Tutorial Letter 101/0/2023

Programming: Data Structures

COS2611

Year Module

Department of Computer Science

IMPORTANT INFORMATION

Please register on myUnisa, activate your myLife e-mail account and make sure that you have regular access to the myUnisa module website, COS2611-23-Y, as well as your group website.

Note: This is a fully online module. It is, therefore, only available on myUnisa.

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1 INTRODUCTION

Dear Student

Unisa is a comprehensive open distance e-learning (CODeL) higher education institution. The comprehensiveness of our curricula encapsulates a range of offerings, from strictly vocational to strictly academic certificates, diplomas and degrees. Unisa's "openness" and its distance eLearning character result in many students registering at Unisa who may not have had an opportunity to enrol in higher education. Our CODeL character implies that our programmes are carefully planned and structured to ensure success for students ranging from the under-prepared but with potential to the sufficiently prepared.

Teaching and learning in a CODeL context involves multiple modes of delivery ranging from blended learning to fully online. As a default position, all post graduate programmes are offered fully online with no printed study materials, while undergraduate programmes are offered in a blended mode of delivery where printed study materials are augmented with online teaching and learning via the learner management system – myUnisa. In some instances, undergraduate programmes are offered fully online as well.

Furthermore, our programmes are aligned with the vision, mission and values of the University. Unisa's commitment to serve humanity and shape futures combined with a clear appreciation of our location on the African continent, Unisa's graduates have distinctive graduate qualities which include

- independent, resilient, responsible and caring citizens who are able to fulfil and serve in multiple roles in their immediate and future local, national and global communities
- having a critical understanding of their location on the African continent with its histories, challenges and potential in relation to globally diverse contexts
- the ability to critically analyse and evaluate the credibility and usefulness of information and data from multiple sources in a globalised world with its ever-increasing information and data flows and competing worldviews
- how to apply their discipline-specific knowledges competently, ethically and creatively to solve real-life problems
- an awareness of their own learning and developmental needs and future potential

COS2611 is a fully online module.

Whether a module is offered either as blended (meaning that we use a combination of printed and online material to engage with you) or online (all information is available via the internet), we use myUnisa as our virtual campus. This is an online system that is used to administer, document and deliver educational material to you and support engagement with you. Look out for information from your lecturer as well as other Unisa platforms to determine how to access the virtual myUnisa module site. Information on the tools that will be available to engage with the lecturer and fellow students to support your learning will also be communicated via various platforms.

You are encouraged to log into the module site on myUnisa regularly (that is, at least twice per week).

Because this is a fully online module, you will need to use myUnisa to study and complete the learning activities for this module. Visit the website for COS2611 on myUnisa frequently. The website for your module is COS2611-23-Y.

We wish you every success with your studies!

2 MODULE OVERVIEW

2.1 Purpose

Students who successfully complete this module will have the knowledge, skills and competencies to apply Data Structures and Algorithm Analysis knowledge and strategies in solving real-world programming problems, according to industry-approved processes within African, South African and global contexts.

2.2 Outcomes

For this module, you will have to master several outcomes:

- Demonstrate an understanding of algorithm analysis and the Big-Oh notation used in algorithm analysis.
- Demonstrate an understanding of the basic properties of pointers and linked lists.
- Demonstrate an understanding of how to use recursion to solve problems and how to think in terms of recursion.
- Demonstrate an understanding of Abstract Data Types (ADTs) and how they are stored on computers.
- Demonstrate an understanding of search techniques used to retrieve data held in data structures.
- Demonstrate an understanding of sort techniques used to sort data held in data structures.

3 CURRICULUM TRANSFORMATION

Unisa has implemented a transformation charter, in terms of which the university has placed curriculum transformation high on the teaching and learning agenda. Curriculum transformation includes student-centred scholarship, the pedagogical renewal of teaching and assessment practices, the scholarship of teaching and learning, and the infusion of African epistemologies and philosophies. All of these will be phased in at both programme and module levels, and as a

result of this you will notice a marked change in the teaching and learning strategy implemented by Unisa, together with the way in which the content is conceptualised in your modules. We encourage you to embrace these changes during your studies at Unisa in a responsive way within the framework of transformation

4 LECTURER(S) AND CONTACT DETAILS

4.1 Lecturer(s)

The details of the lecturers will be provided on the home page of the COS2611 site on *my*Unisa.

