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# SCSSE

**School of Computer Science and Software Engineering  
Faculty of Informatics**

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## **CSCI317 Database Performance Tuning Subject Outline Spring Session 2009**

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Head of School –Professor Willy Susilo, Student Resource Centre, Tel: (02) 4221 3606

### **GENERAL INFORMATION**

#### **Subject Coordinator**

Telephone Number:

Email:

Location:

Dr Janusz Getta

02 4221 4339

[jrg@uow.edu.au](mailto:jrg@uow.edu.au)

3.210

Dr Getta's consultation times during session:

Day

Tuesday

Wednesday

Time

13.30 – 15.30

9.30 – 11.30

#### **Subject Organisation**

Session:

Credit Points

Contact hours per week:

Lecture Times & Location:

Spring Session, Wollongong Campus

6 credit points

3 hours lectures, 2 hours Computer lab

Lecture A 17:30-19:30 Tues, 3.123

Lecture B 9:30-10:30 Fri, 67.301

Tutorial Day, Time and Location can be found at: <http://www.uow.edu.au/student/timetables/index.html>

Students should check the subject's web site regularly as important information, including details of unavoidable changes in assessment requirements will be posted from time to time via e-Learning space <http://www.uow.edu.au/student/>. Any information posted to the web site is deemed to have been notified to all students.

#### **Subject Description**

The subject addresses the performance problems of relational database systems. In particular, it presents optimisation of query processing in relational database systems, performance tuning of database applications, transaction processing in database systems, optimisation of transaction processing, performance tuning of relational database servers, performance tuning of three tier database applications. Laboratory classes demonstrate the techniques used for elimination of performance problems in database systems. Oracle 9i database management system is used for demonstration purposes and all practical work in the subject.

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*This subject outline can be found at: <http://www.uow.edu.au/informatics/scsse/current>*

### **Subject Objectives:**

On successful completion of this subject, students should be able to:

1. Explain the principles of query processing and optimisation of query processing in relational database systems
2. Evaluate and improve performance of database applications
3. Explain the principles of transaction processing in database systems
4. Improve performance of transaction processing
5. Explain the principles of benchmarking in relational database management systems
6. Evaluate and tune performance of relational database servers.

### **Graduate Qualities**

This subject will continue to the following graduate qualities:

Informed

Independent Learners

Problem Solvers

Further information can be found at:

<http://www.uow.edu.au/informatics/scsse/current/SubjectInformation/UOW049401.html>

### **Attendance Requirements:**

It is the responsibility of students to attend all lectures/tutorials/labs/seminars/practical work for subjects for which you are enrolled. It should be noted that the amount of time spent on each 6 credit point subject should be at least 12 hours per week, which includes lectures/tutorials/labs etc.

Satisfactory attendance is deemed by the University, to be attendance at approximately 80% of the allocated contact hours.

### **Method of Presentation:**

In order to maximize learning outcomes, it is strongly recommended that students attend all lectures.

This subject comprises 3 hr lecture, 2 hrs Computer Lab.

## Lecture Schedule:

A proposed Lecture schedule for the subject is as follows:

Week	Topic	Reading
1	Introduction, performance tuning methodology, architecture of relational database server	[2].1, [3].1, [9].1, [5].1
2	Operational aspects of relational database server, utilities for tuning and optimization: dynamic performance views, database server monitoring and diagnostics tools	[1].18, [15].9
3	Relational database server tuning in practice: tuning transient and persistent memory structures, tuning server processes	[2].2, [2].19, [4].2, [4].3, [4].4, [4].5, [4].6, [4].7, [3].19, 8.[4], [8].8, [6]
4	Relational algebra, query evaluation, syntax-based optimization	[1].4.2, [1].12.1, [1].12.4, [1].12.5, [1].12.6
5	Evaluation of relational operators	
6	Utilities for the static and dynamic analysis of SQL statements	[8].8.7, [3].7, [9].5, [9].6, [7].3, [7].4, [7].5, [5].14
7	Relational query optimizers, rule-based optimizers, cost-based optimizers	[1].14, [1].15, [3].4, [3].5
8	SQL tuning in practice: table access, joins and subqueries, sorts and set operations	[3].8, [3].9, [3].10, [3].12, [7].6, [7].7, [7].8, [7].9, [5].3, [5].7, [5].9, [5].10, [5].11, [5].12, [5].13
9	SQL tuning in practice: data manipulation and data definition statements, PL/SQL, JDBC, Embedded SQL	[3].14, [3].15
10	Transaction processing and recovery in database systems	[1].16.1, [1].16.2, [1].16.3, [1].16.4, [1].16.6, [1].17.6.2
11	Optimization of transaction processing and recovery	[4].7, [4].8
12	Performance tuning of three tier database applications	[2].2.2, [2].B, [2].5, 2.[6], [2].8
13	Benchmarking of relational database servers: TPC benchmarks, Winsconsin benchmark, other database benchmarks	[16], [17]

