DBMS Lab

SQL(Structured Query Language)

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DBMS Lab Outline part 1 introduction(2lab)

- Introduction to Database and DBMS
- Installing Microsoft server 2008
- Sql introduction
- Sql server introduction
- Connecting to sql server
- Creating and altering a database

  i- Sql select database

  II- Deleting or dropping a database
- Creating and working with tables

  i-creating a table

  ii-SQL drop or delete table

DBMS Lab Outline part 2
basic sql statements(2lab)

- SQL insert QUERY
- SQL select query
- Alter Table Statement
  - i-Adding a column
  - ii-deleting a column
  - iii-changing a data type of a column
- SQL auto increment
- Sql constraints
  - i-Foreign key constraints
  - ii-default constraint
  - iii-unique constraint
  - iv-check cinstraint

DBMS Lab Outline part 3 basic sql statements(1lab)

- SQL Distinct
- SQL where
- Sql and & or operators
- Sql order by
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- Sql delete

DBMS Lab Outline part 4
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- SQL like
- SQL wild card
- Sql in
- Sql between
- Sql joins
  - i-inner join
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  - iii-right join
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- Sql union
- Sql views

DBMS Lab Outline part 5
sql functions(1lab)

- SQL avg()
- SQL count()
- SQL first()
- SQL last()
- SQL max()
- SQL min()
- SQL sum()
- SQL Group By
- SQL Having

.....MID exam.....

part 1
introduction

What is Data ,information

- *Data*: -Meaningful facts, text, graphics, images, sound, video segments.

- *Information*:- Data processed to be useful in decision making.

What is a Database?

- An organized collection of logically related data.
- A collection of information that is organized so that it can *easily be accessed, managed and updated.*

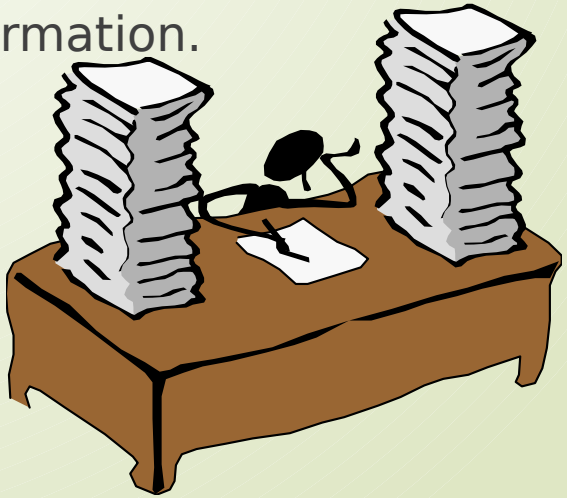
Purpose of a Database

- The purpose of a database is:
  - To store data
  - To provide an organizational structure for data
  - To provide a mechanism for querying, creating, modifying, and deleting data
- A database can store information and relationships that are more complicated than a simple list

Problem with lists

What is a list?

- List:-a simple two dimensional table of data, which we store information.



Problems with lists

Redundancy

- In a list , each row is intended to stand on its own as a result the same information may be entered several times.

Project Manager	Manager ID	Phone Extension
Dan	3	x7270
Dan	3	x7270
Dan	3	x7270
Cho	2	x2114
Dan	3	x7270
Dan	3	x7270
Rajesh	1	x5754
Dan	3	x7270
Dan	3	x7270
Dan	3	x7270

Problems with lists

Multiple theme

In a list , each row may contain information on more than one theme or business concept. As a result certain information might appear in a list only if information about other themes or business concept is also present.

Business concept:-*refers to a number of different attributes or properties that are all naturally related to one type of business entity*. Eg..Employee

Problems with lists

Multiple theme

Project Manager	Manager ID	Phone Extension	Project Name	Project ID	Start Date	Budget
Dan	3	x7270	OS upgrade	101	01 Mar 2014	$12000
Dan	3	x7270	SQL training	102	03 Apr 2014	$9000
Dan	3	x7270	New tablet PCs	103	11 May 2014	$14200
Cho	2	x2114	Website design	104	07 Jun 2014	$37450
Dan	3	x7270	Cloud hosting	105	15 Jun 2014	$4650
Dan	3	x7270	A.I. research	106	30 Jul 2014	$3000
Rajesh	1	x5754	New web server	107	17 Aug 2015	$12500
Dan	3	x7270	WiFi upgrade	108	03 Sep 2015	$9800
Dan	3	x7270	Client training	109	22 Oct 2015	$2200
Dan	3	x7270	DB upgrade	110	19 Nov 2015	$8700
Dan	3	x7270	New email server	111	09 Jan 2016	$11900

List modification issues

- Redundancy and multiple themes in a list create modification problems.
- **Deletion problems**
- **Update problems**
- **Insertion problems**

List Modification Issues

If Adviser **Baker** is changed to **Taing**, we need to change *AdviserEmail* as well. If changed to **Valdez**, we need to change *AdviserEmail*, *Department*, and *AdminLastName*.

