

Database Testing



Class Format

2

- ❑ Lecture - Concepts
- ❑ Exercises/ Quiz
- ❑ Work in Small Groups
- ❑ Final Test – Take home



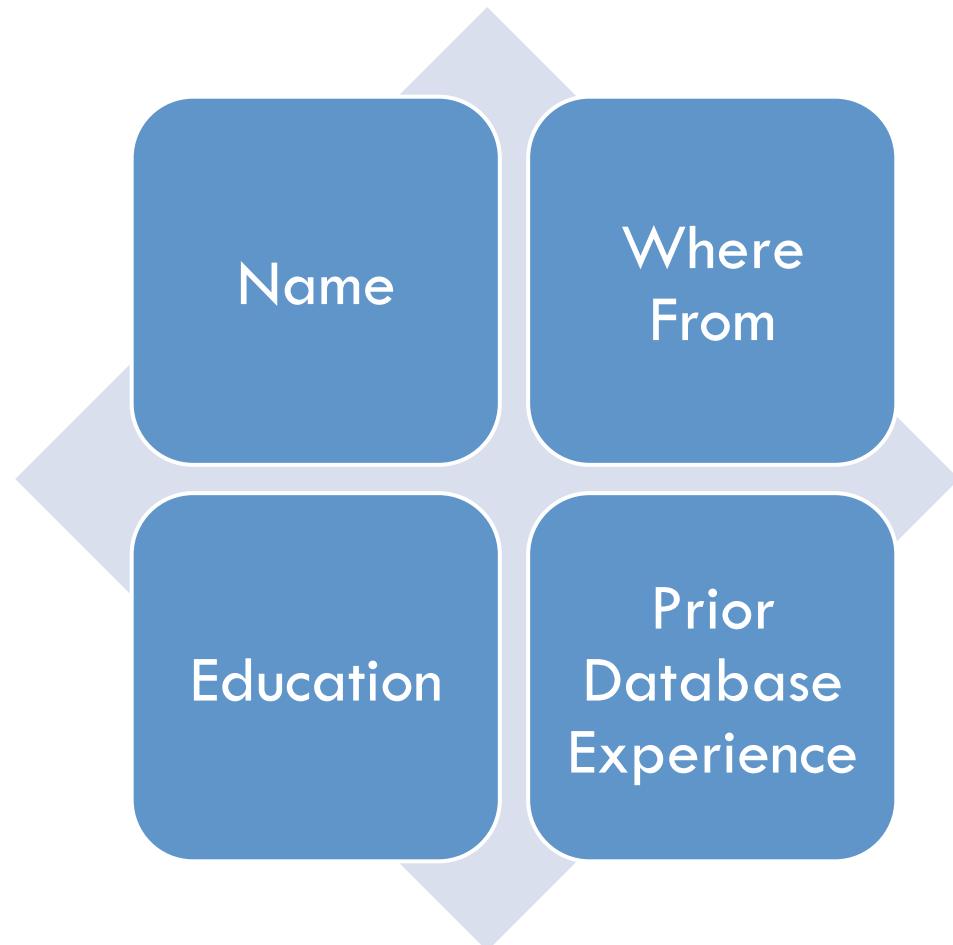
Itinerary

3

Day 1	
Introduction	1 Hour
Database Concepts	1 Hour
Basic SQL Commands	2 Hours
SQL Functions, Grouping Data	2 Hours
Day 2	
Advanced SQL – Join, Sub query	4 Hours
Table Operations	1 Hour
Back-end Testing Concepts	1 Hour

