# A Simple Example

```
import java.sql.*;
import java.io.*;
class simple {
  public static void main (String args [])
      throws SQLException, IOException {

    try {
      Class.forName ("oracle.jdbc.driver.OracleDriver");
    } catch (ClassNotFoundException e) {
        System.out.println ("Could not load the driver");
      }
    String user, pass;
    user = readEntry("userid  : ");
    pass = readEntry("password: ");
    Connection conn = DriverManager.getConnection(
                "jdbc:oracle:oci7:"+user+"/"+pass);

    Statement stmt = conn.createStatement ();

    ResultSet rset = stmt.executeQuery
           ("select eno,ename,zip,hdate from employees");
    while (rset.next ()) {
      System.out.println(rset.getString(1) + "  " +
                         rset.getString(2) + "  " +
                         rset.getString(3) + "  " +
                         rset.getString(4));
    }
    stmt.close();
    conn.close();
  }
```

# Developing JDBC Applications

The basic steps involved in developing JDBC applications are:

1. Import the JDBC classes (`java.sql.*`).
2. Load the JDBC drivers.
3. Connect to the database.
4. Interact with the database using JDBC.
5. Disconnect from database.

# Using the `Statement` object

```
void add_catalog(Connection conn)
  throws SQLException, IOException {

  Statement stmt = conn.createStatement();

  String cnum   = readEntry("Course Number: ");
  String ctitle = readEntry("Course Title : ");
  String query = "insert into catalog values (" +
          "'" + cnum + "','" + ctitle + "')";
  try {
    int nrows = stmt.executeUpdate(query);
  } catch (SQLException e) {
      System.out.println("Error Adding Catalog Entry");
      while (e != null) {
        System.out.println("Message:"+e.getMessage());
        e = e.getNextException();
      }
      return;
    }
  stmt.close();
  System.out.println("Added Catalog Entry");
}
```

```
void create_table(Connection conn)
  throws SQLException, IOException {
  String query =  "create table deleted_scores (" +
           "sid       varchar2(5) not null," +
           "term      varchar2(10) not null," +
           "lineno    number(4) not null," +
           "compname  varchar2(15) not null," +
           "points    number(4) check(points >= 0))";

  Statement stmt = conn.createStatement ();
  try {
    stmt.executeUpdate(query);
  } catch (SQLException e) {
      System.out.println("Could not create table");
      while (e != null) {
        System.out.println("Message:"+e.getMessage());
        e = e.getNextException();
      }
      return;
    }
  System.out.println("Table created");
  stmt.close();
}
```

```
void drop_student(Connection conn,
                  String term_in, String ls)
    throws SQLException, IOException {

  String id = readEntry("Student ID to drop: ");
  String query0 = "insert into deleted_scores " +
    "select * from scores where sid = '" + id +
    "' and term = '" + term_in + "' and lineno = " + ls;
  String query1 = "delete scores where sid = '" + id +
    "' and term = '" + term_in + "' and lineno = " + ls;
  String query2 = "delete enrolls where sid = '" + id +
    "' and term = '" + term_in + "' and lineno = " + ls;

  conn.setAutoCommit(false);
  Statement stmt = conn.createStatement ();
  int nrows;
  try {
    nrows = stmt.executeUpdate(query0);
    nrows = stmt.executeUpdate(query1);
    nrows = stmt.executeUpdate(query2);
  } catch (SQLException e) {
      System.out.println("Could not drop student");
      while (e != null) {
        System.out.println("Message: "+e.getMessage());
        e = e.getNextException();
      }
      conn.rollback();
      return;
    }
  System.out.println("Dropped student");
  conn.commit();
  conn.setAutoCommit(true);
  stmt.close();
}
```