	A	B	C	D	E	F	G
1	**LastName**	**FirstName**	**Email**	**AdviserLastName**	**AdviserEmail**	**Department**	**AdminLastName**
2	Andrews	Matthew	Matthew.Andrews@ourcampus.edu	Baker	Linda.Baker@ourcampus.edu	Accounting	Smith
3	Bisbon	Lisa	Lisa.Bisbon@ourcampus.edu	Valdez	Richard.Valdez@ourcampus.edu	Chemistry	Chaplin
4	Fiedler	Douglas	Douglas.Fiedler@ourcampus.edu	Baker	Linda.Baker@ourcampus.edu	Accounting	Smith
5	Hwang	Terry	Terry.Hwang@ourcampus.edu	Taing	Susan.Taing@ourcampus.edu	Accounting	Smith
6	Lai	Tzu	Tzu.Lai@ourcampus.edu	Valdez	Richard.Valdez@ourcampus.edu	Chemistry	Chaplin
7	**Mason**	**Chip**	**Chip.Mason@ourcampus.edu**	**Tran**	**Ken.Tran@ourcampus.edu**	**InfoSystems**	**Rogers**
8	Thompson	James	James.Thompson@ourcampus.edu	Taing	Susan.Taing@ourcampus.edu	Accounting	Smith
9	???	???	???	???	???	Biology	Kelly

Deleted row—Student, Adviser, and Department data lost

Inserted row—both Student and Adviser data missing

Solution

- Relational databases are designed to address many of the information complexity issues that arise in business.

What is a relational database?

- A Relational Database stores information in a tables. Each informational theme or business concept is stored in its own table.
- In essence, a relational database will break up a list into several parts
- One part for each theme in a list.

Employee ID	Name	Phone Number	Department ID
101	Dan	714-555-7270	1
102	Fry	657-555-6561	2
103	Leela	303-555-3247	2
104	Bender	480-555-4439	2

Department ID	Department Name
1	Information Systems
2	Package Delivery

Putting pieces back together

- In our relational database example ,we broke apart our table into several tables . somehow the tables must be joined back together.

- In relational databases tables are joined together using *matched pair of data values*.

Putting pieces back together

- For example: if a PROJECT has a customer the CUSTOMER_ID can be stored in a column in a project table.
- *whenever we need information about the customer, we can use the CUSTOMER_ID to look up the customer information in he customer table.*

Project Name	Project ID	Start Date	Budget	Customer ID
DB upgrade	110	19 Nov 2015	$8700	2
New email server	111	09 Jan 2016	$11900	2
3D printers	112	06 Jul 2016	$25000	2
Network upgrade	113	24 Aug 2016	$33200	1

Customer ID	Customer Name
1	Dan
2	Priya

Sounds like More Work, Not Less

- A relational database is more complicated than a list
- However, a relational database minimizes data redundancy, preserves complex relationships among topics, and allows for partial data (*null* values)
- Furthermore, a relational database provides a solid foundation for creating user interface forms and reports

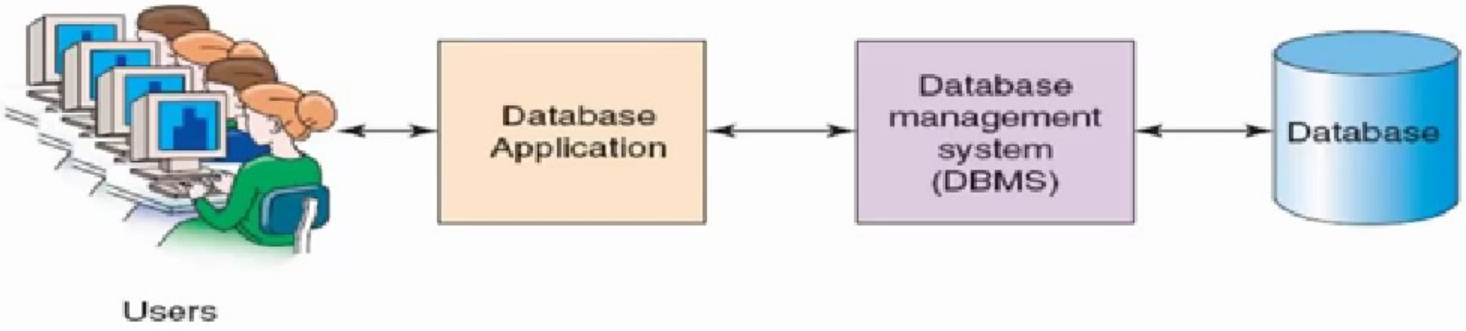
The Structured Query Language (SQL)

