

# 2420ICT

## Systems Programming

### Semester 2 - 2008

|                                 |  |
|---------------------------------|--|
| Academic Organisation:          | School of Information and Communication Technology                   |
| Faculty:                        | Science, Environment, Engineering and Technology                     |
| Credit point value:             | 10   |
| Student Contribution Band:      | Band 2   |
| Course level:                   | Undergraduate  |
| Campus/Location/Learning Mode:  | Gold Coast / On Campus / In Person<br>Nathan / On Campus / In Person |
| Convenor/s:                     | APro John Thornton (Gold Coast)<br>Dr Rene Hexel (Nathan)            |
| Enrolment Restrictions:         | Restricted: Course must be listed in Program                         |
| This document was last updated: | 12 June 2008   |

#### **BRIEF COURSE DESCRIPTION**

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This course covers a selection of advanced systems programming topics in multitasking, process synchronisation, inter-process communication, and operating system mechanisms and interaction. Material about task handling (such as multiprocessing and multithreading), task synchronisation mechanisms (such as signals, locks, semaphores, or monitors), task communication mechanisms (including shared memory, pipes, and messages), file system interaction, system functions, and current open standards will be presented and used in programming assignments, exercise and example material.

## SECTION A – TEACHING, LEARNING AND ASSESSMENT

### COURSE AIMS

Operating systems are the foundation of computer systems. A course discussing the fundamental concepts in operating systems, how to use them and interact with them, is an essential part of a computer science degree program.

The purpose of this course is to provide a thorough coverage of the basic issues in programs interacting directly with operating systems. The issues that will be addressed are:

- The needs that operating systems address, and how these needs are met in contemporary practical operating systems,
- How programs can interact with the operating system and each other using operating system mechanisms.

Coverage will extend from high-level design to low-level implementation, and will be reinforced by practical experience with implementing systems programs within a POSIX environment. Students undertaking this course will develop skills in problem solving and programming, critical thinking, inter-personal and oral and written communication.

### LEARNING OUTCOMES

On completion of this course, students should have:

1. A detailed knowledge of the basic issues in and interacting with operating systems. These basic issues include topics selected from multitasking, process synchronisation, inter-process communication, memory and storage management, and other fundamental operating system mechanisms.
2. Learned and practiced problem solving skills on operating systems specific topics, this includes designing and implementing programs that operating system functions and algorithms.

### CONTENT, ORGANISATION AND TEACHING STRATEGIES

| Type                          | Hrs / Week  | Weeks | Hours      |
|-------------------------------|-------------|-------|------------|
| Type                          | Hrs/Week    | Weeks | Hours      |
| Lectures                      | 1-2         | 1-13  | 13         |
| Tutorials                     | 1           | 2-13  | 13         |
| Private Study and Preparation | 8 (average) | 1-13  | <u>104</u> |
|                               |             |       | 130        |

- The course has two hours of class contact per week, with one hour of lectures and one hour of tutorial/laboratory work. Lectures cover the basic fundamentals and principles of the course topics, while the tutorial/laboratory sessions serve as problem solving areas, with specified problems being set.
- The tutorial program will be specifically designed to help with the assignments. Attendance and participation at tutorials is strongly recommended and expected.
- The lecture program will be supported by lecture notes published on the course web-site. Attendance at lectures is strongly encouraged. Important course announcements may be made during the lectures and extra course content not contained in either this outline or lecture notes may also be presented.
- Students are encouraged to research and read the references given below and other material relevant to the course. The lecture notes are regarded as only guidelines and summaries to

provide the basis for further reading. Other reference and support material will be listed on the course web-site and students are required to use their own resources to further develop their knowledge and skills.

## CONTENT SUMMARY

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This course builds on the concepts of advanced programming, data structures, and algorithms introduced in 2501ICT Programming III as well as the computer communication networking fundamentals covered in 2506ICT Computer Communication Network, extending the theoretical knowledge and practical programming experience through the introduction of distributed computing principles and paradigms. The course will cover content from the following major topics:

| Topic | Lecture Content  |
|-------|--|
| 1.    | Introduction to Operating Systems  |
| 2.    | Processes, Threads, Scheduling, Synchronisation, Inter-Process Communication |
| 3.    | Memory Management and Virtual Memory   |
| 4.    | File and I/O Systems   |

Systems programming techniques to be covered will be selected from processes, threads, semaphores and locks, deadlocks, deadlock detection and avoidance, monitors, memory management, shared memory, signals, pipes, sockets, messages, file system interaction and structure, I/O drivers, portability, and standards.

Reading material and references are provided on the course website, in the corresponding lectures, and in the lecture notes.

