1. Consider the following set of requirements for a database that is used to manage the borrowing and returning of books in a library.

a) Books in the library have many types (historical, political, economic, literary, technical, etc.) and have the attributes of type code, type name. Each book has a title and needs to be known by which author.

b) Author information includes: author code, author name, and year of birth. An author can write many books, and a book can be written by many authors.

c) A book can have multiple editions. Information about an edition including: edition, year, paper size, number of pages, publisher, price, with or without CD. The editions are numbered 1, 2, 3,... for each title, so there is an overlap of titles between different books.

d) Information about the reader includes: reader's card number, date of issue, reader's name, occupation, gender.

e) Readers can borrow many books at a time, where the information to be saved is the date of borrowing and the date of return for each book.

2. Consider the following set of requirements for a database that is used to keep track information about a real-estate company.

a) The company has many offices located in many cities. Information about each office is number (No.) and location.

b) Each office has one or more employees. Employees have employee code, name, date of birth, address, and each employee only works at one office.

c) An office always has an office manager. The head of the office must be one of the employees working in that office.

d) The company needs to keep a real-estate listing. The real-estate information required is the real-estate code and location. Real-estate location includes number (No.), type of real estate (house, land), street name, city. Each real estate only stores information at one office and has one or more owners.

e) Information about the owner includes code, name, address, phone number. A person can own many real estate. Percentage information is required in the case of joint ownership.

3. Consider the following set of requirements for a database that is used to keep track of students' transcripts.

a) The university keeps track of each student's name, student number, social security number, current address and phone number, permanent address and phone number, birth date, sex, class (freshman, sophomore, ..., graduate), major department, minor department (if any), and degree program (B.A., B.S., ..., Ph.D.). Some user applications need to refer to the city, state, and ZIP Code of the student's permanent address and to the student's last name. Both social security number and student number have unique values for each student.

b) Each department is described by a name, department code, office number, office phone number, and college. Both name and code have unique values for each department.

c) Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of the course number is unique for each course.

d) Each section has an instructor, semester, year, course, and section number. The section number distinguishes sections of the same course that are taught during the same semester/year; its values are 1, 2, 3, ..., up to the number of sections taught during each semester.

e) A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3, or 4).

4. Consider the following set of requirements for a database that is used to manage employees of a software company.

a) Employee information includes employee code, name, date of birth, address, gender, salary level. In addition, each employee is directly managed by another employee and must work in a department.

b) Information about the department includes department code, name, manager, and date of acceptance. Each department is located in a location and participates in leading a number of projects.

c) Information about the project includes project code, name, budget, start date, implementation time (estimated) and location of the project. Each project has multiple employees involved, and an employee can be involved in multiple projects.

d) Information about each employee's participation in the project, including position (project manager, analyst, designer, team leader, coder, program tester), date of participation and duration of participation. Employees participating in the project will receive additional allowances.

5. Consider the following set of requirements for a company's database that is used to store information about musicians who perform on its albums (as well as other company data) in a database.

a) Each musician that records at the company has an 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.

b) Each instrument used in songs recorded at the company has a unique identification number, a name (e.g., guitar, synthesizer, flute) and a musical key (e.g., C, B-flat, E-flat).

c) Each album recorded on the company label has a unique identification number, a title, a copyright date, a format (e.g., CD or MC), and an album identifier.

d) Each song recorded at the company has a title and an author.

e) Each musician may play several instruments, and a given instrument may be played by several musicians.

f) Each album has a number of songs on it, but no song may appear on more than one album.

g) Each song is performed by one or more musicians, and a musician may perform a number of songs.

h) Each album has exactly one musician who acts as its producer. A musician may produce several albums, of course.

6. Consider the following set of requirements for a database that is used to store information about all the airplanes stationed and maintained at a airport.

a) Every airplane has a registration number, and each airplane is of a specific model.

b) The airport accommodates a number of airplane models, and each model is identified by a model number (e.g., DC-10) and has a capacity and a weight.

c) A number of technicians work at the airport. You need to store the name, SSN, address, phone number, and salary of each technician.

d) Each technician is an expert on one or more plane model(s), and his or her expertiss may overlap with that of other technicians. This information about technicians must also be recorded.

e) Traffic controllers must have an annual medical examination. For each traffic controller, you must store the date of the most recent exam.

f) All airport employees (including technicians) belong to a union. You must store the union membership number of each employee. You can assume that each employee is uniquely identified by a social security number.

g) The airport has a number of tests that are used periodically to ensure that airplanes are still airworthy. Each test has a Federal Aviation Administration (FAA) test number, a name, and a maximum possible score.

h) The FAA requires the airport to keep track of each time a given airplane is tested by a given technician using a given test. For each testing event, the information needed is the date, the number of hours the technician spent doing the test, and the score the airplane received on the test.

7. Consider the following set of requirements for a database of a prescription chain of pharmacies to assist its pharmacies in administering drug sales.

a) Patients are identified by an SSN, and their names, addresses, and ages must be recorded.

b) Doctors are identified by an SSN. For each doctor, the name, specialty, and years of experience must be recorded.

c) Each pharmaceutical company is identified by name and has a phone number.

d) For each drug, the trade name and formula must be recorded. Each drug is sold by a given pharmaceutical company, and the trade name identifies a drug uniquely from among the products of that company. If a pharmaceuticai company is deleted, you need not keep track of its products any longer.

e) Each pharmacy has a name, address, and phone number.

f) Every patient has a primary physician. Every doctor has at least one patient.

g) Each pharmacy sells several drugs and has a price for each. A drug could be sold at several pharmacies, and the price could vary from one pharmacy to another.

h) Doctors prescribe drugs for patients. A doctor could prescribe one or more drugs for several patients, and a patient could obtain prescriptions from several doctors.

i) Each prescription has a date and a quantity associated with it. You can assume that, if a doctor prescribes the same drug for the same patient more than once, only the last such prescription needs to be stored.

j) Pharmaceutical companies have long-term contracts with pharmacies. A pharmaceutical company can contract with several pharmacies, and a pharmacy can contract with several pharmaceutical companies. For each contract, you have to store a start date, an end date, and the text of the contract.

k) Pharmacies appoint a supervisor for each contract. There must always be a supervisor for each contract, but the contract supervisor can change over the lifetime of the contract.

8. Consider the following set of requirements for a database that is used to store all the information about a gallery.

a) Galleries keep information about artists, their names (which are unique), birthplaces, age, and style of art.

b) For each piece of artwork, the artist, the year it was made, its unique title, its type of art (e.g., painting, lithograph, sculpture, photograph), and its price must be stored.

c) Pieces of artwork are also classified into groups of various kinds, for example, portraits, still lifes, works by Picasso, or works of the 19th century; a given piece may belong to more than one group. Each group is identified by a name (like those just given) that describes the group.

d) For each customer, galleries keep that person’s unique name, address, total amount of dollars spent in the gallery, and the artists and groups of art that the customer tends to like.