- The Structured Query Language (SQL) is an international standard language for creating, processing, and querying databases and their tables
- The vast majority of data-driven applications and websites use SQL to retrieve, format, report, insert, delete, and/or modify data for users

Database Systems

- The four components of a database system are:
  - Users
  - Database Application(s)
  - Database Management System (DBMS)
  - Database

Components of a Database System



Users

- A user of a database system will:
  - Use a database application to keep track of information
  - Use different user interface forms to enter, read, delete, and query data
  - Produce reports

The Database

- A database is a *self-describing* collection of *related* records
- Self-describing:
  - The database itself contains the definition of its structure
  - *Metadata* are data describing the structure of the data in the database
- Tables within a relational database are related to each other in some way

Database Management System (DBMS)

- A database management system (DBMS) serves as an intermediary between database applications and the database
- The DBMS manages and controls database activities
- The DBMS creates, processes, and administers the databases it controls

Functions of a DBMS

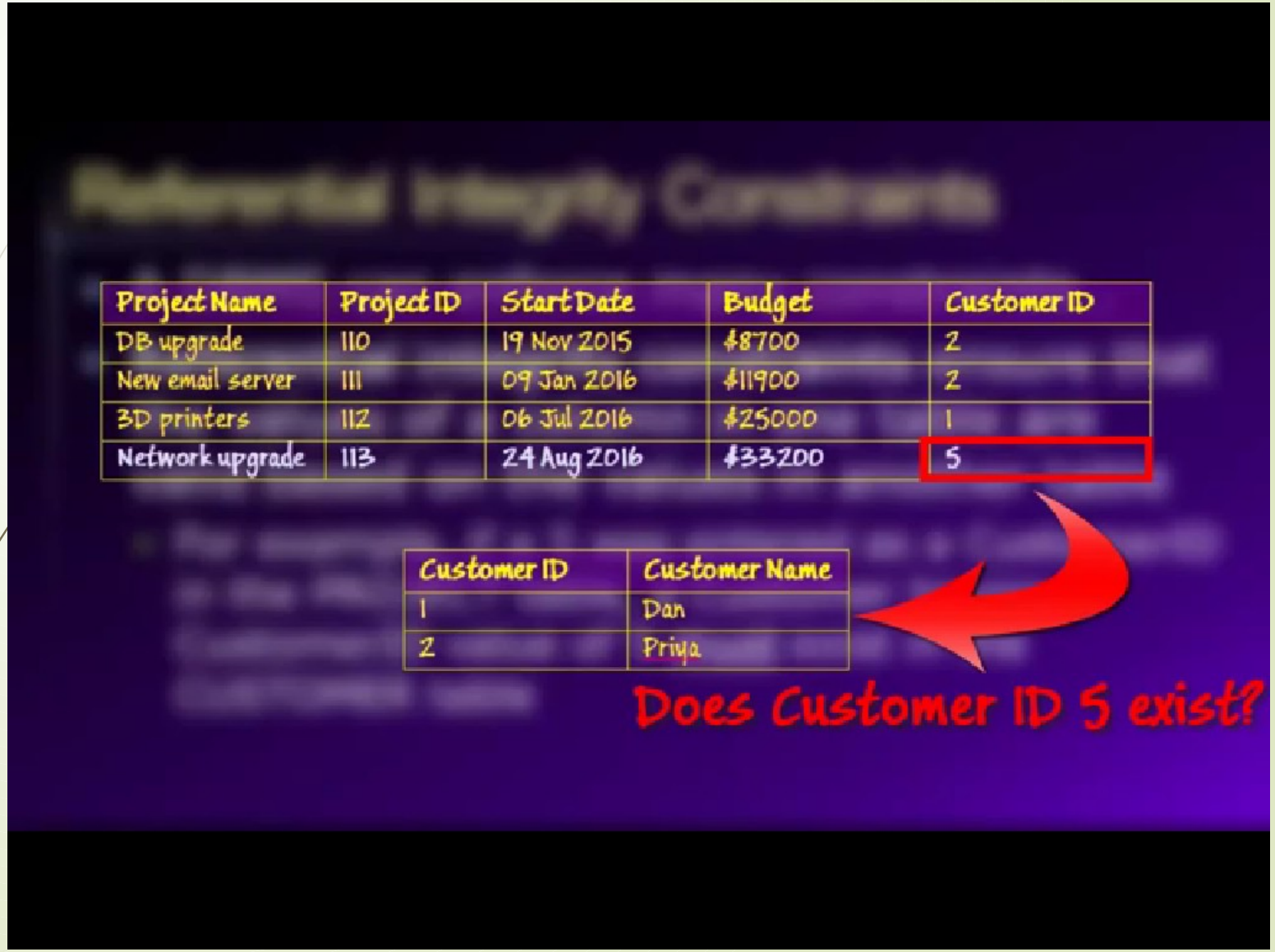
- Create databases
- Create tables
- Create supporting structures
- Read database data
- Modify database data (insert, update, delete)
- Maintain database structures
- Enforce rules
- Control concurrency
- Provide security
- Perform data backup and recovery

