UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

# Faculty of Engineering, Built Environment and Information Technology

# Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie

School of Information Technology

Department of Computer Science

**Database Systems**
**COS 326**


Lecturer: Dr. Patricia E.N. Lutu


Last Revision: 10 August 2016, Version 2

## Table of Contents



# Overview

## Description

This module builds on prior modules on relational database systems and provides coverage of other types of database systems that are used in the modern (business) organization database environment.

## Prerequisites

INF 214, *Databases and database design* or permission from the Head of Department.

## Related modules

INF 214, *Databases and database design* **INF 261** *Database management*

## Study units

This course reviews relational database technology and then introduces the student to other database paradigms: object-oriented databases, object-relational databases, semi-structured databases and NoSQL databases. The course also covers advanced database topics in data analytics. The following study units are covered in the course.

**a. Database models**

i. Review of relational databases (revision)
ii. Object-oriented databases
iii. Object-relational databases
iv. Semi-structured databases (XML)
v. NoSQL databases

**b. Data analytics**

i. data mining
ii. analytics for Big Data

# Outcomes

## Study units and outcomes for the ACM curriculum

To be updated.

# Plagiarism Policy

This department considers plagiarism as a serious offence. Disciplinary action will be taken against students who commit plagiarism. For a formal definition of plagiarism the students are referred to http://www.ais.up.ac.za/plagiarism/index.htm (from the UP Main page follow the Library quick link and then click the Plagiarism link).

# Instructors

## Lecturers and teaching assistants

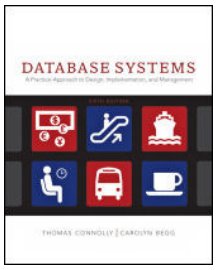
| Name | Capacity | Office | e-mail address and phone |
|---|---|---|---|
| Dr. Patricia E.N. Lutu | Lecturer and course coordinator | IT 5-41 | plutu@cs.up.ac.za<br>xt 4116 |
| Benjamin Shilakwe | Teaching Assistant | | bshilakwe@gmail.com |
| Semaka Malapane | Teaching Assistant | | u13081129@tuks.co.za |
| Szymon Ziolkowski | Teaching Assistant | | nomyzs.z@gmail.com |

## Communication

When communicating by email, ALWAYS give the module code and your full name, including your surname and your student number.

# Study Material

## Prescribed / Recommended



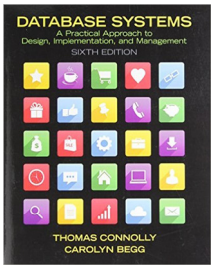

Thomas Connolly and Carolyn Begg

*Database Systems – A Practical Approach to Design, Implementation, and Management*

Addison Wesley, 5th edition 2010

ISBN: 10 0-321-52306-7

ISBN: 13 978-0-321-52306-8




Thomas Connolly and Carolyn Begg

*Database Systems – A Practical Approach to Design, Implementation, and Management*

Addison Wesley, 6th edition 2015

ISBN 10: 1-292-06118-9

ISBN 13: 978-1-292-06118-4

You may use either the 5th or 6th edition. The 5th edition of the book is available in the Reference section of the library. The library will also make the following chapters of the 5th edition available via their website: Chapters: 8, 27, 29, 31.

## Additional references

Additional notes and references will be provided on the COS326 website.

## Software

Software for the course will be made available on the CS web site at http://www.cs.up.ac.za/courses/COS326. The following software will be used for the practicals:

| Software | Available from | Purpose |
|---|---|---|
| db4objects 8.0 | COS326 website | Object databases |
| PostgreSQL version 9.2 | http://www.PostgreSQL.org | Relational databases and SQL<br>Object Relational databases |
| BaseX | http://basex.org | XML databases |
| MongoDB | http://www.mongodb.org/downloads | NoSQL Document databases |
| Neo4j | http://www.neo4j.org/download | NoSQL Graph databases |

# Assignment

You are required to work in groups of four or five and select one of the assignment topics and a date for the presentation as indicated on the lecture schedule below. You should hand in the assignment on the Friday prior to your presentation date. During the second part of the lecture that you selected, you will have 10 minutes to present your assignment. More details about the assignment will be posted on the COS326 website. Each group will receive a mark for the essay and the presentation. The presentation marks will be awarded by the class.

# Assessment

## Mark allocation

| Activity | Attendance requirement | Contribution to final mark | Sick procedure |
|---|---|---|---|
| 26 lectures | | | |
| 9 practical sessions<br>(7 practical exercises) | 7 practical exercises | Best 6 marks:<br>15% | Make up in own time |
| 3 class tests | at least 2 | Best 2 marks:<br>10% | none |
| Semester test | full attendance | 15% | Medical certificate for the sick test within TWO days after the semester test |
| Assignment and presentation | full attendance | 10% | None. Must be handed in and presented at the scheduled time |
| Written exam | full attendance | 50% | Medical certificate to Faculty Office for sick exam |
| **TOTAL** | | **100%** | |

**Note:**

1. The module consists of the following activities: lectures, practical sessions, tests, and an assignment. Satisfactory attendance in all activities is required.
2. **Exam entrance requirement: A mark of at least 40% for the semester mark.**
3. You must **complete 7 practical exercises.** The best 6 of your practical marks will count. No sick certificates are accepted for practical sessions.
4. You must **attend and complete at least 2 class tests.** The best 2 of your marks count. You may be absent for 1 class test without penalty. No sick certificates are accepted for class tests.

## Mark policy

Marks are posted on the website when ready. Thereafter, they may be queried within **seven working days**, by e-mail or in office hours or during the TAs consultation hours. No late queries will be considered.

