Shane Hauck

CS345 Database Systems

Homework 1

1.7 List four significant differences between a file-processing system and a DBMS.

1. Being able to access data in a convenient and efficient manner is easier in a DBMS than a file-processing system. To extract necessary information based on variables or make alterations, a file-processing system requires either someone to extract the information manually or a programmer to write the necessary application program. A DBMS exploits commonalities in the structure of data to gain efficiency for the users.
2. A DBMS allows for better consistency in the data as it limits redundancy in the data. A file-processing system could the same information duplicated in several places causing higher storage and access cost. Also, if information is changed for a copy of the data, various other copies of that same data may no longer agree.
3. Data in a file-processing system are likely to be scattered in various files, possibly containing different formats. This makes retrieving the data from all of these files in difficult because different ways of accessing the data need to be created and altered per version. Meanwhile, a DBMS allows for data whose formats are highly variable.
4. A file-processing system is not as secure as DBMS because information is added to a file-processing system in a certain way that is required, it is difficult to enforce string security constraints.

1.8 Explain the concept of physical data independence and its importance in database systems.

The concept of physical data independence is that the entire database is described as a small number of relatively simple structures. This allows for certain aspects of the data to be separated from one another so database administrators can decide what information to keep in the database.

1.9 List five responsibilities of a database-management system. For each responsibility, explain the problems that would arise if the responsibility were not discharged.

1. A DBMS must define a database based on specifying data types, structures and constraints of the data that are to be stored in the database. If a database is not intentionally defined, users could accidentally define things as there will be nothing stopping them from doing so.
2. A DBMS is responsible for constructing the database in a way that stores the data in a consistent manner. If this is not done, there will be a lack of organization of the data.
3. A DBMS is responsible for having a way to manipulate the database. If there is no way to manipulate the database, users will struggle to find necessary information or make precise conclusions based on the data.
4. A DBMS must allow a database to be shared so multiple users can access the database simultaneously. If databases are unable to be shared, it will be hard for changes to be made consistent and backed up.

5. A DBMS is responsible to make sure the database is protected from both system protection against hardware or software malfunctions and security protection against unauthorized or malicious access. If protection is not enabled, the database will likely be exposed to various security threats.

1.11 Assume that two students are trying to register for a course in which there is only one open seat. What component of a database system prevents both students from being given that last seat?

The component of a database system that prevents both students from being given that last seat is transaction management. This allows either student A or student B to register for the seat, not both as that would violate the database-consistency constraints.

1.12 Explain the difference between two-tier and three-tier application architectures. Which is better suited for web applications? Why?

A two-tier application architecture is when the application resides at the client machine and invokes database system functionally at the server machine through query language statements. A three-tier application architecture is where the client machine acts as merely a front end and does not contain any direct database calls. A three-tier architecture is better suited for web applications because they provide better security as well as better performance than two-tier applications and that is useful because web applications generally have a large number of users.

1.14 Explain why NoSQL systems emerged in the 2000s, and briefly contrast their features with traditional database systems.

NoSQL systems were created because of the new data-intensive applications and the need for rapid development. NoSQL systems provide a lightweight form of data management whereas huge volumes of data in traditional database systems was textual or semi-structured.

1.15 Describe at least three tables that might be used to store information in a social networking system such as Facebook.

1. A table featuring all the users on Facebook. This would likely include information like name, age, gender, etc.
2. A table that features the marketplace, or all things being sold on facebook. This would likely include the product, price, seller, date posted, etc.
3. A table that features friends. This table would likely include users who are allowed to see certain posts of yours, a priority on your feed, instant messaging access etc.