Changes to the above schedule will be posted via e-Learning space <http://www.uow.edu.au/student/>. Any information posted to the web site is deemed to have been notified to all students.

## Subject Materials:

Any readings/references are recommended only and are not intended to be an exhaustive list. Students are encouraged to use the library catalogue and databases to locate additional readings

## Textbook(s):

- [1] R. Ramakrishnan and J. Gehrke, *Database Management Systems*, WCB/McGraw-Hill, 3rd edition, 2003 chapters 4, 12, 13, 14, 18, 19, 20, (the book is available from the University Union Bookshop or from UoW Library on shelves and in a reserve collection)
- [2] D.Shasha, P. Bonnet, *Database Tuning Principles, Experiments, and Troubleshooting Techniques*, Morgan Kaufmann., 1998, chapters 2, 5, 7 (the book is available in a reserve collection of UoW Library)

### **Other Resources:**

- [3] G. Harrison, *Oracle SQL High-Performance Tuning*, Prentice Hall, 2<sup>nd</sup> ed. 2001
- [4] T. Kyte, *Expert Oracle Database Architecture 9i and 10g Programming Techniques and Solutions*, Apress, 2005
- [5] J. Lewis *Cost-Based Oracle Fundamentals*, O'Reilly and Associates, 2006
- [6] D.K. Burleson, A.B. Danchenkov, *Oracle Tuning The Definitive Reference*, Rampant TechPress, 2005
- [7] D. Tow, *SQL Tuning*, O'Reilly and Associates, 2004
- [8] S.S. Mitra, *Database Performance Tuning and Optimization using Oracle*, Springer Verlag, 2003
- [9] C. Millsap, *Optimizing Oracle Performance*, O'Reilly and Associates, 2003
- [10] E. Whalen, M. Schroeter, *Oracle Performance Tuning*, Addison Wesley, 2002
- [11] D.K. Burleson, *Oracle High-Performance Tuning with STATSPACK*, Oracle Press, 2003
- [12] R.D. Schneider, *MySQL Database Design and Tuning*, MySQL Press, 2005
- [13] H. Garcia-Molina, J.D.Ullman, J. Widom, *Database Systems The Complete Book*, Prentice Hall, 2002
- [14] P. Atzeni, S. Ceri, S Paraboschi, and R. Torlone *Database Systems Concepts, Languages, and Architectures*, McGraw-Hill, 1999, chapter 9
- [15] C. Shallahamer, *Forecasting Oracle Performance*, Apress, 2007
- [16] Jim Gray (Ed.), *The Benchmark Handbook for Database and Transaction Systems (2nd Edition)*. Morgan Kaufmann 1993,
- [17] B. Scalzo, K. Kline, C. Fernandez, D. Burleson, M. Ault, *Database Benchmarking: Practical Methods for Oracle & SQL Server*, Rampant TechPress, 2007

**Oracle manuals are available on <https://sai.uow.edu.au/oradocs/> (firewall) and on <http://www.oracle.com/pls/db102/homepage> (no firewall). The links to the relevant chapters in the manuals are included in the laboratory specifications.**

**Oracle textbooks available on Safari Bookshelf (O'Reilly Network), access through a link to Proquest Safari website, the links to relevant chapters in the textbooks are included in the laboratory specifications.**

**The materials referenced in the lecture presentations and lecture schedule above are available in READINGS folder both on e-Learning or at <http://www.uow.edu.au/student/lol>.**

**All other materials related to this subject are available on e-Learning or at <http://www.uow.edu.au/student/lol>.**

### Assessment:

This subject has the following assessment components.

