scenarios:

(i) A single SQL command to increase all price rent fee values by $0.50.

(ii) A query to display the movie number, movie title, and price code for all movies with a title that starts with the letter "R".

(iii) A query to display the movie number, movie title, movie cost, and movie genre for all movies that are either action or comedy movies and that have a cost that is less than $50. Sort the results in ascending order by genre.

(iv) A query to display the movie genre and average cost of movies in each genre.

(v) A query to display the movie title, movie year, price description, and price rental fee for all movies that are in the genres Family, Comedy, or Drama.

[20 marks]

b. Explain briefly all the phases of the Database Development Life Cycle.

[5 marks]

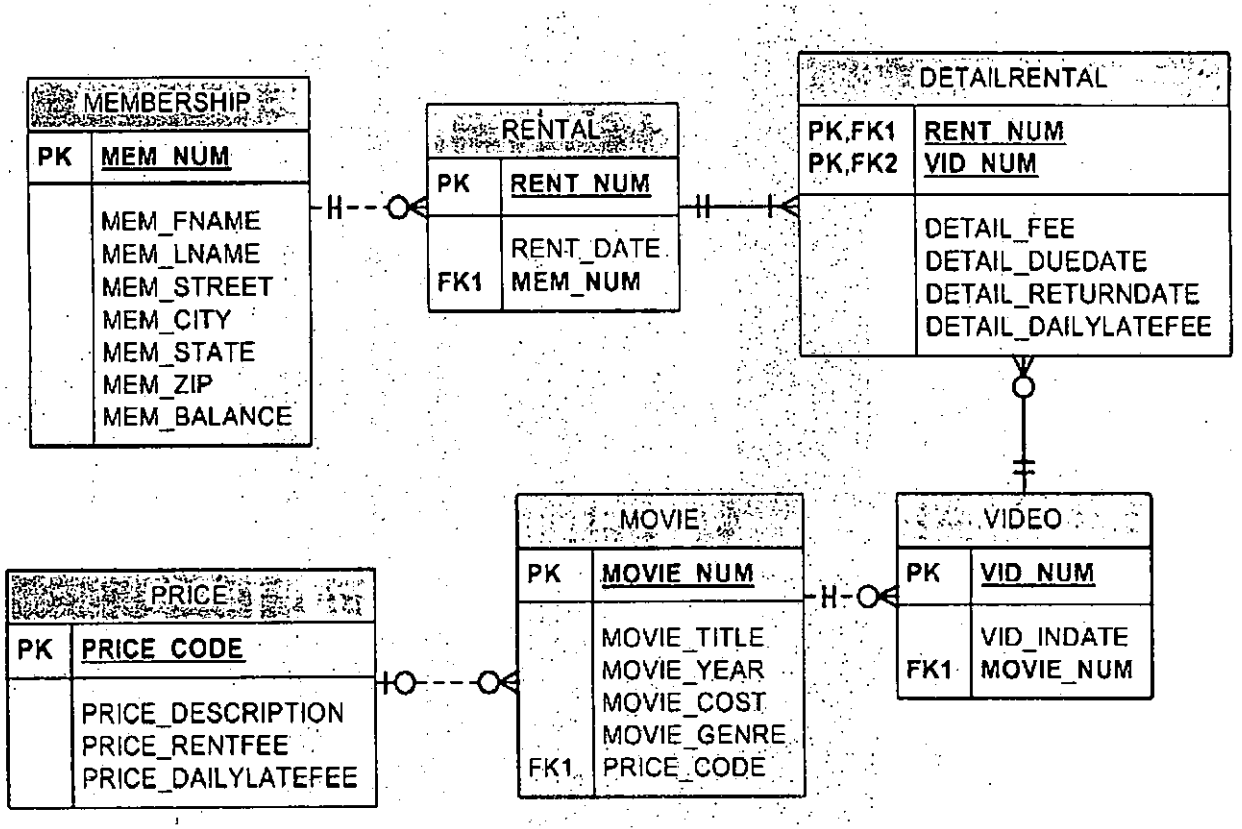
MEMBERSHIP
PK MEM_NUM
MEM_FNAME
MEM_LNAME
MEM_STREET
MEM_CITY
MEM_STATE
MEM_ZIP
MEM_BALANCE
RENTAL
PK RENT_NUM
RENT_DATE
FK1 MEM_NUM
DETAILRENTAL
PK,FK1 RENT_NUM
PK,FK2 VID_NUM
DETAIL_FEE
DETAIL_DUEDATE
DETAIL_RETURNDATE
DETAIL_DAILYLATEFEE
MOVIE
PK MOVIE_NUM
MOVIE_TITLE
MOVIE_YEAR
MOVIE_COST
MOVIE_GENRE
FK1 PRICE_CODE
VIDEO
PK VID_NUM
VID_INDATE
FK1 MOVIE_NUM
PRICE
PK PRICE_CODE
PRICE_DESCRIPTION
PRICE_RENTFEE
PRICE_DAILYLATEFEE

Figure 1.