Introductions

4



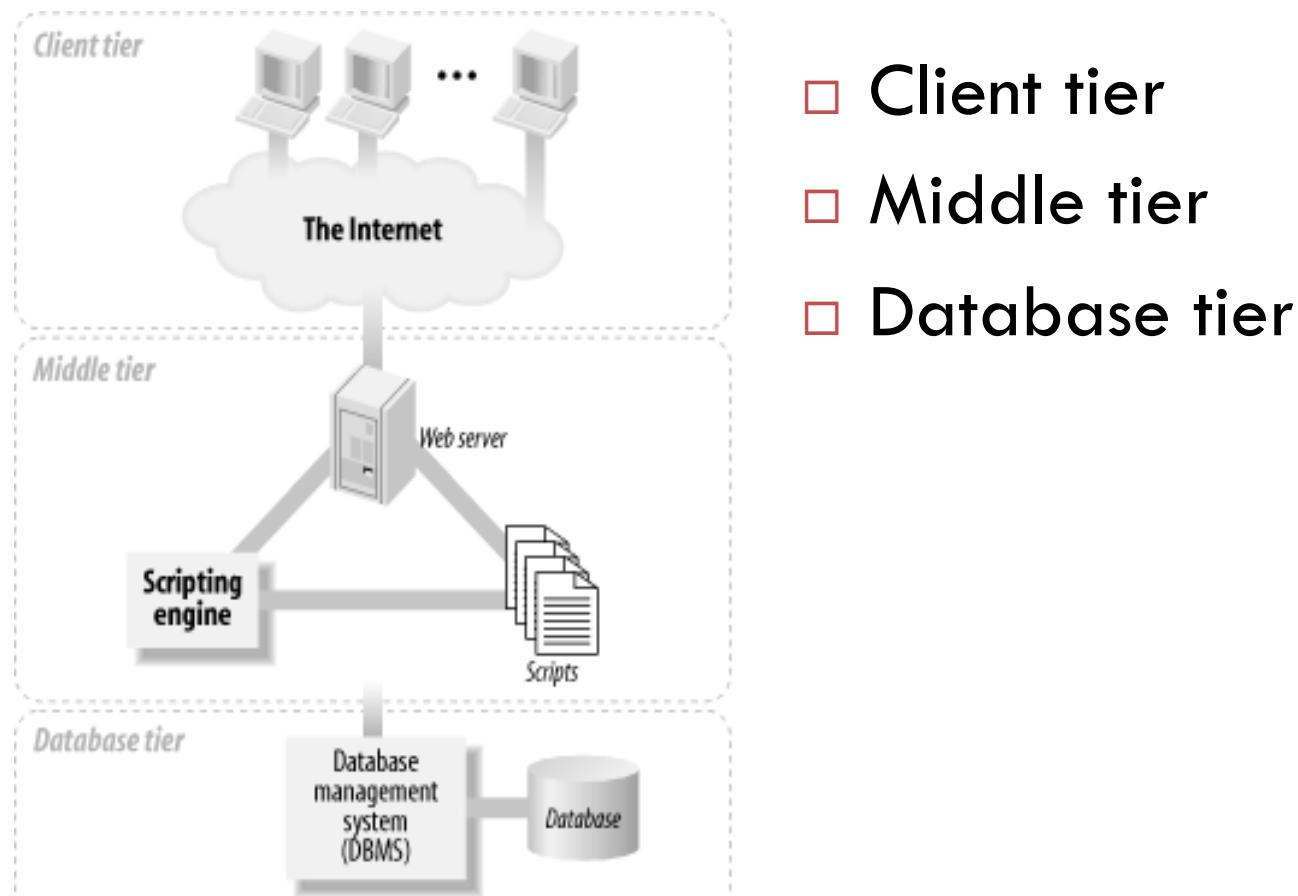
Why Database & SQL?

5

- Most application uses database to store and manage application related data
- Database testing/ Backend testing plays an important role in Software quality assurance
- Front-end testing may not validate stored data in database especially when a process impacts multiple areas in database
- SQL is used to retrieve data from database
- To learn SQL, you must understand database concepts

