Sample questions

1. a) State the requirement for referential integrity constraint. Write down a formal definition of foreign key. (2 + 3)

(b) Consider the following relations for a database that keeps track of student enrollment in courses and the books adopted for each course:

STUDENT(Ssn, Name, Major, Bdate)

COURSE(CourseId, Cname, Dept)

ENROLL(Ssn, CourseId, Quarter, Grade)

BOOK_ADOPTION(CourseId, Quarter, Book_isbn)

TEXT(Book_isbn, Book_title, Publisher, Author)

Specify the foreign keys for this schema. (5)

2. (a) Distinguish between model-based constraint, schema-based constraint and application-based constraint, citing an example of each type of constraint. (6)

(b) Every key is a super key but every super key is not a key – Justify. A part of a key cannot be a key – Justify. (4)

3. Consider a CONFERENCE_REVIEW database in which researchers submit their research papers for consideration. Reviews by reviewers are recorded for use in the paper selection process. The database system caters primarily to reviewers who record answers to evaluation questions for each paper they review and make recommendations regarding whether to accept or reject the paper. The data requirements are summarized as follows:

Authors of papers are uniquely identified by e-mail id. First and last names are also recorded. Each paper is assigned a unique identifier by the system and is described by a title, abstract, and the name of the electronic file containing the paper. A paper may have multiple authors, but one of the authors is designated as the contact author. Reviewers of papers are uniquely identified by e-mail address. Each reviewer's first name, last name, phone number, affiliation, and topics of interest are also recorded. Each paper is assigned between two and four reviewers. A reviewer rates each paper assigned to him or her on a scale of 1 to 10 in four categories: technical merit, readability, originality, and relevance to the conference. Finally, each reviewer provides an overall recommendation regarding each paper. Each review contains two types of written comments: one to be seen by the review committee only and the other as feedback to the author(s).

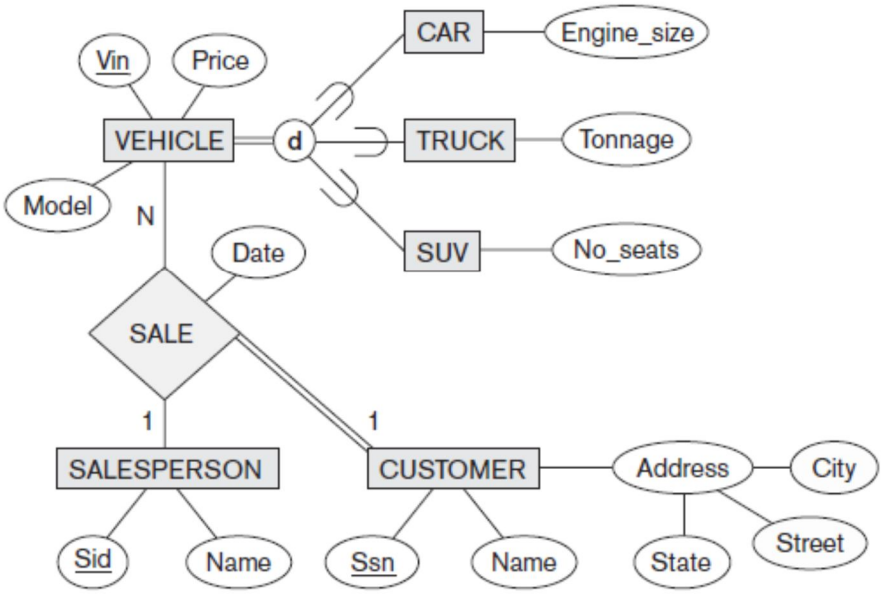
Design an entity-relationship diagram for the above data requirements. Indicate key constraints, cardinality constraints and participation constraints on the diagram. (10)

4. Notown Records has decided to store information about musicians who perform on its albums (as well as other company data) in a database. The following are the data requirements:

