Course TDT4145 Data Modelling and Database Systems

Exercise 1: Introduction to databases and ER-modelling

Task 1

a) Give a short definition of these concepts: Data, database and database system. Explain the relationship and differences between them.

b) How is a database different from traditional file systems?

c) Which advantages does it provide?

Task 2

a)

We want to model a database system for a hotel chain.

The hotel chain has hotels in several cities in Norway. Every hotel has a name, which is not necessarily unique. Every hotel has several types of hotel rooms (i.e. single, double, family, luxury), each with a fixed price (800, 1100, 1400, 2200).

The system will be used to register bookings of hotel rooms. A booking will consist of a reservation of one or several rooms, in one hotel. For instance, one booking could be room 3205, 4111 and 4112. A booking lasts from one date to another, and all rooms in one booking is booked in the same time period.

Design an ER-model to solve this problem.

b)

Extend the ER-model so it can cope with the following requirements:

For each booked room, we want to be able to register if the customers want an extra bed in the room.

It should be possible to register discounts for some types of rooms for specific time periods.

Task 3

Two computer science students, Roberta and Jonathan, are going to launch an online music service and therefore need to design a music database, where they are going to store information about songs, artists, albums, users and playlists. The database is going to store information on which

albums contain which songs, and which artist(s) and which label are behind which album. There are a number of album types such as studio album, single, concert, compilation from the same artist or a split-album between several artists. Each song has to be registered by a full name, length, and a counter for the total number it has been played. The artist information should include artist name, biography, a picture or a logo, and a list of similar artists. For each album it has to store the release year, a cover-art picture, and all of the songs on each album have to be enumerated.

Additionally, each user has to be registered with a unique username, an email address, a password and a profile picture. Each user may list a number of other users as friends and should be able to create his/hers own or subscribe to others playlists. Each playlist consists of a number of songs and can be either shared (can be edited by other users), public (visible to other users, but editable only by its creator) or private (visible only to its creator). Each playlist has a unique URL and a name. Finally, each user may mark any song as his favourite.

Design an ER-model to solve this problem.

Task 4

The Department of Computer and Information Science (IDI) receives at the moment a large number of applications for it's PhD positions. To improve the application review process, IDI wants to design a database that will store information on open vacancies, applicants, etc. The database should contain the information about the positions that are or have been vacant. Each vacancy has a vacancy identifier (such as IDI-11), research area, contact details for the responsible for the vacancy (such as Prof. Drøvel), a date for the advertisement and a application deadline. When the number of applicants is too low, the vacancy may be advertised several times. Each application has to be registered in the database and the stored information should include the applicants name, address and email-address, and additional information of the applicants background (previous education, experiences, etc.). For each applicant it is also possible to have one or several references persons. Information about these should also be stored in the database.

Many candidates apply at several vacancies at once. To facilitate the process, we want to store the information gathered previously (such as interview date and notes and which reference persons have been contacted). For international applicants IDI also uses the Information Section (IS) to evaluate whether the applicant fulfil the official requirements to begin at a Norwegian PhD study. To avoid disturbing applicants more then necessary IS wants also to store the result of a such evaluation. To know who to contact if there will be more questions, we also want to store who is responsible for each IS evaluation.

Design an ER-model to fulfil the requirements above. Remember to specify all cardinalities and keys. The database has also to be able to answer the following questions:

• Find whether the applicant Medel Svensson has previously applied, and whether an IS evaluation has been done?

• If Medel Svensson has applied previously and an IS evaluation has been done, who did the evaluation?

• If Medel Svensson has applied previously, who have been interviewing him?

• How many vacancies has Professor Drøvel been responsible for?

• Who of the current NTNU employees have previously applied at a vacancy at IDI.

(Explain shortly all necessary assumptions you have to do.)