## ASSESSMENT

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| Item | Assessment Task   | Length  | Weighting | Total Marks | Due Date and Time |
|------|-------------------|---------|-----------|-------------|-------------------|
| 1.   | Assignment 1      | 4hr p/w | 25 %      | 50          | appx. Week 6      |
| 2.   | Assignment 2      | 4hr p/w | 35 %      | 70          | appx. Week 11     |
| 3.   | Final Examination | 3 hours | 40 %      | 80          | Exam Weeks        |

### Assessment Details

- Assignment 1 requires students to complete all tutorial exercises up to week 5. An additional 16-24 hours (appx.) are required to produce the final programs and documentation.
- Assignment 2 requires the completion of all tutorial exercises up to week 10. An additional 16-24 hours (appx.) are required to produce the final programs and documentation.
- The final exam will be closed book and students will not be allowed any written material. Calculators will not be allowed.
- To be eligible to pass the course, students are required to demonstrate a reasonable degree of competence in the required course objectives as examined in each form of assessment.
- Non-compliance with any assignment submission criteria may result in the assignment not being marked.
- Assignment marks are not final until the assessment board meeting. Students whose assignment marks deviate substantially from the exam marks may need to sit an interview as part of the assessment for the corresponding assignment(s).

### Return of Assessment Items

The method for returning marked assessment items is online. Submission details will be posted on the course website.

### Notification of Availability of Feedback on Assessment

Students can expect the assignment to take around 2 weeks to mark (in-class marking and an interview may be part of the marking process). Feedback may be given to students either in class or online.

## **GRADUATE SKILLS**

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| <b>Graduate Skills</b><br>(select appropriate boxes )          | <b>Taught</b>                       | <b>Practised</b>                    | <b>Assessed</b>                     |
|--|-------------------------------------|-------------------------------------|-------------------------------------|
| Effective communication (written, oral and interpersonal)      | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Information literacy   | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Problem solving  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Critical evaluation  | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Work autonomously / in teams                                   | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Creativity and innovation                                      | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Ethical behaviour in social / professional / work environments | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Responsible, effective citizenship                             | <input type="checkbox"/>            | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |

## **TEACHING TEAM**

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| <b>Convenor Details</b> | <b>Nathan</b>  |
|-------------------------|--|
| Campus Convenor         | Dr René Hexel  |
| Email                   | <a href="mailto:R.Hexel@griffith.edu.au">R.Hexel@griffith.edu.au</a>       |
| Office Location         | N44_2.21   |
| Phone                   | +61 (7) 373 55041  |
| Fax                     | +61 (7) 373 55051  |
| Consultation times      | By appointment through email.  |
| <b>Convenor Details</b> | <b>Gold Coast</b>  |
| Campus Convenor         | A/Prof. John Thornton  |
| Email                   | <a href="mailto:j.thornton@griffith.edu.au">j.thornton@griffith.edu.au</a> |
| Office Location         | G09_1.52   |
| Phone                   | +61 (7) 555 28730  |
| Fax                     | +61 (7) 555 28066  |
| Consultation times      | By appointment through email.  |

Overall Course Convenor

| Convenor Details   | Cross-Campus   |
|--------------------|--|
| Campus Convenor    | Dr René Hexel  |
| Email              | <a href="mailto:R.Hexel@griffith.edu.au">R.Hexel@griffith.edu.au</a> |
| Office Location    | N44_2.21   |
| Phone              | +61 (7) 373 55041  |
| Fax                | +61 (7) 373 55051  |
| Consultation times | By appointment through email.  |

Additional teaching team members

Contact details for additional teaching team members will be published on the course web-site.

**COURSE COMMUNICATIONS**

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Students can communicate with the Course Convenor and any other member of the teaching team in person during and after the scheduled class contact times. Students may also contact the course convenor and/or any other member of the teaching teams using either email, telephone or in the relevant office during the nominated consulting times. Students may also communicate with the course convenor and each other about the content of the course or related topics using the Web Forum.

**TEXTS AND SUPPORTING MATERIALS**

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Recommended text books are:

William Stallings. *Operating Systems: Internals and Design Principles*, 6/E. Pearson, 2008.

Gadi Taubenfeld. *Synchronization Algorithms and Concurrent Programming*. Pearson, 2006.

Andrew Tanenbaum and Albert Woodhull. *Operating Systems Design and Implementation*, 3/E. Pearson, 2006.

Other reference and support material may be listed on the course web-site.

## **SECTION B – ADDITIONAL COURSE INFORMATION**

Any additional course material may be provided via the course web-site.

## SECTION C – KEY UNIVERSITY INFORMATION

### ACADEMIC MISCONDUCT

Students must conduct their studies at the University honestly, ethically and in accordance with accepted standards of academic conduct. Any form of academic conduct that is contrary to these standards is academic misconduct and is unacceptable.

Some students engage deliberately in academic misconduct, with intent to deceive. This conscious, pre-mediated form of cheating is one of the worst forms of fraudulent academic behaviour, for which the University has zero tolerance and for which penalties, including exclusion from the University, will be applied.