Architecture – Back end

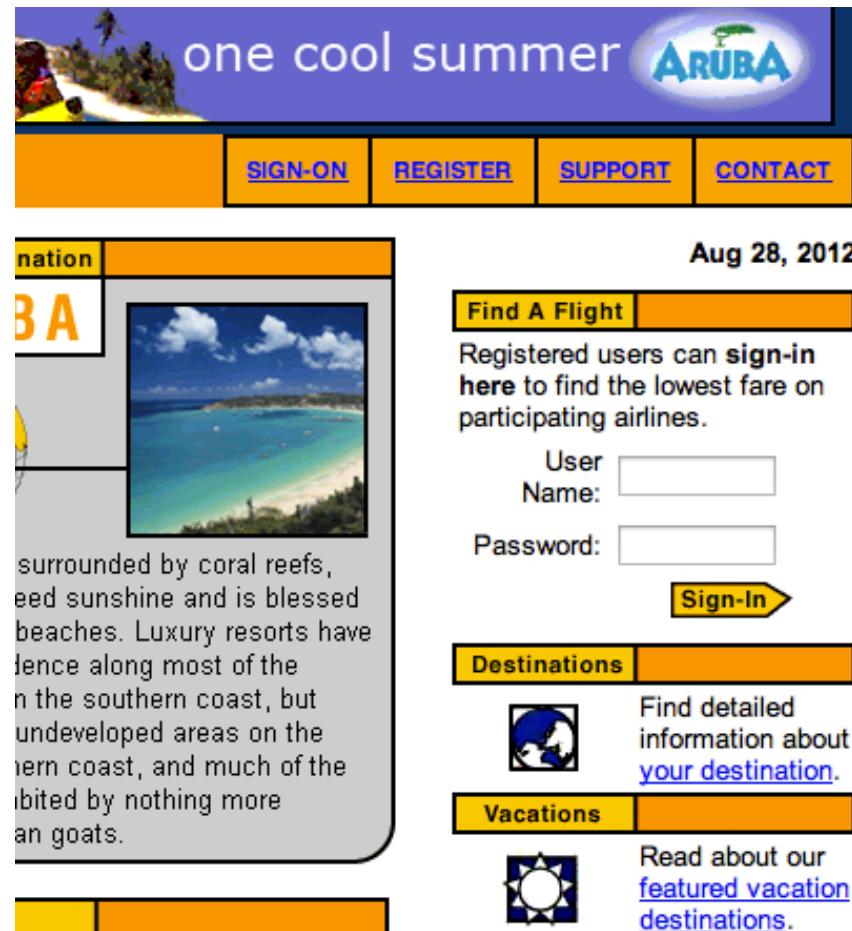
6



Front-end Testing

7

- Front end is testing is conducted through the user interfaces such as webpages.
- Examples: Smoke test, functional, regression, system, GUI, and UAT tests



Back-End Testing

8

- Back-end testing are completed by connecting to databases using tools such as SQL developer, TOAD, Management studios
- Data entry for back end testing are often done through front end

The screenshot shows the Oracle SQL Developer interface. The main area is a 'Worksheet' tab where a multi-select query is being typed:

```
1 SELECT
2   COUNTRY_ID, COUNTRY_NAME, REGION_
3 FROM COUNTRIES ;
4
5 SELECT
6   JOB_ID, JOB_TITLE, MIN_SALARY, MA
7 FROM JOBS ;
8
9 SELECT
10  DEPARTMENT_ID, DEPARTMENT_NAME, M
11 FROM DEPARTMENTS ;
```

Below the worksheet, the 'Script Output' tab shows the results of the query, listing 11 departments from the 'DEPARTMENTS' table:

DEPARTMENT_ID	DEPARTMENT_NAME
10	Administration
20	Marketing
30	Purchasing
40	Human Resources
50	Shipping
60	IT
70	Public Relations
80	Sales
90	Executive
100	Finance
110	Accounting

On the right side of the interface, there are two tabs: 'COUNTRIES' and 'JOBS'. The 'COUNTRIES' tab displays the following table structure:

COLUMN_NAME	DATA_TYPE
COUNTRY_ID	CHAR(2 BYTE)
COUNTRY_NAME	VARCHAR2(40)
REGION_ID	NUMBER

The 'JOBS' tab displays the following table structure:

COLUMN_NAME	DATA_TYPE
JOB_ID	VARCHAR2(10)
JOB_TITLE	VARCHAR2(35)
MIN_SALARY	NUMBER(6,0)
MAX_SALARY	NUMBER(6,0)



Database Concepts

Relational Database

Topics

10

Database
Introduction

Relational
Database Concepts

Relational
Database
Management
System (RDBMS)