# Using the `PreparedStatement` object

```
void add_students(Connection conn)
    throws SQLException, IOException {

  String id, ln, fn, mi;
  PreparedStatement stmt = conn.prepareStatement(
    "insert into students values (?, ?, ?, ?)"  );
  do {
    id = readEntry("ID (0 to stop): ");
    if (id.equals("0"))
      break;
    ln = readEntry("Last  Name    : ");
    fn = readEntry("First Name    : ");
    mi = readEntry("Middle Initial: ");
    try {
      stmt.setString(1,id);
      stmt.setString(2,fn);
      stmt.setString(3,ln);
      stmt.setString(4,mi);
      stmt.executeUpdate();
    } catch (SQLException e) {
      System.out.println("Error adding student");
    }
  } while (true);
  stmt.close();
}
```

# Using the `CallableStatement` object

```
import java.sql.*;
import java.io.*;
class call3 {
  public static void main (String args [])
      throws SQLException, IOException {
    try {
      Class.forName ("oracle.jdbc.driver.OracleDriver");
    } catch (ClassNotFoundException e) {
        System.out.println ("Could not load the driver");
      }
    String user, pass;
    user = readEntry("userid  : ");
    pass = readEntry("password: ");
    Connection conn = DriverManager.getConnection
      ("jdbc:oracle:oci7:"+user+"/"+pass);

    int enum = readNumber("Enter the employee number: ");
    int cnum = readNumber("Enter the customer number: ");
    int onum = readNumber("Enter the order    number: ");
    CallableStatement stmt = conn.prepareCall
      ("{call process_orders.add_order(?,?,?,?)}");
    stmt.setInt(1,onum);
    stmt.setInt(2,cnum);
    stmt.setInt(3,enum);
    stmt.setNull(4,Types.DATE);
    conn.setAutoCommit(false);
```

```
  try {
    stmt.executeUpdate();
  } catch (SQLException e) {
      System.out.println("Could not add order");
      conn.rollback();
      return;
    }
  stmt = conn.prepareCall
    ("{call process_orders.add_order_details(?,?,?)}");
  do {
    int pnum = readNumber(
        "Enter the part number (0 to stop): ");
    if (pnum == 0)
      break;
    int qty = readNumber("Enter the quantity   : ");
    stmt.setInt(1,onum);
    stmt.setInt(2,pnum);
    stmt.setInt(3,qty);
    try {
      stmt.executeUpdate();
    } catch (SQLException e) {
        System.out.println("Could not add odetail");
      }
  } while (true);
conn.commit();
conn.setAutoCommit(true);
stmt.close();
conn.close();
}
```

```
import java.sql.*;
import java.io.*;
class call1 {
  public static void main (String args [])
      throws SQLException, IOException {
    try {
      Class.forName ("oracle.jdbc.driver.OracleDriver");
    } catch (ClassNotFoundException e) {
        System.out.println ("Could not load the driver");
      }
    String user, pass;
    user = readEntry("userid  : ");
    pass = readEntry("password: ");
    Connection conn = DriverManager.getConnection
      ("jdbc:oracle:oci7:"+user+"/"+pass);

    String cnum = readEntry(
      "Enter the customer number to find city: ");
    CallableStatement stmt =
      conn.prepareCall ("{? = call get_city (?)}");
    stmt.setString(2,cnum);
    stmt.registerOutParameter(1,Types.VARCHAR);
    stmt.execute();
    String city = stmt.getString(1);
    if (stmt.wasNull())
      System.out.println("Customer's city = Null");
    else
      System.out.println("Customer's city = "+
                         stmt.getString(1));
    stmt.close();
    conn.close();
  }
}
```