Commercial DBMS Products

- Example Desktop DBMS Products
  - Microsoft Access
- Example Organizational DBMS Products
  - SQL Server
  - Oracle
  - MySQL
  - DB2

Referential Integrity Constraints

- A DBMS can enforce many constraints…
- Referential integrity constraints ensure that the values of a column in one table are valid based on the values in another table
  - For example, if a 5 was entered as a CustomerID in the PROJECT table, a Customer having a CustomerID value of 5 must exist in the CUSTOMER table


Referential Integrity Constraints
Project Name
Project ID
Start Date
Budget
Customer ID
DB upgrade
110
19 Nov 2015
$8700
2
New email server
111
09 Jan 2016
$11900
2
3D printers
112
06 Jul 2016
$25000
1
Network upgrade
113
24 Aug 2016
$33200
5
Customer ID
Customer Name
1
Dan
2
Priya
Does Customer ID 5 exist?

Database Applications

- A database application is a set of one or more computer programs or websites that serve as an intermediary between the user and the DBMS

quiz

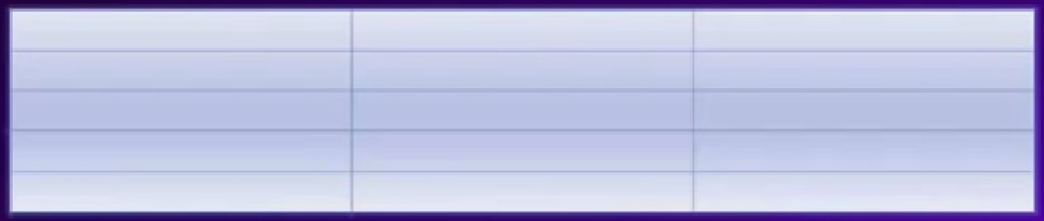
- What are the three list modification issues?
- How do we address the problem of lists?
- What are the four components of a database system?
- What is a DBMS? functions of DBMS? Example of a DBMS?

Entity

- An entity represents on theme ,topic or business concept.
- Eg:- employee , department…….

Relation

- A relation is a two-dimensional table that has specific characteristics
- The table dimensions, like a matrix, consist of rows and columns



Characteristics of a Relation

- Rows contain data about instances of an entity
- Columns contain data about attributes of the entity
- Cells of the table hold a single value
- All values in a column are of the same kind (data type)
- Each column has a unique name
- The order of the columns is unimportant
- The order of the rows is unimportant
- No two rows can be identical

A Sample Relation

EmployeeNumber	FirstName	LastName
100	Yousef	Hassan
101	Jerry	Cadley
104	Yi	Chang
107	Shir	Anavi

A Non-relation Example

EmployeeNumber	Phone	LastName
101	335-6421, 454-9744	Hassan
100	215-7789	Cadley
104	610-9850	Chang
107	299-9090	Anavi
100	215-7789	Cadley