# Lectures and practical sessions

## Time table

| Activity | Day | Time | Venue |
|---|---|---|---|
| Lecture 1 | Tuesday | 12:30 – 13:20 | IT 4-2 |
| Lecture 2 | Wednesday | 13:30 – 14:20 | IT 2-24 |
| Practical session | Friday | 12:30 – 15:20 | Red lab, Informatorium |

You are expected to work on the practical exercise for the week before attending the practical session for the week. *The practical exercises will be uploaded a week in advance*. During the practical session you will get assistance from the Teaching Assistants (if you need this). You must upload your submission to the COS326 website before the submission deadline and get a Teaching Assistant to mark your submission during the practical session. Only uploaded work will be marked. You must sign next to your mark before you leave the practical session.

**Lecture plan (subject to change)**

| Wk | Date | Day | Topic | Source / chapters | Assignment Topic presentation |
|---|---|---|---|---|---|
| 1 | 19 Jul | Tues | L1: Course overview | | |
| | 20 Jul | Wed | L2: Object DBMS (1) | Ch. 27 | |
| | 22 Jul | Fri | ***No practical*** | | |
| | | | | | |
| 2 | 26 Jul | Tues | L3: Object DBMS (2) | Ch. 27, 28 | |
| | 27 Jul | Wed | L4: Object-Relational DBMS (1) | Ch. 29 | |
| | 29 Jul | Fri | ***Tutorial 1 & Practical 1: Object DBMS (db4objects)*** | | |
| | | | | | |
| 3 | 2 Aug | Tues | L5: Object-Relational DBMS (2) | Ch. 29 | |
| | **3 Aug** | **Wed** | **No lecture: public holiday** | | |
| | 5 Aug | Fri | ***Tutorial & Practical 2: Object-Relational DBMS (PostreSQL)*** | | |
| | | | | | |
| 4 | 9 Aug | Tues | **No lecture: public holiday** | | |
| | 10 Aug | Wed | L6: Object-Relational DBMS (3) | Ch. 29 | |
| | 12 Aug | Fri | ***Practical 3: Object-Relational DBMS (PostgreSQL)*** | | |
| | | | | | |
| 5 | 16 Aug | Tues | L7: Semi-structured data & XML DBs (1) | Ch. 31 | |
| | 17 Aug | Wed | L8: Semi-structured data & XML DBs (2) | Ch. 31 | |
| | 19 Aug | Fri | ***Practical 4: BaseX and XML*** | | |
| | | | | | |
| **6** | **23 Aug** | Tues | **Class Test 1: OODB and ORDB**<br>L9: Semi-structured data & ORDBs (1) | Notes | |
| | 24 Aug | Wed | L10: Semi-structured data & ORDBs (2) | | 1 |
| | 26 Aug | Fri | ***Practical 5: PostgreSQL and XML*** | | |
| | | | | | |
| 7 | 30 Aug | Tues | L11: Big data and NoSQL database | Notes | 2 |
| | 31 Aug | Wed | L12: NoSQL databases (MongoDB) | Notes | 3 |
| | 2 Sep | Fri | ***Practical 6a: Tutorial on MongoDB*** | | |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | 6 Sept | Tue | L13: NoSQL databases (Mongo DB) | Notes | 4 |
| 8 | **7 Sep** | **Wed** | **UP Spring day: no lecture** | | |
| | **8 Sep** | **Thur** | **Wednesday timetable**<br>L14: NoSQL databases (Mongo DB) | | 5 |
| | 9 Sep | Fri | ***Prac 6b: MongoDB document DB*** | | |
| | | | | | |
| 9 | 13 Sep | Tues | L15: NoSQL databases (Neo4j DB) | Notes | 6 |
| | 14 Sep | Wed | L16: NoSQL databases (Neo4j DB) | Notes | 7 |
| | 16 Sept | Fri | ***Prac7a: Tutorial on Neo4j graph database*** | | |
| | | | | | |
| 10 | 20 Sep | Tues | **Class test 2: XML and NoSQL DBs**<br>L17: NoSQL databases (Neo4j) | Notes | |
| | 21 Sep | Wed | L18: NoSQL databases (Neo4j) | | 8, 9 |
| | 23 Sept | Fri | ***Prac 7b: Neo4j graph database*** | | |
| | | | | | |
| 11 | 27 Sep | Tues | L19: Data Analytics: big data | Notes | 10 |
| | 28 Sep | Wed | **L20:** The modern database environment.<br>Guest lecturer: ORACLE | | |
| | 30 Sep | Fri | no prac | | |
| | | | **Recess 1 Oct to 9 Oct** | | |
| 12 | 11 Oct | Tues | L21: Data Analytics: big data | Notes | 11 |
| | 12 Oct | Wed | L22: Data Analytics: big data | | 12 |
| | 14 Oct | Fri | no prac | | |
| | | | | | |
| 13 | 18 Oct | Tues | **L23:** Big data in the modern business organization. Guest lecturer: SAP | Ch. 35 & journal papers | |
| | 19 Oct | Wed | L24: Data Analytics: data mining | | 13 |
| | 21 Oct | Fri | no prac | | |
| | | | | | |
| 14 | 25 Oct | Tues | **Class test 3: data analytics**<br>L25: Data Analytics: data mining | Ch. 35 & journal papers | |
| | 26 Oct | Wed | L26: Data Analytics: data mining | | 14, 15 |
| | 28 Oct | Fri | no prac | | |
| | | | | | |
| | 1 Nov | Tues | | | |
| | 2 Nov | Wed | | | |

## Class Tests (subject to change)

Class Test 1: Tuesday, 23ugust; Class Test 2: Tuesday, 20September; Class test 3: Tuesday, 25October

## Semester test and exam

**Semester Test** and **Exam:** Information is available from the UP portal.

# Some career opportunities

Data Administrator (DA) , Database Administrator (DBA) , Database Programmer