**Exercise 1**

The International Cricket authority plans to store the details regarding all the cricketers, matches, stadiums, Teams etc.

The details of the cricketer like his name, age, date of joining the team, his skill area, total score in terms of Runs or Wickets as per the skill, country details and the current fitness status need to be maintained.

The details of the team like the name, their office location, name of the team manger are stored. The team gets changed as per the matches. The teams are specific to the countries.

The match details are maintained like Date, location, teams, innings score, winner, type of match i.e. whether it is a One-Day, Test Match or a 20-20 match.

The details of the performance of the cricketer’s in terms of Runs or Wickets are stored. The cricketers are classified as Batsman, Bowlers, Wicket Keepers and All rounder.

The stadiums for the matches are decided depending upon the location, capacity of audience and availability. As the cricketers retire their details are stored in the history tables.

**Exercise 2**

The International Bank is bank spread across the entire globe with multiple branches in each city. Each branch has certain set of Employees who work in various capabilities to support the various functionalities in the bank. Each branch is lead by a Branch manager. All the employees of the branch report into the branch manager.

The Bank offers various kinds of facilities to its customer. The Customer can have multiple accounts in the bank across different branches. The Bank offers the customer a facility of Saving Account, Current Account, Fixed Deposit Account, Loan Account etc.

The bank offers the customers with an over draft facility, depending upon the usage and the balance in the account. The maximum withdraw capacity per day is also decided.

The customer can operate his various accounts through the same customer id. The bank also supports the Internet banking which lets the user perform the transaction online. The details of all his transactions are sent to him on a monthly basis.

**Exercise 3**

The Technical training cell is responsible for delivering training across the organization. The trainings can be request based, Calendar based or Fresher. The training Cell has its own set of trainers who conduct the calendar based trainings.

In case of request based trainings, if the resource is not available with the training cell, it makes it available through the external source. The training cell maintains the details of such trainers like their names, qualifications, training feedback etc.

The training cell maintains all the records about the trainings conducted so that the various reports can generated. The attendance and the test result details are mailed to the participants who attend the training.

The training cell also maintains a list of classrooms with capacity. The training calendar is generated depending upon the availability of the Classroom, capacity, trainer availability etc.

In addition to all this the training cell also maintains a list of software required for the training.

**Exercise 4**

Consider the following information about a university database:

Professors have an SSN, a name, an age, a rank, and a research specialty. Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget. Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.).

Each project is managed by one professor (known as the project’s principal investigator).Each project is worked on by one or more professors (known as the project’s co-investigators).

Professors can manage and/or work on multiple projects. Each project is worked on by one or more graduate students (known as the project’s research assistants). When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.

Departments have a department number, a department name, and a main office. Departments have a professor (known as the chairman) who runs the department. Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.

Graduate students have one major department in which they are working on their degree. Each graduate student has another, more senior graduate student (known as a student advisor) who advises him or her on what courses to take.

Design and draw an ER diagram that captures the information about the university.

Use only the basic ER model here; that is, entities, relationships, and attributes. Be sure to indicate any key and participation constraints.

**Exercise 5**

**HR Database**

A company database needs to store information about employees (identified by *ssn*, with *salary* and *phone* as attributes), departments (identified by *dno*,with *dname* and *budget* as attributes), and children of employees (with *name* and *age* as attributes). Employees *work* in departments; each department is *managed by* an employee; a child must be identified uniquely by *name* when the parent (who is an employee; assume that only one parent works for the company) is known. We are not interested in information about a child once the parent leaves the company.

Draw an ER diagram that captures this information.

**Exercise 6**

**BMG** Records has decided to store information about musicians who perform on its albums (as well as other company data) in a database. The company has wisely chosen to hire you as a database designer (at your usual consulting fee of $2500/day).

Each musician that records at BMG has an SSN, a name, an address, and a phone number.

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

Each album recorded on the BMG 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 BMG 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, of course.

Design a conceptual schema for BMG and draw an ER diagram for your schema.

The preceding information describes the situation that the BMG database must model. Be sure to indicate all key and cardinality constraints and any assumptions you make. Identify any constraints you are unable to capture in the ER diagram and briefly. Explain why you could not express them.

**Exercise 7**

The Ranbaxy chain of pharmacies has ordered to give you a free lifetime supply of medicine if you design its database. Given the rising cost of health care, you agree. Here’s the information that you gather:

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

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

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

Each pharmacy has a name, address, and phone number. Every patient has a primary physician. Every doctor has at least one patient. 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.

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. 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.

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.

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.

1. Draw an ER diagram that captures the preceding information. Identify any constraints not captured by the ER diagram.

2. How would your design change if each drug must be sold at a fixed price by all pharmacies?

3. How would your design change if the design requirements change as follows: If a doctor prescribes the same drug for the same patient more than once, several such prescriptions may have to be stored