However the University recognises many students commit academic misconduct without intent to deceive. These students may be required to undertake additional educational activities to remediate their behaviour.

Specifically it is academic misconduct for a student to:

- **Cheat in examinations and tests** by communicating, or attempting to communicate, with a fellow individual who is neither an invigilator or member of staff; by copying, or attempting to copy from a fellow candidate; attempting to introduce or consult during the examination, any unauthorised printed or written material, or electronic calculating or information storage device; or mobile phones or other communication device, or impersonates another.
- **Fabricate results** by claiming to have carried out tests, experiments or observations that have not taken place or by presenting results not supported by the evidence with the object of obtaining an unfair advantage.
- **Misrepresent themselves** by presenting an untrue statement or not disclosing where there is a duty to disclose in order to create a false appearance or identity.
- **Plagiarise** by representing the work of another as their own original work, without appropriate acknowledgement of the author or the source. This category of cheating includes the following:
  1. collusion, where a piece of work prepared by a group is represented as if it were the student's own;
  1. acquiring or commissioning a piece of work, which is not his/her own and representing it as if it were, by
    - purchasing a paper from a commercial service, including internet sites, whether pre-written or specially prepared for the student concerned
    - submitting a paper written by another person, either by a fellow student or a person who is not a member of the University;
  2. duplication of the same or almost identical work for more than one assessment item;
  3. copying ideas, concepts, research data, images, sounds or text;
  4. paraphrasing a paper from a source text, whether in manuscript, printed or electronic form, without appropriate acknowledgement;
  5. cutting or pasting statements from multiple sources or piecing together work of others and representing them as original work;
  6. submitting, as one own work, all or part of another student's work, even with the student's knowledge or consent.

A student who willingly assists another student to plagiarise (for example by willingly giving them their own work to copy from) is also breaching academic integrity, and may be subject to disciplinary action.

Visit the University's Institutional Framework for Promoting Academic Integrity Among Students for further details.

### PLAGIARISM DETECTION SOFTWARE

The University uses plagiarism detection software. Students should be aware that your Course Convenor may use this software to check submitted assignments. If this is the case your Course Convenor will provide more detailed information about how the detection software will be used for individual assessment items.

## HEALTH AND SAFETY

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Griffith University is committed to providing a safe work and study environment, however all students, staff and visitors have an obligation to ensure the safety of themselves and those whose safety may be affected by their actions. Staff in control of learning activities will ensure as far as reasonably practical, that those activities are safe and that all safety obligations are being met. Students are required to comply with all safety instructions and are requested to report safety concerns to the University.

General health and safety information can be obtained from [http://www.griffith.edu.au/hrm/health\\_and\\_safety/](http://www.griffith.edu.au/hrm/health_and_safety/)

Information about Laboratory safety can be obtained from [http://www.griffith.edu.au/ots/secure/health/content\\_labsafety.html](http://www.griffith.edu.au/ots/secure/health/content_labsafety.html)

## KEY STUDENT-RELATED POLICIES

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All University policy documents are accessible to students via the University's Policy Library website at: [www.griffith.edu.au/policylibrary](http://www.griffith.edu.au/policylibrary). Links to key policy documents are included below for easy reference:

[\*Academic Calendar\*](#)

[\*Academic Standing, Progression and Exclusion Policy\*](#)

[\*Assessment Policy\*](#)

[\*Examinations Timetabling Policy and Procedures\*](#)

[\*Guideline on Student E-Mail\*](#)

[\*Health and Safety Policy\*](#)

[\*Institutional Framework for Promoting Academic Integrity Among Students\*](#)

[\*Policy on Student Grievances and Appeals\*](#)

[\*Student Administration Policy\*](#)

[\*Student Charter\*](#)

## UNIVERSITY SUPPORT RESOURCES

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The University provides many facilities and support services to assist students in their studies. Links to information about University support resources available to students are included below for easy reference:

[\*Learning Centres\*](#) - the University provides access to common use computing facilities for educational purposes. For details visit [www.griffith.edu.au/cuse](http://www.griffith.edu.au/cuse)

[\*Learning@Griffith\*](#) - there is a dedicated website for this course via the Learning@Griffith student portal.

[\*Student Services\*](#) facilitate student access to and success at their academic studies. Student Services includes: Careers and Employment Service; Chaplaincy; Counselling Service; Health Service; Student Equity Services (incorporating the Disabilities Service); and the Welfare Office.

[\*Learning Services\*](#) within the Division of Information Services provides learning support in three skill areas: computing skills; library skills; and academic skills. The study skills resources on the website include self-help tasks focusing on critical thinking, exam skills, note taking, preparing presentations, referencing, writing, proof reading, and time management.

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