Terminology

Synonyms…

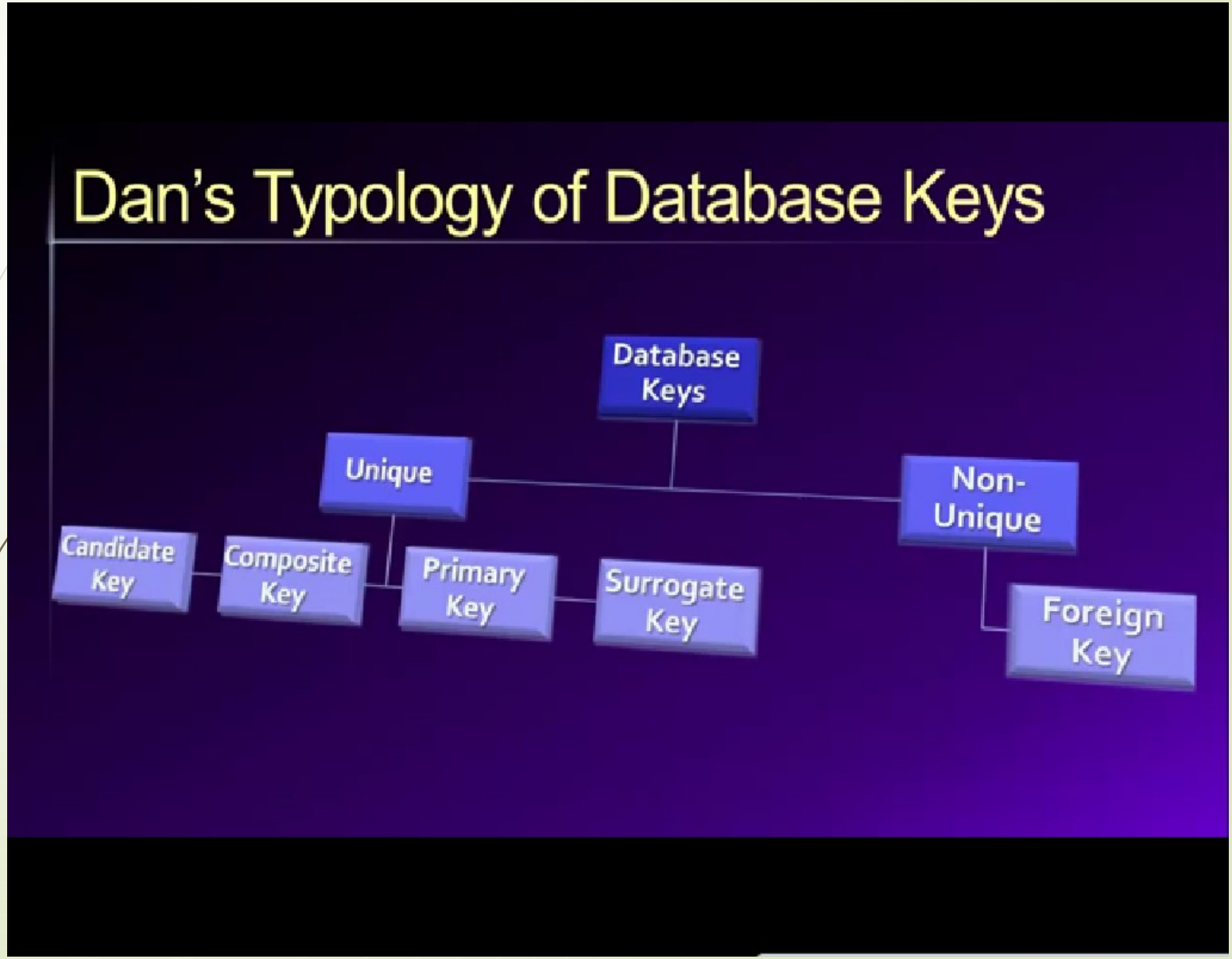
Table	Row	Column
File (rarely)	Record	Field
Relation	Tuple (rarely)	Attribute

Keys

- A key is one (or more) columns of a relation whose values are used to identify a row

Uniqueness of Keys

Unique Key	Nonunique Key
Data value is unique for each row.	Data value may be shared among several rows.
Consequently, the key will uniquely identify a row.	Consequently, the key will identify a set of rows.


Dan's Typology of Database Keys
Database Keys
Unique
Non-Unique
Candidate Key
Composite Key
Primary Key
Surrogate Key
Foreign Key

A Composite Key

- A composite key is a key that is composed of two or more attributes
- For a key to be unique, it must often become a composite key

Composite Key Example

Flight Number	Date
UA 36	03 Sep 2016
AA 704	31 Oct 2016
UA 36	04 Sep 2016
BA 9	31 Oct 2016

Flight Number + Date = Unique!