The details of the lecturers will also be communicated in a COSALL tutorial letter.

When you contact the lecturers, please do not forget to always include your student number and module code. This will help the lecturers to assist you.

4.2 Department

You can contact the School of Computing as follows:

Telephone number: **+27 (0) 11 670 9200**

E-mail: **computing@unisa.ac.za**

4.3 University

Contact addresses of the various administrative departments appear on the Unisa website: http://www.unisa.ac.za/sites/corporate/default/Contact-us/Student-enquiries.

Please include your student number in all correspondence

5 RESOURCES

5.1 Prescribed book(s)

MALIK, D. S., C++ Programming – Program Design including Data Structures, Custom Edition. Cengage Learning, 2022. 9781473792098

We refer to this book, in the tutorial letters, as **Malik**. You should purchase this prescribed text from one of the official university booksellers.

5.2 Recommended book(s)

The additional books listed below can be consulted if you require additional reading matter on this course. The library usually has only one copy of each of these items. Consequently, this material may not be readily available.

1. MALIK, D. S., C++ Programming – Program Design including Data Structures, 8th Edition. Thomson Course Technology, 2018.

2. NYHOFF, L., C++: An Introduction to Data Structures. Prentice-Hall, 1999.

3. PREISS, B. R., Data Structures and Algorithms with Object-Oriented Design Patterns in C++. John Wiley & Sons, Inc. 1999.

4. WEISS M.A., Data structures and problem solving using C++, 2nd edition. Addison Wesley, 2000

5. MALIK, D.S., Data structures using C++, International Edition, 2nd Edition, Cengage Learning,

Recommended books can be requested online, via the Library catalogue.

5.3 Electronic reserves (e-reserves)

No e-reserves are prescribed for this module

E-reserves can be downloaded from the library catalogue. More information is available at: http://libguides.unisa.ac.za/request/request

5.4 Library services and resources

The Unisa library offers a range of information services and resources:

- For brief information, go to https://www.unisa.ac.za/library/libatglance
- For more detailed library information, go to http://www.unisa.ac.za/sites/corporate/default/Library
- For research support and services (e.g. the services offered by personal librarians and the request a literature search service offered by the information search librarians), go to http://www.unisa.ac.za/sites/corporate/default/Library/Library-services/Research-support
- For library training for undergraduate students, go to https://www.unisa.ac.za/sites/corporate/default/Library/Library-services/Training

The library has created numerous library guides, available at http://libguides.unisa.ac.za

Recommended guides:

- Request and find library material/download recommended material: http://libguides.unisa.ac.za/request/request
- Postgraduate information services: http://libguides.unisa.ac.za/request/postgrad
- Finding and using library resources and tools: http://libguides.unisa.ac.za/Research_skills

- Frequently asked questions about the library: http://libguides.unisa.ac.za/ask
- Services to students living with disabilities: http://libguides.unisa.ac.za/disability
- A–Z of library databases: https://libguides.unisa.ac.za/az.php

Important contact information:

- Ask a librarian: https://libguides.unisa.ac.za/ask
- Technical problems encountered in accessing library online services: Lib-help@unisa.ac.za
- General library-related queries: Library-enquiries@unisa.ac.za
- Queries related to library fines and payments: Library-fines@unisa.ac.za
- Social media channels: Facebook: UnisaLibrary and Twitter: @UnisaLibrary

6 STUDENT SUPPORT SERVICES

The *Study @ Unisa* brochure is available on myUnisa: www.unisa.ac.za/brochures/studies

This brochure contains important information and guidelines for successful studies through Unisa.