Tables & Table
Keys

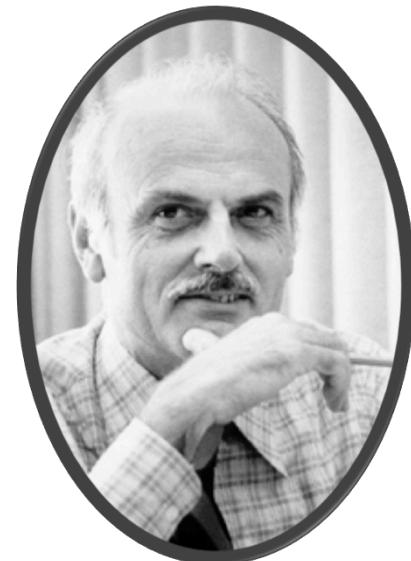
Table Relationships

Entity Relationship
Diagram – ERD &
Normalization

Database Introduction

11

- A database is a collection of interrelated records
- Conceived in 1969 by an IBM Research Scientist – Dr. Edgar Codd
- Professional mathematician & used set theory & first-order predicate logic to create model



Database – Examples

12

Database are maintained

- Manually
- Computerized

Example by Industry

- Banking - Bank Account Database
- Retail - Inventory Database
- Aerospace - Aircraft Database
- Service - Travel Booking Database

What is Data?

13

Data

- Data is recordable facts that have implicit meaning
- Distinct pieces of information, usually formatted in a special way
- Data can exist in a variety of forms such as
 - Numbers
 - Text on paper
 - Bits, and bytes stored in a electronic memory
 - Facts

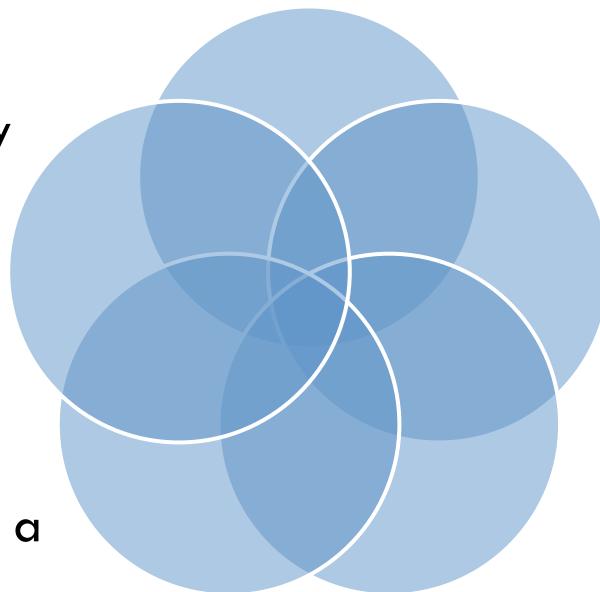
Relational Database Concepts

14

On the Relational Database, all data is stored in tables.
Tables are comprised of columns and rows.

Each relation has a
Primary key that uniquely
identify each tuple in a
relation.

A relation is made up of a
collection of attributes.



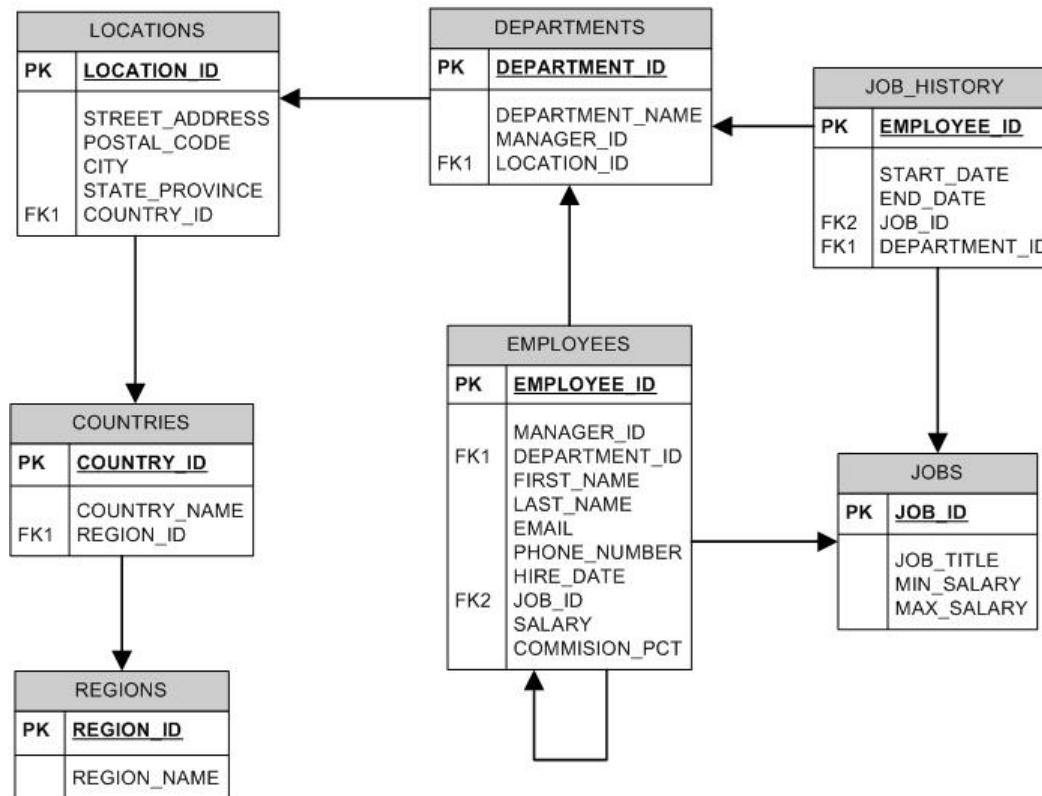
Each Table is separate
entity, and a relation.