A Candidate Key

- A candidate key is called "candidate" because it has the potential to become the primary key
- A candidate key is a unique key

A Primary Key

- A primary key is a candidate key chosen to be the main key for the relation
- If you know the value of the primary key, you will be able to uniquely identify a single row within the table

Primary Key Example

EmployeeNumber	FirstName	LastName
100	Yousef	Hassan
101	Jerry	Cadley
102	Yi	Chang
107	Shir	Anavi

A Surrogate Key

- A **surrogate key** is a unique, numeric value that is added to a relation to serve as the primary key
- Surrogate key values have no meaning to users and are usually hidden on forms, queries, and reports
- A surrogate key is often used in place of a composite primary key

Primary Key Example

EmployeeNumber	FirstName	LastName
100	Yousef	Hassan
101	Jerry	Cadley
102	Yi	Chang
107	Shir	Anavi

EmployeeNumber is the primary key, but this type of primary key is called a **Surrogate Key**

Surrogate Key Example

Flight ID	Flight Number	Date
1	UA 36	03 Sep 2016
2	AA 704	31 Oct 2016
3	UA 36	04 Sep 2016
4	BA 9	31 Oct 2016

Relationships Between Tables

- A table may be related to other tables
- For example
  - An Employee works in a Department
  - A Manager controls a Project

A Foreign Key

- To establish relationships, we need to implement a **foreign key**
- A foreign key is a primary key from one table that is placed into another table
- The key is called a foreign key in the table that receives the key

Foreign Key Example 1



Referential Integrity

- Referential integrity states that every value of a foreign key must match a value of an existing primary key

Referential Integrity Example

Project Name	Project ID	Start Date	Budget	Customer ID
DB upgrade	110	19 Nov 2015	$8700	2
New email server	111	09 Jan 2016	$11900	2
3D printers	112	06 Jul 2016	$25000	1
Network upgrade	113	24 Aug 2016	$33200	5

Customer ID	Customer Name
1	Dan
2	Priya

Does Customer ID #5 exist?

quiz

- What is an entity?
- What are the two types of keys?
- How do we create relationships between tables?
- A foreign key is a primary key in another table.t/f

Installing sql server 2008

...use the installation pdf

What is SQL?

- SQL is Structured Query Language, which is a computer language for storing, manipulating and retrieving data stored in relational database.
  SQL is the standard language for Relation Database System.
- All relational database management systems like MySQL, MS Access, Oracle, Sybase, Informix, postgres and SQL Server use SQL as standard database language.

Why SQL

- Allows users to access data in relational database management systems.
  - Allows users to describe the data.
  - Allows users to define the data in database and manipulate that data.
  - Allows to embed within other languages using SQL modules, libraries & pre-compilers.
  - Allows users to create and drop databases and tables.

Objectives of SQL

- **Can be used by range of users including DBAs, management, application developers, and other types of end users.**
- **An ISO standard now exists for SQL, making it both the formal and *de facto* standard language for relational databases.**

Structured Query Language (SQL)

- The ANSI standard language for the definition and manipulation of relational database.
- Includes data definition language (DDL), statements that specify and modify database schemas.
- Includes a data manipulation language (DML), statements that manipulate database content.

SQL Commands:

DDL - Data Definition Language:

Command	Description
CREATE	Creates a new table, a view of a table, or other object in database
ALTER	Modifies an existing database object, such as a table.
DROP	Deletes an entire table, a view of a table or other object in the database.

DML - Data Manipulation Language:

Command	Description
INSERT	Creates a record
UPDATE	Modifies records
DELETE	Deletes records

DCL - Data Control Language:

Command	Description
GRANT	Gives a privilege to user
REVOKE	Takes back privileges granted from user

DQL - Data Query Language:

Command	Description
SELECT	Retrieves certain records from one or more tables

Some Facts on SQL

- SQL data is case-sensitive, SQL commands are not.
- First Version was developed at IBM by Donald D. Chamberlin and Raymond F. Boyce. [SQL]
- Developed using Dr. E.F. Codd's paper, “A Relational Model of Data for Large Shared Data Banks.”
- SQL query includes references to tuples variables and the attributes of those variables

Literals

- **Literals are constants used in SQL statements.**
- **All non-numeric literals must be enclosed in single quotes (e.g. ‘London’).**
- **All numeric literals must not be enclosed in quotes (e.g. 650.00).**

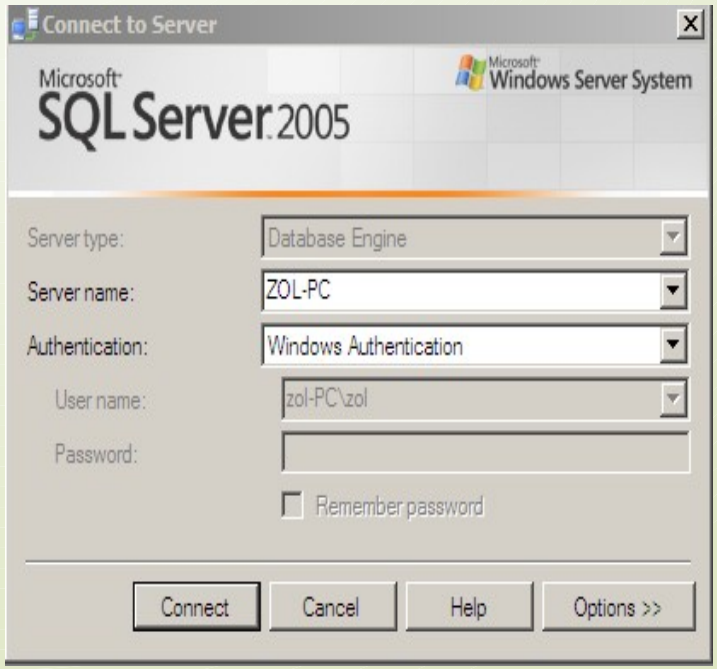
What is Microsoft sql server?