If you need assistance with regard to the myModules system, you are welcome to use the following contact details:

- Toll-free landline: 0800 00 1870 (Select option 07 for myModules)
- E-mail: mymodules22@unisa.ac.za or myUnisaHelp@unisa.ac.za

You can access and view short videos on topics such as how to view your calendar, how to access module content, how to view announcements for modules, how to submit assessment and how to participate in forum activities via the following link:

https://dtls-qa.unisa.ac.za/course/view.php?id=32130

Registered Unisa students get a free myLife e-mail account. Important information, notices and updates are sent exclusively to this account. Please note that it can take up to 24 hours for your account to be activated after you have claimed it. Please do this immediately after registering at Unisa, by following this link: myLifeHelp@unisa.ac.za

Your myLife account is the **only** e-mail account recognised by Unisa for official correspondence with the university, and will remain the official primary e-mail address on record at Unisa. You remain responsible for the management of this e-mail account.

6.1 First-Year Experience Programme

Many students find the transition from school education to tertiary education stressful. This is also true in the case of students enrolling at Unisa for the first time. Unisa is a dedicated open distance and e-learning institution, and it is very different from face-to-face/contact institutions. It is a mega university, and all our programmes are offered through either blended learning or fully online learning. It is for this reason that we thought it necessary to offer first-time students additional/extended support to help them seamlessly navigate the Unisa teaching and learning journey with little difficulty and few barriers. We therefore offer a specialised student support programme to students enrolling at Unisa for the first time – this is Unisa's First-Year Experience (FYE) Programme, designed to provide you with prompt and helpful information about services that the institution offers and how you can access information. The following FYE services are currently offered:

- FYE website: All the guides and resources you need in order to navigate through your first year at Unisa can be accessed using the following link: www.unisa.ac.za/FYE
- FYE e-mails: You will receive regular e-mails to help you stay focused and motivated.
- FYE broadcasts: You will receive e-mails with links to broadcasts on various topics related to your first-year studies (e.g. videos on how to submit assessments online).
- FYE mailbox: For assistance with queries related to your first year of study, send an e-mail to fye@unisa.ac.za .

7. STUDY PLAN

Please visit *my*Unisa for a study plan.

8 HOW TO STUDY ONLINE

8.1 What does it mean to study fully online?

Studying fully online modules differs completely from studying some of your other modules at Unisa.

- **All your study material and learning activities for online modules are designed to be delivered online on myUnisa.**
- **All your assignments must be submitted online.** This means that you will do all your activities and submit all your assignments on myUnisa. In other words, you may **NOT** post your assignments to Unisa using the South African Post Office.
- **All communication between you and the University happens online.** Lecturers will communicate with you via e-mail and SMS, and use the **Announcements,** the **Discussion Forums** and the **Questions and Answers** tools. You can also use all of these platforms to ask questions and contact your lecturers.

9. ASSESSMENT

9.1 Assessment criteria

Assessment for COS2611 is in the form of assignments and a final exam.

The final mark is made up of the semester mark and the exam mark based on the following assessment plan guidelines.

This module covers basic data structures and algorithms. The data structures include queues, stacks, linked lists, graphs, trees and binary search trees. You will learn to implement and use them. You will also learn about complexity analysis, recursion and sorting and searching algorithms.

The syllabus covers the following selected topics:

Algorithm Analysis: After studying Algorithm analysis in **lesson 2 on myUnisa** , you should be able to:

- Specify a function to indicate the time and space requirements of a (non-recursive) algorithm in terms of the input size.
- Determine the worst case time and space complexity of non-recursive algorithms.

Pointers: After studying **Lesson 3** you should be able to:

- Declare and manipulate pointer variables.
- Use the new and delete operators to manipulate dynamic variables.
- Use dynamic arrays.
- Distinguish between shallow and deep copies of data.
- Implement classes with pointer data members.

STL: After studying **Lesson 4** you should be able to:

- Apply STL components such as containers, iterators and algorithms.

Linked Lists: After studying **Lesson 5** you should be able to:

- Explain the basic concepts of linked lists.
- Implement insertion and deletion operations on linked lists.
- Implement and manipulate a linked list.
- Implement and manipulate an ordered list.
- Apply the STL list container.

Recursion: After studying **Lesson 6** you should be able to:

- Understand recursive functions.
- Implement recursive functions to solve problems.

Stacks: After studying **Lesson 7** you should be able to:

- Explain the basic concepts of stacks.
- Implement a stack using an array.
- Apply the STL stack container.

Queues: After studying **Lesson 8** you should be able to:

- Explain the basic concepts of queues.
- Implement a queue using an array.
- Apply the STL queue container.

