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# Essential Data Skills for Business Analytics

## Lecture 10 (04/03, 04/05): Database operations

**Decision, Operations & Information Technologies**
**Robert H. Smith School of Business**
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# Steps

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- Install MySQL
  - On Microsoft Windows
    - https://dev.mysql.com/doc/refman/5.6/en/windows-installation.html
  - On Mac OS X
    - https://dev.mysql.com/doc/refman/5.6/en/osx-installation.html
- Install MySQL-python package: MySQLdb
  - Under the terminal: pip install MySQL-python

# Database connection

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```
#!/usr/bin/python

import MySQLdb

# Open database connection
db = MySQLdb.connect("localhost","testuser","test123","TESTDB" )

# prepare a cursor object using cursor() method
cursor = db.cursor()

# execute SQL query using execute() method.
cursor.execute("SELECT VERSION()")



# disconnect from server
db.close()
```

Import the package

User name, password, database name

# Create database tables

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```
#!/usr/bin/python

import MySQLdb

# Open database connection
db = MySQLdb.connect("localhost","testuser","test123","TESTDB" )

# prepare a cursor object using cursor() method
cursor = db.cursor()

# Drop table if it already exist using execute() method.
cursor.execute("DROP TABLE IF EXISTS EMPLOYEE")

# Create table as per requirement
sql = """CREATE TABLE EMPLOYEE (
         FIRST_NAME  CHAR(20) NOT NULL,
         LAST_NAME  CHAR(20),
         AGE INT,
         SEX CHAR(1),
         INCOME FLOAT )"""

cursor.execute(sql)

# disconnect from server
db.close()
```

Execute the SQL statement

# Insert operation

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```
#!/usr/bin/python

import MySQLdb

# Open database connection
db = MySQLdb.connect("localhost","testuser","test123","TESTDB" )

# prepare a cursor object using cursor() method
cursor = db.cursor()

# Prepare SQL query to INSERT a record into the database.
sql = """INSERT INTO EMPLOYEE(FIRST_NAME,
         LAST_NAME, AGE, SEX, INCOME)
         VALUES ('Mac', 'Mohan', 20, 'M', 2000)"""
try:
   # Execute the SQL command
   cursor.execute(sql)
   # Commit your changes in the database
   db.commit()
except:
   # Rollback in case there is any error
   db.rollback()

# disconnect from server
db.close()
```

Commit your insertion

Database rollback

# Insert operation

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Values can be dynamically inserted into the database.

```
#!/usr/bin/python

import MySQLdb

# Open database connection
db = MySQLdb.connect("localhost","testuser","test123","TESTDB" )

# prepare a cursor object using cursor() method
cursor = db.cursor()

# Prepare SQL query to INSERT a record into the database.
sql = "INSERT INTO EMPLOYEE(FIRST_NAME, \
       LAST_NAME, AGE, SEX, INCOME) \
       VALUES ('%s', '%s', '%d', '%c', '%d' )" % \
       ('Mac', 'Mohan', 20, 'M', 2000)
try:
   # Execute the SQL command
   cursor.execute(sql)
   # Commit your changes in the database
   db.commit()
except:
   # Rollback in case there is any error
   db.rollback()

# disconnect from server
db.close()
```

**%s: string**
**%d: integer**
**%c: character**
**%f: float**

# Insert operation

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- You can pass parameters directly into SQL execution statement

```
user_id = "test123"
password = "password"

cursor.execute('insert into Login values("%s", "%s")' % (user_id, password))
```

# Read operation

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- Read operation on any database means to fetch data from the database.
  - **fetchone**: it fetches the next row of a query result set. A result set is an object that is returned when a cursor object is used to query a table
  - **fetchall**: it fetches all the rows in a result set.
  - **rowcount**: this is a read-only attribute and returns the number of rows that were affected by an execute method.

# Read operation

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```
#!/usr/bin/python

import MySQLdb

# Open database connection
db = MySQLdb.connect("localhost","testuser","test123","TESTDB" )

# prepare a cursor object using cursor() method
cursor = db.cursor()

# Prepare SQL query to INSERT a record into the database.
sql = "SELECT * FROM EMPLOYEE \
       WHERE INCOME > '%d'" % (1000)
try:
   # Execute the SQL command
   cursor.execute(sql)
   # Fetch all the rows in a list of lists.
   results = cursor.fetchall()
   for row in results:
      fname = row[0]
      lname = row[1]
      age = row[2]
      sex = row[3]
      income = row[4]
      # Now print fetched result
      print "fname=%s,lname=%s,age=%d,sex=%s,income=%d" % \
             (fname, lname, age, sex, income )
except:
   print "Error: unable to fecth data"

# disconnect from server
db.close()
```

# Update operation

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**Update** operation on any database means to update one or more records, which are already available in the database.

```
#!/usr/bin/python

import MySQLdb

# Open database connection
db = MySQLdb.connect("localhost","testuser","test123","TESTDB" )

# prepare a cursor object using cursor() method
cursor = db.cursor()

# Prepare SQL query to UPDATE required records
sql = "UPDATE EMPLOYEE SET AGE = AGE + 1
                          WHERE SEX = '%c'" % ('M')
try:
   # Execute the SQL command
   cursor.execute(sql)
   # Commit your changes in the database
   db.commit()
except:
   # Rollback in case there is any error
   db.rollback()

# disconnect from server
db.close()
```

# Delete operation

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**Delete** operation is required when you want to delete some records from your database.

```
#!/usr/bin/python

import MySQLdb

# Open database connection
db = MySQLdb.connect("localhost","testuser","test123","TESTDB" )

# prepare a cursor object using cursor() method
cursor = db.cursor()

# Prepare SQL query to DELETE required records
sql = "DELETE FROM EMPLOYEE WHERE AGE > '%d'" % (20)
try:
   # Execute the SQL command
   cursor.execute(sql)
   # Commit your changes in the database
   db.commit()
except:
   # Rollback in case there is any error
   db.rollback()

# disconnect from server
db.close()
```

# Transactions

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- Transactions are a mechanism that ensures data consistency. It has ACID properties:
  - **Atomicity**: either a transaction completes or nothing happens at all.
  - **Consistency**: a transaction must start in a consistent state and leave the system in a consistent state.
  - **Isolation**: intermediate results of a transaction are not available outside the current transaction.
  - **Durability**: Once a transaction was committed, the effects are persistent, even after a system failure.

# Performing transactions

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- COMMIT operation: it gives a green signal to database to finalize the changes, and after this operation, no change can be reverted back.
  - db.commit()
- ROLLBACK operation: if you are not satisfied with one or more of the changes and you want to revert back those changes completely, then use rollback method.
  - db.rollback()
- DISCONNECT database
  - db.close()