- Is a relational database management system(RDBMS) developed by Microsoft.
- Like major RDBMS ,sql server supports ANSI SQL, the standard sql language ,however it also contains T_SQL its own SQL implementation.
- SQL server management studio(SSMS) is sql servers main interface tool.

Name	Number	Release Date
Sybase	-	-
SQL Server 6.5	6.5	1996
SQL Server 7	7.0	1998
SQL Server 2000	8.0	2000
SQL Server 2005	9.0	2005
SQL Server 2008	10.0	2008
SQL Server 2008 Release 2	10.5	2010

Connecting to sql server

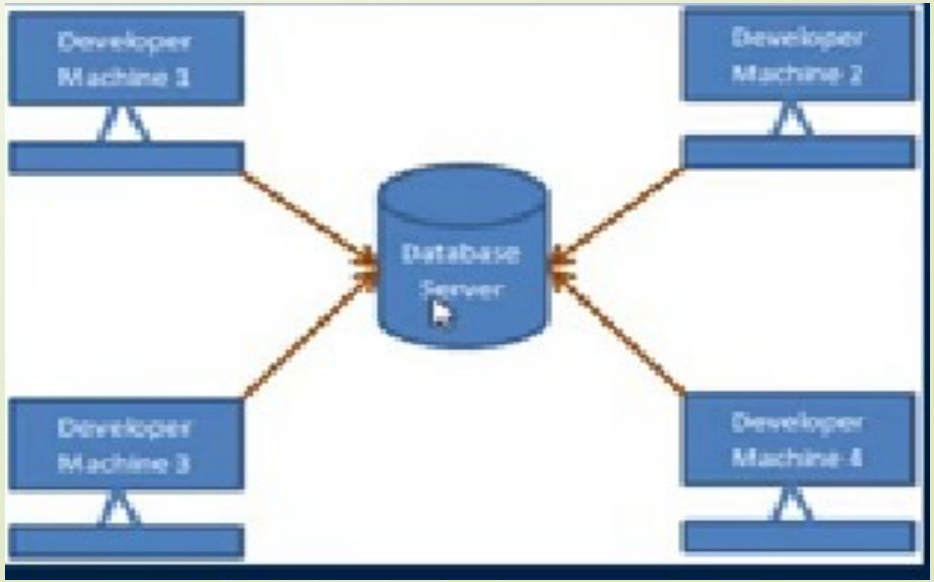
- You need to have sql server management studio already installed in your machine.
- To open the management studio click on start->all programs->sql server 2008/5-> select sql server management studio



Connecting to sql server

- The ssms and sql server database are two different things.
- Ssms:- is a client tool which is used to connect to sql server

  and not the server by itself.
- Developer machines or clients connect to sql server using ssms



Connecting to sql server



- Server Type=Database Engine
- Server name=(local) or . Or 127.0.0.1(loopback ip address)
- Authentication=Windows or sql server
- If sql server authentication

  Login

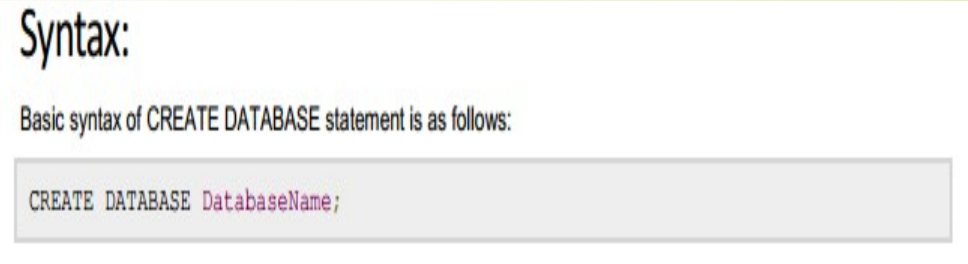
  Pasword

Creating and Altering a Database

- An Sql Server Database can be Created, Altered and Dropped
  - Using SSMS
  - Using a QUERY

Creating and Altering a Database

- The SQL **CREATE DATABASE** statement is used to create new SQL database.