Search Algorithms: After studying **Lesson 9** you should be able to:

- Implement and analyze the sequential search algorithm.
- Implement and analyse the binary search algorithm.

Sorting Algorithms: After studying **Lesson 10** you should be able to:

- Implement and analyze the selection sort algorithm.
- Implement and analyze the insertion sort algorithm.
- Apply the quick sort algorithm.
- Apply the merge sort algorithm.

Binary Trees: After studying **Lesson 11** you should be able to:

- Explain the basic concepts of binary trees.
- Apply binary tree traversals.
- Implement a binary tree.
- Implement a binary search tree.
- Analyze binary search trees.

Graphs: After studying **Lesson 12** you should be able to:

- Explain the basic concepts of graph theory.
- Know how to represent a graph as an ADT.
- Explain and apply the breadth-first traversal algorithm.
- Explain and apply the shortest path algorithm**.**

9.2 Assessment plan

- To complete this module, you will be required to submit 03 assessments.
- All information about when and where to submit your assessments will be made available to you via the myModules site for your module.
- Due dates for assessments, as well as the actual assessments are available on the myModules site for this module.
- To gain admission to the examination, you will be required to submit 1 assignment/s.
- To gain admission to the examination, you need to obtain a year mark average of 50% for the assignments.
- The assignment weighting for the module is 20%.
- You will receive examination information via the myModules sites. Please watch out for announcements on how examinations for the modules for which you are registered will be conducted.
- The examination will count 80% towards the final module mark.

9.3 Assessment due dates

- There are no assignment **due dates** included in this tutorial letter.
- Assignment due dates will be made available to you on the myUnisa landing page for this module. We envisage that the due dates will be available to you upon registration.
- Please start working on your assessments as soon as you register for the module.
- Log on to the myUnisa site for this module to obtain more information on the due dates for the submission of the assessments.

9.4 Submission of assessments

- Unisa, as a comprehensive open distance e-learning institution (CODeL), is moving towards becoming an online institution. You will therefore see that all your study material, assessments and engagements with your lecturer and fellow students will take place online. We use myUnisa as our virtual campus.
- The myUnisa virtual campus will offer students access to the myModules site, where learning material will be available online and where assessments should be completed. This is an online system that is used to administer, document, and deliver educational material to students and support engagement between academics and students.

- The myUnisa platform can be accessed via https://my.unisa.ac.za. Click on the myModules 2023 button to access the online sites for the modules that you are registered for.

- The university undertakes to communicate clearly and as frequently as is necessary to ensure that you obtain the greatest benefit from the use of the myModules learning management system. Please access the announcements on your myModules site regularly, as this is where your lecturer will post important information to be shared with you.

- When you access your myModules site for the module/s you are registered for, you will see a welcome message posted by your lecturer. Below the welcome message you will see the assessment shells for the assessments that you need to complete. Some assessments may be multiple choice, some tests, others written assessments, some forum discussions, and so on. All assessments must be completed on the assessment shells available on the respective module platforms.

- To complete quiz assessments, please log on to the module site where you need to complete the assessment. Click on the relevant assessment shell (Assessment 1, Assessment 2, etc.). There will be a date on which the assessment will open for you. When the assessment is open, access the quiz online and complete it within the time available to you. Quiz assessment questions are not included in this tutorial letter (Tutorial Letter 101) and are only made available online. You must therefore access the quiz online and complete it online where the quiz has been created.

- It is not advisable to use a cell phone to complete the quiz. Please use a desktop computer, tablet or laptop when completing the quiz. Students who use a cell phone find it difficult to navigate the **Online Assessment** tool on the small screen and often struggle to navigate between questions and successfully complete the quizzes. In addition, cell phones are more vulnerable to dropped internet connections than other devices. **If at all possible, please do not use a cell phone for this assessment type**.

- For written assessments, please note the due date by which the assessment must be submitted. Ensure that you follow the guidelines given by your lecturer to complete the assessment. Click on the submission button on the relevant assessment shell on myModules. You will then be able to upload your written assessment on the myModules site of the modules that you are registered for. Before you finalise the upload, double check that you have selected the correct file for upload. Remember, no marks can be allocated for incorrectly submitted assessments.