Each relation has a
name.

Example – Relational Database

15

Relational Database



RDBMS - Introduction

16

- RDBMS – Relational Database Management System
- RDBMS – Software programs that provide the tools for creating and maintaining database structures such as DB2, Oracle, and Microsoft SQL Server
- Every RDBMS must have standard Structured Query Language (SQL) integrated
- Data in databases is retrieved, created, modified, and updated using SQL

RDBMS – Examples

17

Leading RDBMS

Oracle –
by Oracle
Corp

MS SQL –
by
Microsoft

DB2 – by
IBM

Terminology (Value-Related Terms)

18

- Data is static values stored in the database
- Information is data which has been processed
- Null means missing or unknown value. Null does not represent spaces or zeroes.
- Table is the primary structure in a database and represents a single subject.
- View is a virtual table created from fields from one or more tables.

Tables & Attributes

19

Elements of the ideal table are:

- It represents a single subject, which can be an object or event.
- It does not contain multipart or multi-valued fields.

Elements of the ideal field/attributes are:

- It represents a distinct characteristic of the subject of the table.
- It contains only a single value.
- It cannot be deconstructed into smaller components.

Table Keys

20

Keys are crucial to the table structure.

- They ensure that each record in a table is precisely identified.
- They help establish and enforce various types of integrity.
- They serve to establish table relationships.

Table Keys

21

- **Primary key** uniquely identifies each row in the table.
- **Foreign key** creates a relationship between the two tables. Therefore values of a foreign key must match existing values of the primary key to which it refers.
- **Unique key** refers to the set of columns which have a unique set of values for each row of the table.
- **Candidate Key:** A candidate key has all the characteristics to be a primary key.

Primary Key

22

Characteristics of a primary key

- Must uniquely and exclusively identify each record in the table
- Does not contain Null values
- Does not cause a breach of the organization's security or privacy rules.

Establishing Table Relationships

23

- **Table Relationships**
 - exist between tables when records from one table can be related to the record of another table
 - Relationships are formed through primary and foreign keys or through a *linking table*
- **Table relationships are important because they:**
 - Establish a connection between related tables
 - Minimize redundant data

ERD - Entity Relationship Diagram

24

- A graphical representation of the entities (Tables) and their relationships.
- Three Main Components of ERDs:
 - Entity
 - Relationship
 - Cardinality (1-1; 1-M; M-N)

Normalization

25

- The process of making the database more flexible by reducing data redundancy and inconsistent dependencies
 - Process of decomposing large tables into smaller tables to eliminate redundant data
- Typically, databases are normalized to the Third Normal form

Normalization – Third Normal

26

Table to Normalization

Student #	Advisor	Adv-Room	Class1	Class2	Class3
1022	Jones	412	101-07	143-01	159-02
4123	Smith	216	201-01	211-02	214-01

Registration Table

Student #	Class#
1022	101-07
1022	143-01
1022	159-02
4123	201-01
4123	211-02
4123	214-01

Student Table

Student#	Advisor
1022	Jones
4123	Smith

Faculty Table

Advisor	Room
Jones	412
Smith	216