Each musician that records at Notown has a social security number (SSN), a name, an address, and a phone number. Poorly paid musicians often share the same address, and no address has more than one phone. Each instrument used in songs recorded at Notown has a unique identification number, a name (e.g., guitar, synthesizer, flute) and a musical key (e.g., C, B-flat, E-flat). Each album recorded on the Notown label has a unique identification number, a title, a copyright date, a format (e.g., CD or MC), and an album identifier. Each song recorded at Notown has a title and an author. Each musician may play several instruments, and a given instrument may be played by several musicians. Each album has a number of songs on it, but no song may appear on more than one album. Each song is performed by one or more musicians, and a musician may perform a number of songs. Each album has exactly one musician who acts as its producer. A musician may produce several albums.

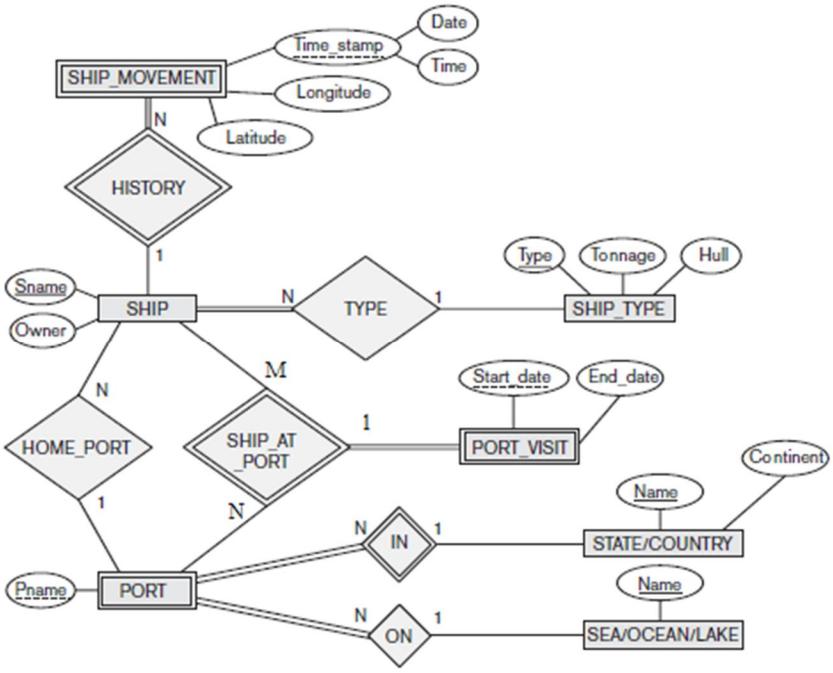
Design an entity-relationship diagram for the above data requirements. Indicate key constraints, cardinality constraints and participation constraints on the diagram. (10)

5. (a) Convert the following enhanced entity-relationship diagram into a relational database schema and indicate primary key and foreign key. (6)



(b) Explain the concept of attribute defined specialization, predicate defined specialization and user defined specialization. (4)

6. (a) Convert the following entity-relationship diagram into a relational database schema and indicate primary key and foreign key. (6)



(b) Explain the concept of specialization and generalization in extended entity-relationship model with the help of suitable example. (4)

7. Consider an ONLINE_AUCTION database system in which members (buyers and sellers) participate in the sale of items. The data requirements for this system are summarized as follows:

The online site has members, each of whom is identified by a unique member number and is described by an e-mail address, name, password, home address, and phone number. A member may be a buyer or a seller. A buyer has a shipping address recorded in the database. A seller has a bank account number and routing number recorded in the database. Items are placed by a seller for sale and are identified by a unique item number assigned by the system. Items are also described by an item title, a description, starting bid price, bidding increment, the start date of the auction, and the end date of the auction. Buyers make bids for items they are interested in. Bid price and time of bid is recorded. The bidder at the end of the auction with the highest bid price is declared the winner and a transaction between buyer and seller may then proceed. The buyer and seller may record feedback regarding their completed transactions. Feedback contains a rating of the other party participating in the transaction (1–10) and a comment.

