Answers to Guide 7

1. Database Management Systems
   1. Database versus database management system
      1. DBM - “software system that enables user to define, create, maintain, and control access to the database”
      2. Core functionality is the storage, retrieval, and update of data.
      3. Other functionalities:
         1. Access support from remote locations
         2. Enforce constraints to ensure data in database abides by rules
         3. Support for authorization of access and update of data
         4. Facilities for recovering database if damaged
         5. Support for transactions and concurrency
         6. User accessible catalog or data dictionary describing metadata
      4. Also provides API and processor for database languages (ie. SQL) to allow applications to bet written to interact with the database
      5. Database: an organized collection of data, stored and accessed electronically
   2. DBMS is a program that generally provides facilities for what four things?
      1. Controlling data access
      2. Enforcing data integrity
      3. Managing concurrency control
      4. Recovering the database and failures and restoring from backup files
      5. Maintaining database security
   3. What is the significance of E.F. Codd’s paper “A Relational Model of Data for Large Shared Data Banks”?
      1. Described a new system for storing and working with large databases
      2. All data is represented in terms of tuples, grouped into relations
      3. Codd’s 12 rules or 12 Commandments – designed to define what is required from a DBMS in order for it to be considered a RDBMS
         1. <https://en.wikipedia.org/wiki/Codd%27s_12_rules>
   4. What were database systems like before the development of the relational model?
      1. Navigational models – hierarchical model and the CODASYL model (network model)
      2. CODASYL model relied on the manual navigation of linked data sets which was formed into a large network
   5. Compare and contrast the following:
      1. Conceptual versus logical data models
         1. Conceptual data models identify the highest-level relationships between the different entities.
            1. Entity names
            2. Entity relationships
         2. Logical data models describes the data in as much detail as possible, without regard to how they will be physically implemented in the database
            1. Entity names
            2. Entity relationships
            3. Attributes
            4. Primary keys
            5. Foreign keys
      2. Conceptual versus internal views
         1. External views: defines how each group of end-user sees the organization of data in the database.
         2. Conceptual views: unifies the various external views into a compatible global view.
         3. Internal views: the internal organization of data inside a DBMS
2. Relational Model
   1. Who developed the relational model?
      1. Edgar F. Codd in 1969
      2. An approach to managing data using a structure and language consistent with first-order predicate logic.
   2. What does it mean for a model to be declarative?
      1. Declarative method for specifying data and queries:
      2. User directly state what information the database contains and what information they want from it, and let the DBMS take care of describe data structures for storing the data and retrieval procedures for answering queries.
   3. Be able to explain and use the following concepts:
      1. Relation: A tuple (H,B) with H, the header, and B, the body, a set of tuples that all have the domain H
      2. Tuple: a partial function from attribute names to atomic values.
         1. One record (one row)
         2. Contains all the data for an individual record.
      3. Column: a set of data values of a particular simple type, one value for each row of the database.
      4. Field: a part of a record and contains a single piece of data for the subject of the record.
      5. NULL: special mark that can appear instead of a value wherever a value can appear in SQL.
         1. Indicates the data value does not exist in the database
      6. Integrity: data integrity, the maintenance of, and the assurance of the accuracy and consistency of data over its entire life-cycle.
      7. Primary keys: a specific choice of a minimal set of attributes (columns) that uniquely specify a tuple (row) in a relation table.
      8. Foreign keys: a field or collection of fields in one table that uniquely identifies a row of another table or the same table.
   4. Compare and contrast relational keys and traditional pointers
      1. Relational keys:
         1. Superkey: set of attributes that uniquely identifies each tuple in a relation
         2. Candidate key: similar to a superkey, but doesn’t contain a subset of attributes that is itself a superkey.
         3. Primary key: candidate key selected to uniquely identify all other attribute values in any given entity.
         4. Secondary key: an attribute or combination of attributes that identify a set of rows based on a value.
         5. Foreign key: an attribute or combination of attributes in one table whose values must either match the primary key in another table or be NULL.
         6. Support for operations based on set theory
      2. Traditional pointers:
         1. Extension to the widely used tuple identifiers
         2. Have efficiency of a shared variable combined with the advantages of using a real-time database system.
         3. Allow fast and predictable way of accessing data in a database without the need of consulting the indexing system of a database.
         4. Provide an interface that uses a pointer-like syntax.
   5. Considering the example given in Section 4, is the relational model object-oriented?
      1. ORDBMS – similar to a relational database but with a object-oriented database model
         1. Objects, classes, and inheritance are directly supported in database schemas and in the query language.
         2. Supports extension of the data model with custom data-types and methods.
      2. OODBMS stores data in objects – an item that contains data, as well as the operations that reads or processes the data.