Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie

School of Information Technology
Skool vir Inligtingtegnologie

Department of Computer Science
Departement Rekenaarwetenskap

COS 226: Concurrent Systems
COS 226: Gelyktydige Stelsels

Lecturers: Ms. T. Morkel, Dr. M. Adedayo
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1 Overview

1.1 Description

Computer science courses deal mostly with sequential programs. This course introduces the notion of concurrent program execution. Concurrency is defined and its usefulness illustrated, as its nature is investigated by means of well-known problems and examples.

This course will be presented as a series of lectures, interspersed with practical assignments to be completed by individual students. A textbook is prescribed (see Study Material) and the Java programming language will be utilized in practise.

1.2 Prerequisites

COS153 or COS131 or COS132

1.3 Study Units

- Mutual Exclusion
- Concurrency
- Foundations of Shared Memory
- Primitive Synchronization Operations
- Spin Locks and Contention
- Monitors and Blocking Synchronization
- Linked Lists: The Role of Locking
- Stacks

2 Plagiarism policy

This department considers plagiarism as a serious offense. Disciplinary action will be taken against a student who commits plagiarism. For a formal definition of plagiarism, the student is referred to http://www.ais.up.ac.za/plagiarism/docs/policy_2010.pdf

3 Course Website

This course will make use of the Computer Science website at: http://www.cs.up.ac.za/ The course website is hosted at: http://www.cs.up.ac.za/courses/COS226. Please note that ClickUP will not be used and no material, announcements or marks will be posted to the ClickUP website.
4 Instructors

4.1 Contact details

4.1.1 Course Coordinator and Afrikaans Lecturer

Ms Tayana Morkel
Office: IT 4-26
E-mail: tmorkel@cs.up.ac.za
Telephone: (012) 420 5267

4.1.2 English Lecturer

Dr Mary Adedayo
Office: IT 4-32
E-mail: madedayo@cs.up.ac.za
Telephone: (012) 420 2019

4.1.3 Assistant Lecturer

Mr Madoda Nxumalo
E-mail: mnxumalo@cs.up.ac.za

4.2 Interaction with the Instructors

You are encouraged to discuss the subject with the lecturers during the scheduled lectures. You are also welcome to make an appointment with a teaching assistant or tutor should you require help with a topic. Likewise, you may compose detailed emails to the teaching assistants, tutors, and lecturers.

Should you wish to make an appointment with a teaching assistant, tutor, or lecturer, please send an email directly to the person that you would like to see. Only upon receiving a reply may you consider the appointment confirmed.

When requesting an appointment with a lecturer, please consider the following:

- Emails are better than phone calls as lecturers are not necessarily in their offices at all times throughout the day.

- Expect a turnaround of 1-2 days on emails (in other words, plan to request an appointment at least three days in advance).

- Ensure that your student email account is not full, as replies sent to your address may be rejected by the mail server.

Please note that no consultations will be conducted telephonically.
5 Study Material

5.1 Prescribed

*The Art of Multiprocessor Programming, Revised Reprint*
Maurice Herlihy & Nir Shavit
Morgan Kaufmann, 2012
ISBN: 978-0123973375

6 Contact Sessions

6.1 Lectures

Lectures are your primary introduction to the prescribed material. While each lecture will be based on the contents of the textbook, lecturers may add or remove material as needed. Therefore, lectures are considered to be the basis of the course curriculum.

6.1.1 Lecture Schedule

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Language</th>
<th>Day</th>
<th>Time</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Afrikaans</td>
<td>Monday</td>
<td>12:30 - 13:20</td>
<td>IT 4-2</td>
</tr>
<tr>
<td>2</td>
<td>Afrikaans</td>
<td>Tuesday</td>
<td>07:30 - 08:20</td>
<td>IT 2-25</td>
</tr>
<tr>
<td>3</td>
<td>Afrikaans</td>
<td>Friday</td>
<td>12:30 - 13:20</td>
<td>IT 4-3</td>
</tr>
<tr>
<td>1</td>
<td>English</td>
<td>Monday</td>
<td>08:30 - 09:20</td>
<td>HSB 4-1</td>
</tr>
<tr>
<td>2</td>
<td>English</td>
<td>Tuesday</td>
<td>10:30 - 11:20</td>
<td>Louw Hall</td>
</tr>
<tr>
<td>3</td>
<td>English</td>
<td>Friday</td>
<td>13:30 - 14:20</td>
<td>IT 4-1</td>
</tr>
</tbody>
</table>

6.2 Tutorials

One tutorial session will be presented each week. During the session you will write a short test that will assess your understanding of the previous week's work. The scripts for the previous week's test will also be returned and the answers will be discussed. The tutorial session is therefore your weekly self-check to ensure that you understand the theory.