ASSESSMENT ITEMS & FORMAT	% OF FINAL MARK	GROUP/ INDIVIDUAL	DUE DATE
<p><b>Assignment 1</b> The tasks of this assignment include the performance tuning of a simple database application, finding and impact of DBMS initialization parameters on the performance of the system, identification and interpretation of log files and trace files produced by the system, discovering SQL statements executed by an unknown application and tracing block replacements in a data buffer cache.</p>	4.0%	INDIVIDUAL	<p><b>Released:</b> Monday, 27 July 2009</p> <p><b>Due:</b> Monday 17 August 2009, 7.30 pm</p> <p><b>Submission format:</b> Electronic submission through WebCT</p>
<p><b>Assignment 2</b> The tasks of this assignment include the performance tuning of database system through the modifications of system initialization parameters, finding the frequently accessed data objects and permanently "pinning" data objects in transient memory, investigating a negative impact of frequent parsing on performance of SELECT statements, finding the database files used by an unknown database application, and implementing a mini database load monitoring and reporting tool, the manual construction of the query execution plans and estimation of the computation costs, dynamic tracing of SQL statements with SQL_TRACE and interpretation of the results generated by tkprof, tuning of SELECT statement.</p>	8.0%	INDIVIDUAL	<p><b>Released:</b> Monday, 17 August 2009</p> <p><b>Due:</b> Monday, 14 September 2009, 7.30 pm</p> <p><b>Submission format:</b> Electronic submission through WebCT</p>
<p><b>Assignment 3</b> The tasks of this assignment include the manual construction of the query execution plans and estimation of the computation costs, interpretation of query execution plan generated by a database system, using UTLBSTAT/UTLESTAT for monitoring of data dictionary cache, dynamic tracing of SQL statements with SQL_TRACE and interpretation of the results generated by tkprof, tuning of SELECT statement.</p>	8.0%	INDIVIDUAL	<p><b>Released:</b> Monday, 14 September 2009</p> <p><b>Due:</b> Monday, 26 October 2009, 7.30 pm</p> <p><b>Submission format:</b> Electronic submission through WebCT</p>
<p><b>Class test</b> Covers Assignment 1 and Assignment 2</p>	20%	INDIVIDUAL	<p>Week 11, 13 October, 5.30pm in 3.123</p> <p><b>Submission format:</b> hardcopy</p>
<p><b>Final examination</b></p>	60%	INDIVIDUAL	<p>During examinations</p> <p><b>Submission format:</b> hardcopy</p>

### **Notes on Assessment:**

All assignments are expected to be completed independently. Plagiarism may result in a FAIL grade being recorded for that assignment.

### **Electronic Submission of Assessment Items:**

Unless otherwise notified by the subject coordinator, all written assignments must be submitted electronically.

Submission of assessment items via email will not be accepted.

All assignments will be returned within 1 week of their submission.

### **Electronic release of Assessment Items**

Specifications of all assignments will be released in electronic format **ONLY**. There will be **NO** printed hardcopies distributed during lecture or lab classes. The students will collect the electronic copies of specifications on e-learning site and at <http://www.uow.edu.au/student/lol>. Only one submission is accepted for each assignment. Therefore, make sure that you are really happy with your assignment before submission.

### **Remarks on Assessment**

- (a) As assignments are to assess a student's understanding of course material, each assignment must be solved using only material covered up to that point in the course (unless otherwise stated in the question).
- (b) Students who copy an assignment will receive zero for that assignment. This also covers assignments which may be the product of community effort by several students. Working together is acceptable, but the final assignment must be the work of the individual student, as assessment is a measure of your ability.
- (c) Programs that do not compile due to the syntax errors will receive no marks, and may still be commented upon. Proper documentation and program style are needed in the assignments to receive the full marks.
- (d) The specifications of assignments and sample solutions will be available on e-Learning site and at <http://www.uow.edu.au/student/lol>.
- (e) Students should check the web page regularly for changes and updates to subject information together with assessment marks.