# Executing SQL Queries

```
void print_report(Connection conn,
                  String term_in, String ls)
      throws SQLException, IOException {

  String query0 = "select a, b, c, d from courses " +
    "where term = '" + term_in + "' and lineno = " + ls;

  String query1 = "select compname, maxpoints, weight " +
    "from components where term = '" + term_in +
    "' and lineno = " + ls;

  String query2 = "select E.sid, S.lname, S.fname " +
    "from enrolls E, students S " +
    "where S.sid = E.sid and " +
    "E.term = '" + term_in + "' and " +
    "E.lineno = " + ls + " order by lname, fname";

  String query3 = "select points " + "from scores " +
     "where term = '" +  term_in + "' and " +
     "lineno = '" + ls + "' and " +
     "sid = ? and " +    // substitute ? by sid
     "compname = ?";  // substitute ? by compname
```

```
double total;
int scaleA, scaleB, scaleC, scaleD;
// Read the grade cut off points from courses
Statement stmt = conn.createStatement ();
ResultSet rset0;
try {
  rset0 = stmt.executeQuery(query0);
} catch (SQLException e) {
    System.out.println("Problem reading scales");
    while (e != null) {
      System.out.println("Message:"+e.getMessage());
      e = e.getNextException();
    }
    return;
  }
rset0.next();
scaleA = rset0.getInt(1);
scaleB = rset0.getInt(2);
scaleC = rset0.getInt(3);
scaleD = rset0.getInt(4);
```

```
System.out.print("SID  LNAME       FNAME     ");
// Read the component information into arrays
ResultSet rset1;
try {
  rset1 = stmt.executeQuery(query1);
} catch (SQLException e) {
    System.out.println("Problem reading components");
    while (e != null) {
      System.out.println("Message:"+e.getMessage());
      e = e.getNextException();
    }
    return;
  }
String comp_names[] = new String[20];
double comp_maxpoints[] = new double[20];
double comp_weight[] = new double[20];
int ncomps=0;
while (rset1.next()) {
  System.out.print(rset1.getString(1)+" ");
  comp_names[ncomps] = rset1.getString(1);
  comp_maxpoints[ncomps] = rset1.getDouble(2);
  comp_weight[ncomps] = rset1.getDouble(3);
  ncomps++;
}
```

```
System.out.println("AVG    GRADE");
// Read the students enrolled in the class
// For each student and for each grade component,
// read the score, print and keep total
ResultSet rset2;
try {
  rset2 = stmt.executeQuery(query2);
} catch (SQLException e) {
    System.out.println("Problem reading students");
    while (e != null) {
      System.out.println("Message:"+e.getMessage());
      e = e.getNextException();
    }
    return;
  }
```

```
PreparedStatement stmt2 =
  conn.prepareStatement(query3);
while (rset2.next()) {
  total = 0.0;
  System.out.print(rset2.getString(1)+" ");
  System.out.print(rset2.getString(2));
  for (int k=0;
       k < (12-rset2.getString(2).length()); k++)
    System.out.print(" ");
  System.out.print(rset2.getString(3));
  for (int k=0;
       k < (12-rset2.getString(3).length()); k++)
    System.out.print(" ");
```

```
for (int i=0; i < ncomps; i++) {
  stmt2.setString(1,rset2.getString(1));
  stmt2.setString(2,comp_names[i]);
  ResultSet rset3;
  try {
    rset3 = stmt2.executeQuery();
  } catch (SQLException e) {
      System.out.println("Problem reading scores");
      while (e != null) {
        System.out.println("Message:"+e.getMessage());
        e = e.getNextException();
      }
      return;
    }
  try {
    rset3.next();
  } catch (SQLException e) {
      System.out.println("No entry for " +
        rset2.getString(3) + " in " + comp_names[i]);
      while (e != null) {
        System.out.println("Message:"+e.getMessage());
        e = e.getNextException();
      }
      continue;
    }
```

```
      total = total +
               ((rset3.getDouble(1)/comp_maxpoints[i])*
               comp_weight[i]);
      System.out.print(rset3.getString(1));
    }

    // Print the total and grade.
    Double tot = new Double(total);
    for (int k2=0;
         k2 < (6-tot.toString().length()); k2++)
      System.out.print(" ");
    System.out.print(total + "      ");
    if (total >= scaleA) System.out.println("A");
    else if (total >= scaleB) System.out.println("B");
    else if (total >= scaleC) System.out.println("C");
    else if (total >= scaleD) System.out.println("D");
    else System.out.println("F");
 }
 stmt.close();
}
```