6.2.1 Tutorial Schedule

<table>
<thead>
<tr>
<th>Language</th>
<th>Day</th>
<th>Time</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afrikaans</td>
<td>Thursday</td>
<td>15:30 - 16:20</td>
<td>IT 4-2</td>
</tr>
<tr>
<td>English</td>
<td>Tuesday</td>
<td>11:30 - 12:20</td>
<td>Theology 1-25</td>
</tr>
</tbody>
</table>

6.3 Practicals

Weekly practical sessions provide an opportunity for you to work on your assignments in the university’s computer labs, which will be reserved for this purpose. Practical sessions will be supervised by teaching assistants and you are welcome to ask them for help and advice. The practical session is your weekly self-check to ensure that you can apply the theory.
6.3.1 Practical Schedule

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>13:30 - 16:20</td>
<td>Informatorium: Brown lab</td>
</tr>
<tr>
<td>Wednesday</td>
<td>14:30 - 17:30</td>
<td>Informatorium: Brown lab</td>
</tr>
<tr>
<td>Thursday</td>
<td>13:30 - 16:30</td>
<td>Informatorium: Red lab</td>
</tr>
</tbody>
</table>

7 Assessment

7.1 Practical Assignments

An assignment will be issued for each week during which a practical session takes place. Each assignment will require you to write a short program to solve a problem. Assignments will be marked by an automated evaluation system that will determine if an assignment implementation produces the required output when given a predetermined input. Marks for assignments will be binary. That is, an assignment or part thereof will be awarded either 100% or 0%. All assignments are compulsory and will contribute equally towards the Semester Mark.

7.2 Class Tests

A short test will be conducted during each tutorial session. The class tests are compulsory. The best 8 out of 10 class tests will contribute equally towards your Semester Mark. This gives you the possibility of missing 2 out of the 10 class tests without penalty, thus no sick class tests will be given.

7.3 Semester Tests

Two paper-based tests will be written during the semester. These tests will assess your knowledge of the subject, as presented prior to the test. Both tests will contribute equally to the Semester Mark.

7.3.1 Semester Test Schedule (Preliminary)

<table>
<thead>
<tr>
<th>Test</th>
<th>Date</th>
<th>Time</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 September</td>
<td>17:30 - 20:00</td>
<td>Thuto 1-1</td>
</tr>
<tr>
<td>2</td>
<td>26 October</td>
<td>17:30 - 20:00</td>
<td>Thuto 1-2</td>
</tr>
</tbody>
</table>

7.4 Examination

A paper-based exam will be written at the end of the module, during the scheduled exam period. The exam will cover the whole curriculum, as presented during the semester.

7.5 Absence from an Assessment

Should you be unable to attend an assessment or you have difficulty in handing in an assignment due to special circumstances, suitable provisions may be arranged. However, not all assessments are provided for. The following table lists the only provisions that may be made and how you should apply:
7.6 Calculation of Marks

7.6.1 Semester Mark

The semester mark will consist of the following:
- Class Tests 30%
- Assignments 30%
- Semester Tests 40%

7.6.2 Final Mark

The final mark will consist of the following:
- Semester Mark 50%
- Examination Mark 50%

7.7 Pass Conditions

You must gain Examination Entrance in order to write the exam. If you fail to obtain Examination Entrance, you will fail the course. In addition to gaining Examination Entrance, you will need to meet the exam subminimum to ultimately pass the course.

7.7.1 Examination Entrance

In order to obtain Examination Entrance you must:

1. attempt 70% of the Class Tests
2. attempt 70% of the Practical Assignments
3. achieve a Semester Mark of at least 40%

In order to pass the course you must achieve Examination Entrance as well as both of the following minimum results:
- Examination 40%
- Final Mark 50%

N.B. No backdated medical certificates or certificates that state the student informed the doctor instead of undergoing an examination will be accepted. All medical certificates must be submitted within three working days of the assessment. Unless otherwise indicated, provisions are made at the discretion of the Coordinator or EBIT Faculty.
7.8 Reporting and Querying of Marks

The results of practical assignments will be accompanied by additional feedback in cases where assignments did not work correctly. Since you will also be given detailed specifications as well as the testing framework with which to test your assignments before submitting them, queries regarding assignment marks will generally not be considered. If you do not understand why an assignment did not work or, more accurately, how to fix it, you are advised to consult with one of the teaching assistants, tutor, or assistant lecturer.

Queries for class tests must be made in the tutorial session during which the test is returned. Queries for semester tests must be submitted in writing to the reception of the computer science department - a query form will be provided.

Semester test queries must be submitted within three working days of the relevant scripts having been returned. A query must contain your motivation and reasoning for why you believe an answer was marked inaccurately. Any query that does not include a reason in terms of the module curriculum or that simply states a demand for a remark will be ignored.

N.B. No late queries will be processed. If you do not collect your class test or semester test script and you do not study the outcome of the test within the given time, it will be assumed that you are satisfied with said outcome.

8 Module Structure

8.1 Lecture Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20-07</td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>27-07</td>
<td>Mutual Exclusion</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>03-08</td>
<td>Mutual Exclusion</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>11-08</td>
<td>Concurrent Objects</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>17-08</td>
<td>Foundations of Shared Memory</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>24-08</td>
<td>Synchronization Operations</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>31-08</td>
<td>Spin Locks and Contention</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>07-09</td>
<td>Spin Locks and Contention</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>14-09</td>
<td>Monitors &amp; Blocking</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>21-09</td>
<td>Monitors &amp; Blocking</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>28-09</td>
<td>Linked Lists &amp; Locking</td>
<td>9</td>
</tr>
<tr>
<td>12</td>
<td>05-10</td>
<td>Recess</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>12-10</td>
<td>Linked Lists &amp; Locking</td>
<td>9</td>
</tr>
<tr>
<td>14</td>
<td>19-10</td>
<td>Concurrent Queues and the ABA Problem</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>26-10</td>
<td>Stacks and Elimination</td>
<td>11</td>
</tr>
<tr>
<td>16</td>
<td>02-11</td>
<td>Revision</td>
<td>1-11</td>
</tr>
</tbody>
</table>