### **Class test**

The written class test will be held in **Week 11, 13 October, from 5.30pm to 7.30pm in a room 3-123**. The class test is worth **20%** of the total evaluation in the subject. The class test will cover a scope of Assignment 1 and Assignment 2.

### **Procedures for the return of assessment items:**

The enquiries about the assignment marks can only be made to the tutors during laboratory class times or to the lecturer during the lecturer's office hours. The enquiries about the assignment marks can only be made in a period of time of maximum 2 weeks after the evaluation of an assignment is published. After 2 week of "enquiry period", no more marks will be changed. The assignment marks will be available on SOLS on the assignment return day.

### **Penalties for late submission of assessment items:**

Penalties apply to all late work, except if student academic consideration has been granted. Late submissions will attract a penalty of 20% of the assessment mark.

This amount is per day including weekends.

### **Tutorial/Lab Closure Policy**

If for any reason, the number of students in a tutorial or lab falls below a sustainable enrolment level, as determined by the Head of School, tutorials/labs offered for that subject may be collapsed or deleted.

You will have to attend the new tutorials/lab if this closure affects the one you are attending.

We will endeavour to make this decision no later than Week 4 of session.

### **Supplementary Exams**

Supplementary Exams will be dealt with in accordance with student academic consideration policy (<http://www.uow.edu.au/about/policy/studentacademicconsiderationpolicy.pdf>) 9.2 Timing of Supplementary Exams.

While the School normally grants supplementary exams when the student does not sit the standard exam for an acceptable reason, each case will be assessed on its own merit and there is no guarantee a supplementary exam will be granted. If a supplementary exam is granted, you will normally be notified via SOLS Mail the time and date of this supplementary exam. You must follow the instructions given in the email message.

**To be eligible for a Pass in this subject after a supplementary examination is taken, a student must achieve a mark of at least 50% in the supplementary examination. Students who fail to achieve this minimum mark in the supplementary examination and who would have otherwise passed will be given a TF (Technical Fail) for his subject.**

**Please note that if this is your last session and you are granted a supplementary exam, be aware that your results will not be processed in time to meet the graduation deadline.**

### **Student Academic Consideration Policy**

The School recognises that it has a responsibility to ensure equity and consistency across its subjects for all students. Sometimes, in exceptional circumstances, students need to apply for student academic consideration in order to complete all assessable work.

The University applies strict criteria to the granting of student academic consideration. Before applying for student academic consideration, students should carefully read the University's policy which can be found at: <http://www.uow.edu.au/about/policy/studentacademicconsiderationpolicy.pdf>.

### **Plagiarism**

**When you submit an assessment task, you are declaring the following**

1. It is your own work and you did not collaborate with or copy from others.
2. You have read and understand your responsibilities under the University of Wollongong's policy on plagiarism.
3. You have not plagiarised from published work (including the internet). Where you have used the work from others, you have referenced it in the text and provided a reference list at the end of the assignment.

Students must remember that:

Plagiarism will not be tolerated.

Students are responsible for submitting original work for assessment, without plagiarising or cheating, abiding by the University's policies on Plargiarism as set out in the University Handbook under University Policy Directory and in Faculty handbooks and subject guides. Plagiarism has led to the expulsion from the University.

## Student Academic Grievance Policy

The School aims to provide a fair, equitable and productive learning environment for all its students. The Student Academic Grievance Policy seeks to support the achievement of this goal by providing a transparent and consistent process for resolving student academic grievances.

Any student who has a grievance over a result should obtain a Faculty of Informatics Appeal Against Decision or Action Affecting Academic Experience form from the Informatics Student Enquiry Centre. (<http://www.uow.edu.au/content/groups/public/@web/@inf/@faculty/documents/doc/uow017433.pdf>) The student should firstly take the form to the marker/lecturer to discuss the matter and, if the student is still not satisfied, s/he should take the next step as outlined on the form.

Once the grievance has been considered by the Faculty, if the student still feels the situation has not been fully resolved s/he may consult the Dean of Students. However, the Dean of Students can have no input into the academic judgment of the lecturer and can only review the grievance to ensure proper procedure has been followed.

## Relevant University Policies, procedures and students services:

For more information students must refer to the Faculty handbook, online references or consult the UOW policy in full at <http://www.uow.edu.au/handbook/courserules/studacgrievpol.html> which contains a range of policies on educational issues and student matters.