# ResultSet metadata – SQL Interpreter

```
import java.sql.*;
import java.io.*;
class meta3 {
public static void main (String args [])
    throws SQLException, IOException {

  try {
    Class.forName ("oracle.jdbc.driver.OracleDriver");
  } catch (ClassNotFoundException e) {
      System.out.println ("Could not load the driver");
    }

  String user, pass;
  user = readEntry("userid  : ");
  pass = readEntry("password: ");
  Connection conn = DriverManager.getConnection(
     "jdbc:oracle:oci7:"+user+"/"+pass);

  System.out.println("Welcome to the SQL Interpreter\n");
  System.out.print("SQL> ");
```

```
Statement stmt = conn.createStatement ();
do {
  String query = readQuery();
  if (query .equals("exit"))
    break;
  ResultSet rset;
  try {
    rset = stmt.executeQuery(query);
  } catch (SQLException e) {
      System.out.println("Not well formed query");
      continue;
    }
  ResultSetMetaData rsetmd = rset.getMetaData();
  int nCols;
  nCols = rsetmd.getColumnCount();
  for (int i = 1; i <= nCols; i++) {
    System.out.print(rsetmd.getColumnName(i));
    int colSize = rsetmd.getColumnDisplaySize(i);
    for (int k=0;
         k < colSize-rsetmd.getColumnName(i).length();
         k++)
      System.out.print(" ");
  }
  System.out.println("");
```

```
    while (rset.next ()) {
      for (int i = 1; i <= nCols; i++) {
        String val = rset.getString(i);
        if (rset.wasNull())
          System.out.print("null");
        else
          System.out.print(rset.getString(i));
        int colSize;
        if (rset.wasNull()) colSize = 4;
        else colSize = rsetmd.getColumnDisplaySize(i);
        if (rset.wasNull()) {
          for (int k=0; k < colSize-4; k++)
            System.out.print(" ");
        }
        else {
          for (int k=0;
               k < colSize-rset.getString(i).length();
               k++)
            System.out.print(" ");
        }
      }
      System.out.println("");
    }
  } while (true);
  stmt.close();
  conn.close();
  System.out.println("Thank you for using the SQL"+
                     " Interpreter\n");
}
```

```
//readQuery function
static String readQuery() {
   try {
     StringBuffer buffer = new StringBuffer();
     System.out.flush();
     int c = System.in.read();
     while(c != ';' && c != -1) {
        if (c != '\n')
          buffer.append((char)c);
        else {
          buffer.append(" ");
          System.out.print("SQL> ");
          System.out.flush();
        }
        c = System.in.read();
      }
      return buffer.toString().trim();
    } catch (IOException e) {
      return "";
      }
  }
}
```

# Oracle REFCURSOR type

```
create or replace package refcursor_jdbc as
  type refcurtype is ref cursor;
  function get_courses (term_in varchar2)
           return refcurtype;
end refcursor_jdbc;
/
show errors
create or replace package body refcursor_jdbc as
  function get_courses (term_in varchar2)
           return refcurtype as
    rc refcurtype;
  begin
   open rc for
     select lineno, courses.cno, ctitle
     from   courses, catalog
     where  courses.cno = catalog.cno and
            courses.term = term_in;
   return rc;
  end;
end refcursor_jdbc;
/
show errors
```

```
import java.sql.*;
import java.io.*;
import oracle.jdbc.driver.*;

class refcur {
  public static void main (String args [])
       throws SQLException, ClassNotFoundException {

    try {
      Class.forName ("oracle.jdbc.driver.OracleDriver");
    } catch (ClassNotFoundException e) {
        System.out.println ("Could not load the driver");
      }

    String user, pass;
    user = readEntry("userid  : ");
    pass = readEntry("password: ");
    Connection conn = DriverManager.getConnection
       ("jdbc:oracle:oci7:"+user+"/"+pass);

    String term_in = readEntry("Enter Term: ");

    CallableStatement cstmt = conn.prepareCall
        ("{ ? = call refcursor_jdbc.get_courses (?)}");

    cstmt.registerOutParameter (1, OracleTypes.CURSOR);
    cstmt.setString (2, term_in);
    cstmt.execute ();
    ResultSet rset = (ResultSet)cstmt.getObject(1);
```

```
    System.out.println("Courses offered during " +
                       term_in + " are:");
    while (rset.next ()) {
      System.out.print(rset.getString(1) + "  ");
      System.out.print(rset.getString(2) + "  ");
      System.out.println(rset.getString(3));
    }
    cstmt.close();
    conn.close();
  }
}
```

