***Databases: Relational Databases and SQL***

***Intro to databases:***

*Database Management System (DBMS) provides efficient, reliable, convenient, and safe multi-user storage of and access to massive amounts of persistent data.*

* *Massive*
* *Terabytes*
* *Persistent*
* *Safe*
* *Hardware*
* *Software*
* *Power*
* *Users*
* *Multi-user*
* *Concurrency control*
* *Convenient*
* *Physical data independence*
* *High level query language declarative*
* *Efficient*
* *Thousand of querys and updates per seconds*
* *Reliable*
* *Guarantee 99.99% uptime*
* *Databases application may be programmed via “framework”.*
* *DBMS may run in conjunction with “middleware”.*
* *Data-intensive applications may not use DBMS at all.*

***Key concepts***

* *Data model*
* *Set of records*
* *XML*
* *Graph*
* *Schema versus data*
* *Types*
* *Variables*
* *Data definition language (DDL)*
* *Data manipulation or query language (DML)*

***Key people***

* *DBMS implementer*
* *Builds system*
* *Database designer*
* *Establishes schema*
* *Database application developer*
* *Programs that operate on database*
* *Database administrator*
* *Loads data*
* *Keep running smoothly*

***Introduction to the Relational Model***

* *Used by all major commercial database systems*
* *Very simple model*
* *Query with high-level languages: simple yet expressive*
* *Efficient implementation*

***Dictionary***

* *Database*
  + *A set of named relations*
* *Table*
  + *A relation between values*
  + *Could be viewed as spreadsheets*
  + *Consist of columns and rows*
* *Attribute*
  + *A column in a table*
  + *Each value in a column is an attribute of an instance listed in the database*
* *Domain*
  + *Each attribute has specified type*
* *DDL*
  + *Data Definition Language*
* *DML*
  + *Data Manipulation Language*
* *Database = set of named relations (or tables)*

*Et bilde som inneholder bord

Automatisk generert beskrivelse*

* *Each relation has a set of named attributes (or columns)*
* *Each tuple (or row) has a value for each attribute*
* *Each attribute has a type (or domain)*
* *Schema – structural description of relations in database*
* *Instance – actual contents at given point in time*
* *NULL – special value for “unknown” or “undefined”*
* *Key – attribute whose value is unique in each tuple*

*Or set of attributes whose combined values are unique.*

***Commands***

* *Creating relations (tables) in SQL*
  + *Create Table Student (ID, name, GPA, photo)*
  + *Create Table College (name string, state char (2), enrollment integer)*
* *Query Languages*
  + *Getting IDs of student bigger than 3.7 GPA applying for Stanford*
    - *SELECT Student.ID*
    - *FROM Student, Apply*
    - *Where Student.ID=Apply.ID*
    - *And GPA > 3.7 and college = “Stanford”*

***Statement***

* *SELECT (Basic)*
  + *Consist of 3 parts*
    - *Select – what to return*
    - *From – Coming from what relation*
    - *Where – combining filter*

***Wrapping up***

* *Used by all major commercial database systems*
* *Very simple model*
* *Query with high-level languages: simple yet expressive*
* *Efficient implementations*

***Querying Relational Databases***

* *Steps in creating and using a (relational) databases*
  + *Design schema; creating DDL*
  + *“Bulk load” initial data*
  + *Repeat*
    - *execute queries and modifications*
* *Ad-hoc queries in high-level language*
  + *Some easy to pose*
    - *Some a bit harder*
  + *Some easy for DBMS to execute efficiently*
    - *Some harder*
  + *“Query language” also used to modify data*
* *Queries return relations (compositional, closed)*
* *Query Languages*
  + *Relational algebra*
    - *Formal*
  + *SQL*
    - *Actual/implemented*

***SQL Introduction***

* *SQL: Standard Query Language*
* *“SQL” or “Sequel”*
* *Supported by all major commercial database systems*
* *Standardized*
  + *Many new features over time*
* *Interactive via GUI or prompt, or embedded in programs*
* *Declarative*
  + *Based on relational algebra*
* *Data Definition Language*
  + *Create table*
  + *Drop table*
* *Data Manipulation Language (DML)*
  + *Select*
  + *Insert*
  + *Delete*
  + *Update*