Design an Enhanced Entity-Relationship diagram for the ONLINE_AUCTION database. Indicate the necessary constraints on the diagram. (10)

8. The following narrative describes a simplified version of the organization of Olympic facilities planned for the summer Olympics. Draw an Enhanced Entity Relationship diagram that shows the entity types, attributes, relationships, and specializations for this application.

The Olympic facilities are divided into sports complexes. Sports complexes are divided into *onesport* and *multisport* types. Multisport complexes have areas of the complex designated for each sport with a location indicator (e.g., center, NE corner, and so on). A complex has a location, chief organizing individual, total occupied area, and so on. Each complex holds a series of events (e.g., the track stadium may hold many different races). For each event there is a planned date, duration, number of participants, number of officials, and so on. A roster of all officials will be maintained together with the list of events each official will be involved in. Different equipment is needed for the events (e.g., goal posts, poles, parallel bars) as well as for maintenance. The two types of facilities (one-sport and multisport) will have different types of information. For each type, the number of facilities needed is kept, together with an approximate budget. (10)

9. Consider the following relations containing airline flight information:

FLIGHT(Flno, From, To, Distance, Departs, Arrives)

AIRCRAFT(Aid, Aname, Cruising_range)

CERTIFIED(Eid, Aid)

EMPLOYEE(Eid, Ename, Salary)

The cruising range is the maximum distance that an aircraft can travel at the maximum speed without stopping. Write down the following queries in relational algebra.

(a) Find the name of pilots certified for some Boeing aircraft. (2)

(b) Identify the flights that can be piloted by pilot whose salary is more than $100,000. (3)

(c) Find the name of pilots who can operate planes with a cruising range greater than 3,000 miles but are not certified on any Boeing aircraft. (3)

(d) Find the Aids of aircraft that can be used on non-stop flights from Bonn to Chennai. (2)

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

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

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

EMPLOYEE(Eno, Ename, Zip, Hdate)

ZIP_CODE(Zip, City)

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

ODETAIL(Ono, Pno, Qty)

Qoh stands for *quantity on hand*: the other attribute names are self-explanatory. Specify the following queries in *relational algebra* on the MAILORDER database schema.

(a) Retrieve the name and city of employees who have taken orders for parts costing more than $50.00. (3)

(b) Retrieve the pairs of customer number values of customers who live in the same ZIP Code. (3)

(c) Retrieve the name of customers who have ordered parts from employees living in Wichita. (2)

(d) Retrieve the name and city of customers who have not placed an order. (2)

11. Consider the following relational database schema. The primary keys are underlined. The foreign keys are self-explanatory.

CUSTOMER(Cus_id, Name, Address, Credit_limit)

ORDER(Order_id, Cus_id, Status, Order_date)

INVOICE(Invoice_id, Order_id, Inv_Date, Inv_amount)

(a) Write down the SQL statements for creating the above tables with necessary primary key and foreign key. Ensure that the order status (Status column in ORDER table) can have only one of the three values – Order placed, Order shipped and Out for delivery. (4)

(b) Write down an SQL statement to display name and address of customers with order status Out for delivery. (2)

(c) Write down an SQL statement to display name of customer who live in Chennai. (2)

(d) Write down an SQL statement to display invoice amount and invoice date for customers with credit limit higher than Rs.10,000/-. (2)

12. Consider the following relational database schema. The primary keys are underlined. The foreign keys are self-explanatory.

WAREHOUSE(Warehouse_id, Warehouse_name, Weekly_closing_day, Location_id)

LOCATION(Location_id, Address, Contact_no, Country_code)

COUNTRY(Country_code, Country_name)

(a) Write down SQL statements for creating the above tables with necessary primary key and foreign key. *Ensure* that contact number starts with a + symbol (4)

(b) Write down an SQL statement to display the name of country and the name of warehouses that remain closed on Wednesdays. (2)

(c) Write down an SQL statement to display the name of warehouses and its location address in alphabetic order of the name of warehouses. (2)

(d) Write down an SQL statement to display the name of country with at least four warehouses. (2)