- Always database name should be unique within the RDBMS.
  Example:
  If you want to create new database <testDB>, then CREATE DATAB d be as follows:

```
SQL> CREATE DATABASE testDB;
```

Creating a Database

- Create a database by the name Sample_1?
- Create a database by the name Sample_2?

Creating and Altering a Database

- Altering a database
- To alter a database once its created

Alter database Databasename

Modify name=New Database Name

eg. Alter database hilco1 modify name=hilco

Exercise 2

- Change the name of Sample1 database to hr1.
- Change the name of Sample2 database to hr2.

SQL SELECT Database

- When you have multiple databases in your SQL Schema, then before starting your operation, you would need to select a database where all the operations would be performed.
  The SQL **USE** statement is used to select any existing database in SQL schema.
  Syntax:
  Basic syntax of USE statement is as follows:
- Use DATABASE

Deleting or Dropping a Database

- To delete or Drop a Database use
- Drop Database Databasename

  eg. Drop Database hilco
- You cannot drop a database if its currently in use

Note:-System databases cannot be dropped.

Exercise 3

- Delete database hr1?
- Delete database hr2?

Creating and working with tables

- Creating a basic table involves naming the table and defining its columns and each column's data type.
The SQL **CREATE TABLE** statement is used to create a new table.



Creating and working with tables

- You can create tables using SSMS or by executing query

Data types used when creating tables,

Exact Numeric Data Types:

DATA TYPE	FROM	TO
Bigint	-9,223,372,036,854,775,808	9,223,372,036,854,775,807
Int	-2,147,483,648	2,147,483,647
Smallint	-32,768	32,767
Tinyint	0	255
Bit	0	1
Decimal	-10^38 +1	10^38 -1
Numeric	-10^38 +1	10^38 -1
Money	-922,337,203,685,477.5808	+922,337,203,685,477.5807
Smallmoney	-214,748.3648	+214,748.3647

Creating and working with tables

Date and Time Data Types:

DATA TYPE	FROM	TO
Datetime	Jan 1, 1753	Dec 31, 9999
Smalldatetime	Jan 1, 1900	Jun 6, 2079
Date	Stores a date like June 30, 1991	
Time	Stores a time of day like 12:30 P.M.	

Note: Here, datetime has 3.33 milliseconds accuracy where as smalldatetime has 1 minute accuracy.

Character Strings Data Types:

DATA TYPE	FROM	TO
Char	Char	Maximum length of 8,000 characters.(Fixed length non-Unicode characters)
Varchar	Varchar	Maximum of 8,000 characters.(Variable-length non-Unicode data).
varchar(max)	varchar(max)	Maximum length of 231characters, Variable-length non-Unicode data (SQL Server 2005 only).
Text	text	Variable-length non-Unicode data with a maximum length of 2,147,483,647 characters.

Creating and working with tables

- We want to create the following two tables

Student

Sid	sname	Email	Aid
1	Abebe	ab@gmail.com	3
2	Girma	gir@gmail.com	2
3	saba	saba@gmail.com	null

Advisor

Aid	Aname
1	Dr Alemu
2	Dr biruck
3	Dr gebre

Creating and working with tables

- To create an a table we use a create table statement

eg.

```
create table Advisor
(
Aid int not null primary key,
sname varchar(50)
)
```

This statement will create a table called advisor with a primary key column as Aid and a name column.

Note that if you don’t specify the not null statement ,the default statement null will be executed, which means that the column can accept null values.

Exercise 4

- Create a database with a name hilco
- Create the following two tables inside the database hilco?

SID	Int, primary key not null
sname	Text, not null1
Email	Text,null
advisor	Int null

Aid	int, not null,primary key
Aname	Text, not null

Exercise 5

- Create a database named shop
- Create a table named groceries which have a primary key based on the following list

  Bananas(4) aisle 2,

  Butter(1) aisle 5,

  Chocolate bars(2) aisle 6
- Change the database name to shopping

SQL DROP or DELETE Table

- The SQL **DROP TABLE** statement is used to remove a table definition and all data, indexes, triggers, constraints, and permission specifications for that table.

- **NOTE:** You have to be careful while using this command because once a table is deleted then all the information available in the table would also be lost forever.
  Syntax:
  Basic syntax of DROP TABLE statement is as follows:

-

  DROP TABLE TABLE NAME

Exercise 6

- Delete the table groceries found in shopping database.
- Delete the database shopping.