Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie

School of Information Technology

Department of Computer Science

Theoretical computer science (COS 210)

Lecturers: Dr Nils Timm and Mr Steven Jordaan
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1 Overview

1.1 Description

This module provides the foundation of theoretical computer science for investigating both computability and complexity of problems. Topics include, but are not limited to: finite Automata, regular languages, context-free languages, Turing Machines and the Church-Turing Thesis, P vs NP problem, NP-complete class, the Halting problem etc. While the module is heavily focused on theory, as the name would imply, it provides a very practical basis for the type of logical reasoning a computer scientist should pride themselves in.

1.2 Learning Objectives

After completing this course you should have the knowledge and skills to

- understand the fundamental concepts of Theory of Computation (formal languages, automata, grammars, machines)

- define computational problems as formal languages

- construct computational models corresponding to languages

- perform transformations between the different types of models

- prove complexity and decidability properties of problems

1.3 Prerequisites

The prerequisites for COS 210 are COS 151 and COS 110.

1.4 Credits

COS 210 is a 8-credit module. This translates into approximately 80 hours of time that an average student should spend on all module activities.

2 Plagiarism policy

The Department of Computer Science considers plagiarism as a serious offence. Disciplinary action will be taken against students who commit plagiarism. Plagiarism includes copying someone else's work without consent, copying a friend's work (even with consent), copying material (such as text or program code) from the Internet, giving your work to another student to copy and collusion (working together) on an individual assignment.

Plagiarism will not be tolerated in this course. For a formal definition of plagiarism, students are referred to `http://www.ais.up.ac.za/plagiarism/index.htm` (from the main page of the University of Pretoria site, follow the `Library` quick link, and then click the `Plagiarism` link). If you have any question regarding plagiarism, please ask one of the lecturers to avoid any misunderstanding.

3 Instructors and assistants

The instructors for COS 210 are as follows:

Name	Office	E-mail	Responsibility
Nils Timm (Course coordinator)	IT 4-39	ntimm@cs.up.ac.za	Lectures
Steven Jordaan (Assistant Lecturer)		u18074848@tuks.co.za	Tutorials

4 Study material

4.1 Prescribed books

There is one prescribed textbook for this module:

> Anil Maheshwari and Michiel Smid, *Introduction to Theory of Computation*, Edition built on 23 May 2017.

The textbook is available as a PDF on the ClickUP module website.

4.2 The COS 210 module website

The COS 210 ClickUP module website will be used to host the study material for this course, and is thus the primary point of contact for electronic information and resources including announcements, online lectures, file downloads, notes, and tutorial specifications. Since announcements may be posted at short notice, it is your responsibility to check the COS 210 ClickUP module website at least once a day for updated announcements.

5 Assessment

The assessment for COS 210 will be based on a semester mark and an examination mark.

5.1 Semester assessment opportunities

The semester mark consists of the following assessment opportunities: worksheets, class tests, and semester tests.

- **Worksheets:** Every week you are required to complete a worksheet (homework assignment) with questions on lecture topics. Worksheets will be typically released on Wednesdays and worksheet solutions need to be submitted by the following Tuesday via ClickUP. The first worksheet will be only released in Week 2 and there may be no worksheets in certain test weeks.

- **Class Tests:** There will be three class tests that will be written online via ClickUP. You can write these tests from home. The class tests will be less extensive than semester tests. Class tests will be announced a week in advance. It is planned to have each class test on a Friday, 14:30 - 16:00.

- There will be two **semester tests** and one sick semester test. The sick semester test may be written if you were absent from one of the semester tests and handed in a valid medical certificate within 3 working days of the missed test. The sick semester test will cover the content of both semester tests, and will replace the mark for the missed semester test. Semester tests and the sick test will be ClickUP tests that have to be written **on campus** in the Informatorium labs. The preliminary dates for the regular tests are as follows:
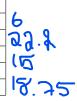
	Day	Date-Time	Venue
Semester test 1	Wednesday	23 March at 17:30	Informatorium labs
Semester test 2	Thursday	12 May at 17:30	Informatorium labs

5.2 Semester mark calculation

The semester mark for the course will be calculated as follows:
All worksheets together will count 10% of the semester mark, all class tests together will count 30% of the semester mark, and each semester test will count 30% of the semester mark. Your worksheet mark, will be based on your $N-1$ best worksheets where N is total number of worksheets. Your class test mark, will be based on your 2 best class tests.

