# Database Programming Revision

## Lecture 1: Introduction to Oracle

SQL flavours:

* DDL Data Definition language – create objects
* DML Data Manipulation Language – Insert, Update, Delete, Select
* DCL – Data Control Language (for DBAs)

Primary Key: A **primary key** is a single field or combination of fields that uniquely defines a record. None of the fields that are part of the primary key can contain a null value. A table can have only one primary key.

Foreign Key: A **foreign key** means that values in one table must also appear in another table.

The referenced table is called the **parent table** while the table with the foreign key is called the **child table**. The foreign key in the child table will generally reference a [**primary key**](http://www.techonthenet.com/oracle/primary_keys.php) in the parent table.

Alternate Key: A unique identifier which is not the primary key. E.g. a tax file number of an employee is an alternate key where empno is the primary key.

Referential Integrity: Maintaining the relationships between tables. Eg delete a record from one table, you must delete it from the child tables as referenced by a PK-FK relationship.

## Lecture 2: Introduction to PL\*SQL

Based on ADA language

Modular: based on blocks (anonymous or named)

Scope: variables available within their context (a block, global, etc)

Anchored data: such as %rowtype – anchors the variable to a database table definition

Cursor: defines a pointer to the outpot of the sql statement. Cursor for loop allows us to traverse through the records one at a time. Access elements by record.column.

Predicates: BETWEEN, LIKE, IS NULL, EXISTS

## Lecture 3: Control structures

FOR record IN cursor

LOOP

...

END LOOP;

## Lecture 4: Procedures, functions, triggers

Modularisation is using methods. The code should be more reusable, manageable, readable and reliable. We can use anonymous blocks, procedures, functions and packages.

Find modules in user\_objects, see the code in user\_source

In isql use exec keyword to run a procedure

Parameters can be by name or order

Modules can have the same name and different number of parameters, like multiple constructors

Triggers execute on an event – before or after an insert, update or delete. They implement database assertions, perform audit functionality, maintain data integrity, automate housekeeping etc.

Raise:

## Lecture 5: Exceptions

Exceptions prevent disfunction due to:

* Logic errors in the program
* Invalid inputs
* Failure of hardware and software supporting the database

Transactions are a logical unit of work which must be either committed or rolled back. The code determines what is a transaction.

Autonomous transactions are declared with PRAGMA AUTONOMOUS\_TRANSACTION; and the commit will not impact the main transaction.

## Lecture 6: Cursors, Collections, Records

CURSOR: CURrent Set Of Records

Implicit cursor is created and used by the system when we use DML such as SELECT INTO, INSERT, UPDATE, DELETE

Explicit cursor is created with the CURSOR keyword by the user when you want to work with multiple records.

A record is a group of related data items stored in fields, each with name and type. Using records allow you to treat the data as a logical unit. The benefit is the ability for data abstraction, aggregate operations and leaner code.

Table based record r\_employee employee%rowtype;

Cursor based record DECLARE CURSOR c\_emp IS SELECT...; r\_employee c\_emp%rowtype;

Collections can be implemented as associative arrays. They are useful for in-memory processing where we can use random and bi-directional access to records in a set.

## Lecture 7: Packages

Package is a grouping of PLSQL code elements. Allows us to hide logic and data from view and define and manipulate global or session variables.

The benefits:

* Maintainability: groups like functionality
* Performance: package loads into memory once
* Extensibility: can be used to enhance weak functionality in existing packages
* Security: can implement access table through a package to restrict based on privileges and changes defined in the package

## Lecture 8: File manipulation and dynamic SQL

Utl\_file: Declare, fOpen, put\_line, fclose

Dynamic SQL: used for dynamic reports where the DML is not created until runtime. The SQL statements may depend on user input, program processing or remotely stored statements.

## Lecture 9/10: System Administration

DBP Tasks:

* User privileges
* Tables/Indexes, tablespaces, file systems
* Backup/restore
* Redo logs

User types:

* DBA
* Security workers
* Network administrators (operations)
* Application developers
* Application administrators (production support)
* General database users

Create user, give create session privilege

Objects created in and owned by the user’s schema

Create role, grant privileges to roles, grant roles to users

Synonyms for data independence and location transparency

Export: export data at various levels (table, user, tablespace or all)

Import: restore one or more objects from the export dump. Benefit is that selective backup/restore is possible

Physical backup copies the files that constitute the database. Offline copies all files. Online copies redo logs. Restore involves running the redo log.

Other backup strategies include replication, RAID, mirroring, hot swaps.

## Lecture 11: Performance tuning the database

Performance must meet user needs.

Rule-based optimiser always prefers index lookup. Outdated.

Cost-based optimiser calculates the cost of each path and takes the quickest path. Based on last stats run – DBMS\_STATS.

Large tables can benefit from an index to more quickly find data. Indexing works best on tables that are changed seldom with large volume.

Balanced trees used to find data quicker.

Selectivity: range of values. A DOB column would have high selectivity.

CREATE INDEX loc\_index on DBP\_POSTCODES(Location); Use the columns in WHERE.

Indexes will be disused if you look for: “not equals”, NULL, LIKE ‘%...’, UPPER(indexedcolumn)

Atomicity: all or nothing

Consistency: from one valid state to another

Isolation: concurrent or serial should produce same result

Durability: once committed, it remains so