This outline should be read in conjunction with the following documents:

Code of Practice - Teaching and Assessment <a href="http://www.uow.edu.au/handbook/codesofprac/teaching_code.pdf">http://www.uow.edu.au/handbook/codesofprac/teaching_code.pdf</a>	Code of Practice - Students <a href="http://www.uow.edu.au/handbook/codesofprac/cop_students.html">http://www.uow.edu.au/handbook/codesofprac/cop_students.html</a>
Code of Practice-Honours <a href="http://www.uow.edu.au/handbook/CodeofPractice-Honours.pdf">http://www.uow.edu.au/handbook/CodeofPractice-Honours.pdf</a>	Acknowledgement Practice <b>Plagiarism will not be tolerated:</b> <a href="http://www.uow.edu.au/handbook/courserules/plagiarism.html">http://www.uow.edu.au/handbook/courserules/plagiarism.html</a>
Key Dates <a href="http://www.uow.edu.au/student/dates.html">http://www.uow.edu.au/student/dates.html</a>	Student Academic Consideration Policy: <a href="http://www.uow.edu.au/about/policy/studentacademicconsiderationpolicy.pdf">http://www.uow.edu.au/about/policy/studentacademicconsiderationpolicy.pdf</a>
Course Progress Requirements: <a href="http://www.uow.edu.au/student/mrp/index.html">http://www.uow.edu.au/student/mrp/index.html</a>	Graduate Qualities Policy: <a href="http://www.uow.edu.au/about/teaching/qualities/index.html#_The new UOW">http://www.uow.edu.au/about/teaching/qualities/index.html#_The new UOW</a>
Academic Grievance Policy (Coursework and honours students) <a href="http://www.uow.edu.au/handbook/courserules/studacgrievpol.html">http://www.uow.edu.au/handbook/courserules/studacgrievpol.html</a>	Non-Discriminatory Language Practice and Presentation <a href="http://staff.uow.edu.au/eed/nondiscrimlanguage.html">http://staff.uow.edu.au/eed/nondiscrimlanguage.html</a>
Occupational Health and Safety <a href="http://staff.uow.edu.au/ohs/commitment/ohspolicy/index.html">http://staff.uow.edu.au/ohs/commitment/ohspolicy/index.html</a>	Ownership of Work & Intellectual Property Policy: <a href="http://www.uow.edu.au/handbook/generalcourserules/UOW028651.html">http://www.uow.edu.au/handbook/generalcourserules/UOW028651.html</a>
Human Research Ethics Committee: <a href="http://www.uow.edu.au/research/rso/ethics/human/">http://www.uow.edu.au/research/rso/ethics/human/</a>	Rules for student conduct: <a href="http://www.uow.edu.au/handbook/generalrules/StudentConductRules.pdf">http://www.uow.edu.au/handbook/generalrules/StudentConductRules.pdf</a>
Independent Learners' Introductory Program <a href="http://www.uow.edu.au/student/attributes/ilip/">http://www.uow.edu.au/student/attributes/ilip/</a>	Informatics Faculty Librarian, Ms Annette Meldrum, phone: 4221 4637, email: <a href="mailto:ameldrum@uow.edu.au">ameldrum@uow.edu.au</a>
Student Support Services: <a href="http://www.uow.edu.au/student/services/">http://www.uow.edu.au/student/services/</a> Informatics Faculty SEDLO ( <b>Student Equity and Diversity Liaison Officers</b> ) Virginie Schmelitschek, phone 4221 3833, <a href="mailto:virginie@uow.edu.au">virginie@uow.edu.au</a>	SCSSE Internet Access & Student Resource Centre <a href="http://www.uow.edu.au/informatics/common/uow024466.html">http://www.uow.edu.au/informatics/common/uow024466.html</a>
SCSSE Computer Usage Rules <a href="http://www.uow.edu.au/informatics/common/uow024457.html">http://www.uow.edu.au/informatics/common/uow024457.html</a>	SCSSE Subject Outlines <a href="http://www.uow.edu.au/informatics/scsse/current">http://www.uow.edu.au/informatics/scsse/current</a>