Assessment component	Number	Weight towards semester mark
Worksheets	Best $N-1$ out of N	10%
Class Tests	Best 2 out of 3	30%
Semester Test 1		30%
Semester Test 2		30%
Total		100%

5.3 Examination

There will be a 3-hour examination for COS 210 at the end of the semester. All the work covered during the semester, including any additional material made available, will be examinable. Please make sure you check the ClickUP website towards the end of the semester for any updates. If you miss the examination for medical reasons, you must present a medical certificate to your faculty to qualify for an aegrotat examination. The preliminary exam date is as follows:

	Day	Date-Time
Exam	Monday	20 June at 08:00

The final examination and the aegrotat examination will be ClickUP tests that will be written **on campus only** in the Informatorium labs.

5.4   Final mark calculation

Each student's final mark for COS 210 will be calculated as follows:

Final Mark = Examination mark (40%) + Semester Mark (60%)

In addition, the following regulations hold for this course:

- A student will be refused examination entrance if his/her semester mark is less than 40%.

- To pass the course, a student must obtain at least 40% in the exam, and a final mark of at least 50%.

- A student will pass the course with distinction if he/she obtains at least 75% for the final mark.

- A supplementary examination will be granted to students with a final mark between 40% and 49%. The supplementary examination mark will replace the normal examination mark.

- To pass the course after attending the supplementary exam, a student must obtain at least 40% in the supplementary exam, and a final mark of at least 50%.

6   Hybrid Teaching Plan and Schedule

6.1   Lectures

In this module we will follow a hybrid approach to teaching that combines recorded material and contact sessions. Two pre-recorded lecture videos will be released every Friday as the study material for the subsequent week.

During the official lecture hours there will be lecture-related Q&A sessions on campus. In these sessions there will be no general lecture presentations, but you will have the opportunity to ask questions and to get clarification with regard to lecture topics. You are expected to watch the most recent lecture videos before you attend a Q&A session. The weekly lecture Q&A session schedule is as follows:

	Day	Time	Venue	Capacity
Session 1	Monday	11:30 - 11:55	IT 2-26	35
Session 2	Monday	12:00 - 12:25	IT 2-26	35
Session 3	Wednesday	08:30 - 08:55	IT 2-26	35
Session 4	Wednesday	09:00 - 09:25	IT 2-26	35

In order to attend a session, you have to make a booking via ClickUP in advance. In accordance with the COVID-19 regulations, each session can be attended by a maximum of 35 participants. You can only attend one lecture Q&A session per week. Bookings need to be repeated every week. In this way we want to avoid that inactive students block seats in the sessions for the whole semester.

6.2   Tutorials

A second type of learning activities in this module are tutorials. In the weekly tutorials solutions to a selection of exercises and questions from worksheets and tests will be discussed. Exercises released on a weekly basis. For tutorials we follow a similar approach as for lectures. Every Wednesday a pre-recorded tutorial video will be released that presents solutions to previous exercises and questions. Additionally, there will be tutorial-related Q&A sessions on campus every Friday where you can get help with regard to exercises, worksheets and the content of the current tutorial. In accordance with the COVID-19 regulations, each tutorial session can be attended by a maximum of 38 participants. The tutorial Q&A session schedule is as follows:

	Day	Time	Venue	Capacity
Tutorial Session 1	Friday	14:30 - 14:55	IT 4-4	38
Tutorial Session 2	Friday	15:00 - 15:25	IT 4-4	38
Tutorial Session 3	Friday	15:30 - 15:55	IT 4-4	38
Tutorial Session 4	Friday	16:00 - 16:25	IT 4-4	38

For tutorial Q&A sessions the same booking concept is used as for lecture Q&A sessions.

In weeks where a class test will be written there won't be tutorial sessions because class tests are scheduled during the tutorial hours.

This teaching plan assumes that South Africa will remain at Lockdown Level 1 for the rest of the semester. In case the country will move to a higher Lockdown Level, the mode of instruction in this module may move to fully online again.

7 Discord

There is also a Discord server where you can ask for support remotely without attending the campus sessions. Support via Discord may be not live, but instructors will answer your written queries as soon as possible. If it turns out that on-campus sessions get only poorly attended, it may be an option to replace certain campus sessions by Discord live sessions. To join use the server link https://discord.gg/7xW5awf8zz. Please ensure you behave and communicate in a respectful manner, and do no post anything unrelated to COS 210.