9.5 The assessments

As indicated in section 9.2, you need to complete 03 assessments for this module. **There are no assignments included in this tutorial letter.** Assignments and due dates will be made available to you on myModules for this module. We envisage that the due dates will be available to you upon registration.

9.6 Other assessment methods

No other assessment methods.

9.7 The examination

Examination information and details on the format of the examination will be made available to you online via the myUnisa site. Look out for information that will be shared with you by your lecturer and e-tutors (where relevant) and for communication from the university.

9.7.1 *Invigilation/proctoring*

Since 2020 Unisa conducts all its assessments online. Given stringent requirements from professional bodies and increased solicitations of Unisa's students by third parties to unlawfully assist them with the completion of assignments and examinations, the University is obliged to assure its assessment integrity through the utilisation of various proctoring tools: Turnitin, Moodle Proctoring, the Invigilator App and IRIS. These tools will authenticate the student's identity and flag suspicious behaviour to assure credibility of students' responses during assessments. The description below is for your benefit as you may encounter any or all of these in your registered modules:

Turnitin is a plagiarism software that facilitates checks for originality in students' submissions against internal and external sources. Turnitin assists in identifying academic fraud and ghost writing. Students are expected to submit **typed** responses for utilisation of the Turnitin software.

The **Moodle Proctoring tool** is a facial recognition software that authenticates students' identity during their Quiz assessments. This tool requires access to a student's **mobile or laptop camera**. Students must ensure their camera is activated in their browser settings prior to their assessments.

The Invigilator "mobile application-based service does verification" of the identity of an assessment participant. The Invigilator Mobile Application detects student dishonesty-by-proxy and ensures that the assessment participant is the registered student. This invigilation tool requires students to download the app from their Play Store (Google, Huawei and Apple) on their **mobile devices** (camera enabled) prior to their assessment.

IRIS Invigilation software verifies the identity of a student during assessment and provides for both manual and automated facial verification. It has the ability to record and review a student's assessment session. It flags suspicious behaviour by the students for review by an academic administrator. IRIS software requires installation on students' **laptop devices** that are enabled with a webcam.

Students who are identified and flagged for suspicious dishonest behaviour arising from the invigilation and proctoring reports are referred to the disciplinary office for formal proceeding.

Please note:

Students must refer to their module assessment information on their myModule sites to determine which proctoring or invigilation tool will be utilised for their formative and summative assessments.

9.8 Supplementary

If your final mark for this module is above 40% but below 50%, you will be allowed to write a supplementary examination in January/February 2023.

10. ACADEMIC DISHONESTY

10.1 Plagiarism

Plagiarism is the act of taking the words, ideas and thoughts of others and presenting them as your own. It is a form of theft. Plagiarism includes the following forms of academic dishonesty:

- Copying and pasting from any source without acknowledging the source.
- Not including references or deliberately inserting incorrect bibliographic information.
- Paraphrasing without acknowledging the original source of the information.

10.2 Cheating

Cheating includes, but is not limited to, the following:

- Completing assessments on behalf of another student, copying the work of another student during an assessment, or allowing another student to copy your work.
- Using social media (e.g. WhatsApp, Telegram) or other platforms to disseminate assessment information.
- Submitting corrupt or irrelevant files, this forms part of examination guidelines
- Buying completed answers from so-called “tutors” or internet sites (contract cheating).

10.3 For more information about plagiarism, follow the link below:

https://www.unisa.ac.za/sites/myunisa/default/Study-@-Unisa/Student-values-and-rules

11. STUDENTS LIVING WITH DISABILITIES

The Advocacy and Resource Centre for Students with Disabilities (ARCSWiD) provides an opportunity for staff to interact with first-time and returning students with disabilities.

If you are a student with a disability and would like additional support or need additional time for assessments, you are invited to contact (name and e-mail address of the lecturer must be inserted) to discuss the assistance that you need.

12. IN CLOSING

Do not hesitate to contact your e-tutors or lecturers by email if you are experiencing problems with the content of this tutorial letter or any aspect of the module.

We wish you a fascinating and satisfying journey through the learning material and trust that you will complete the module successfully.

Enjoy the journey!