# Processing multiple `ResultSet`s

```
import oracle.jdbc.driver.*;
import java.sql.*;
import java.io.*;

class call2 {
 public static void main (String args [])
     throws SQLException, IOException {

  try {
    Class.forName ("oracle.jdbc.driver.OracleDriver");
   } catch (ClassNotFoundException e) {
       System.out.println ("Could not load the driver");
     }

  String user, pass;
  user = readEntry("userid  : ");
  pass = readEntry("password: ");
  Connection conn = DriverManager.getConnection
     ("jdbc:oracle:oci7:"+user+"/"+pass);

  String cnum = readEntry("Enter customer number: ");
  CallableStatement cstmt;
  ResultSet rset;
```

```
cstmt = conn.prepareCall
 ("begin " +
  "open ? for select count(*) from orders " +
    "where cno = ?;" +
  "open ? for select ono,received from orders " +
    "where cno = ?;" +
  "open ? for select orders.ono,parts.pno,pname,qty " +
    "from orders,odetails,parts where " +
    "orders.ono = odetails.ono and " +
    "odetails.pno = parts.pno " +
    "and cno = ?;" +  "end;");

cstmt.setString(2,cnum);
cstmt.setString(4,cnum);
cstmt.setString(6,cnum);
cstmt.registerOutParameter (1, OracleTypes.CURSOR);
cstmt.registerOutParameter (3, OracleTypes.CURSOR);
cstmt.registerOutParameter (5, OracleTypes.CURSOR);
cstmt.execute ();
```

```
  rset = ((OracleCallableStatement)cstmt).getCursor(1);
  while (rset.next ()) {
    System.out.println ("Customer has " +
                    rset.getString(1) + " orders");
  }
  System.out.println("The orders are:");
  rset = ((OracleCallableStatement)cstmt).getCursor(3);
  while (rset.next ()) {
    System.out.print("Order Number " +
                    rset.getString(1));
    System.out.println(":Received on " +
                       rset.getDate(2).toString());
  }
  System.out.println("The order details are:");
  System.out.println("ONO   PNO    PNAME    QUANTITY");
  rset = ((OracleCallableStatement)cstmt).getCursor(5);
  ResultSetMetaData rsetmd = rset.getMetaData();
  while (rset.next ()) {
    System.out.print(rset.getString(1));
    System.out.print(" " + rset.getString(2));
    System.out.print(" " + rset.getString(3));
    for (int k=0;
         k<(rsetmd.getColumnDisplaySize(3)-
            rset.getString(3).length()); k++)
      System.out.print(" ");
    System.out.println(" " + rset.getString(4));
  }
  cstmt.close();
  conn.close();
 }
}
```

# Database Metadata

```
import java.sql.*;
import java.io.*;

class meta2 {
  public static void main (String args [])
      throws SQLException, IOException {

    try {
      Class.forName ("oracle.jdbc.driver.OracleDriver");
    } catch (ClassNotFoundException e) {
        System.out.println ("Could not load the driver");
      }
    String user, pass;
    user = readEntry("userid  : ");
    pass = readEntry("password: ");
    Connection conn = DriverManager.getConnection(
      "jdbc:oracle:oci7:"+user+"/"+pass);

    DatabaseMetaData dmd = conn.getMetaData();

    System.out.println("Database Product Name = " +
           dmd.getDatabaseProductName());
    System.out.println("JDBC Driver Name = " +
           dmd.getDriverName());
```

```
    System.out.println("Tables starting with C " +
                       "in schema BOOK are:");
    ResultSet rset = dmd.getTables(null,"BOOK","C%",null);
    while (rset.next()) {
      System.out.println(rset.getString(3));
         // print table name
    }
    int n = dmd.getMaxColumnsInTable();
    System.out.println("Maximum number of columns " +
                       "allowed in a table = " + n);

    conn.close();
  }
}
```