Department of Intelligent Science

MODULE HANDBOOK

INT102

Algorithmic Foundations and Problem Solving

Dr. Jia WANG, Dr. Yushi LI, Dr. Pengfei FAN

SECTION A: Basic Information

- **Brief Introduction to the Module**

1. To introduce the notation, terminology, and techniques underpinning the study of algorithms.
2. To introduce the standard algorithmic design paradigms employed in the development of efficient algorithmic solutions.
3. To introduce the mathematical tools needed for the analysis of algorithms in terms of the use of formal models of Time and Space

- **Key Module Information**

Module name: Algorithmic Foundations and Problem Solving

Module code: INT102

Credit value: 5

Semester in which the module is taught: Semester 2

Pre-requisites needed for the module:

Programmes on which the module is shared:

BSc Information and Computing Science
BSc Information Management and Information Systems
BSc Bioinformatics
BEng Digital Media Technology

- **Delivery Schedule**

Lecture
Venue: Science Building-SC176 time: 9:00 -10:50 Tuesday (group 1)
Venue: Science Building-SC176 time: 14:00 -15:50 Tuesday (group 2)

Lecture/Tutorial
Venue: Science Building- SC176
time: 11:00 -12:50 Friday (group 1)
time: 14:00 -15:50 Friday (group 2)

- **Module Leader and Contact Details**

1. Dr. Jia Wang

Brief Biography:

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Room number and office hours: Monday SD537/ 11:00-13:00,

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2. Dr. Yushi Li

Brief Biography:

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Preferred means of contact: e-mail

3. Dr. Pengfei Fan

Brief Biography:

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Office telephone number: 5123

Room number and office hours: Wed SD559/ 15:00-17:00,

Preferred means of contact: e-mail

- **Additional Teaching Staff and Contact Details**

Name	Email
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SECTION B: What you can expect from the module

- **Educational Aims of the Module**

1. To introduce the notation, terminology, and techniques underpinning the study of algorithms.
2. To introduce the standard algorithmic design paradigms employed in the development of efficient algorithmic solutions.
3. To introduce the mathematical tools needed for the analysis of algorithms in terms of the use of formal models of Time and Space

- **Learning Outcomes**

At the end of this module students should be able to:

1. describe standard algorithms such as sorting algorithms, search algorithms, string matching algorithms, graph traversal of algorithms;
2. apply these algorithms or a given pseudo code algorithm in order to solve a given problem;
3. carry out simple asymptotic analyses of algorithms involving sequence, selection, and iteration, and identify and compare simple properties of these algorithms;
4. describe the algorithm design principles of divide-and-conquer, greedy method, and dynamic programming and distinguish the differences between these principles;
5. apply the studied algorithms that illustrate these design principles;
6. apply the studied design principles to produce algorithmic solutions to a given problem;
7. explain and illustrate the distinction between different classes of problems, in particular, polynomial time and exponential time solvable problems.

- **Assessment Details**

The assessment of the module consists of three components: two coursework and final exam. Coursework 1 is given in week 7, which covers all the teaching material taught in the first 6 weeks and coursework 2 is given in week 12, which covers the teaching materials taught from week 8 to week 12. The final exam covers all teaching material presented in the module. Each coursework contributes 10% to the final mark and the final exam contributes 80% to the final mark. Re-siting is available at the end of the academic year and will contribute 100% to the final mark.

- **Methods of Learning and Teaching**

In each normal week, students will be expected to attend a three-hour formal lecture and to participate in a one-hour supervised problem solving session. Lectures will introduce students to the academic content and practical skills which are the subject of the module, while problem solving sessions will allow students to practice those skills. In addition, students will be expected to devote 8 hours of unsupervised time for private study. Private study will provide time for reflection and consideration of lecture material and background reading. Two assessments will be used to test to what extent practical skills have been learnt. A written examination at the end of the module will assess the academic achievement of students.

❑ Syllabus & Teaching Plan

	Lecture	Topic/Theme/Title	Pre-reading
Week 2 (Dr. Li)	Lecture1/lecture 2	Introduction to module, Concepts about algorithms	Chapter 1 *
Week 3 (Dr. Li)	Lecture1	asymptotic analysis. brute force methods: searching and sorting algorithms	Chapter 2 Chapter 3:3.1, 3.2
Week 4 (Dr. Li)	Lecture1/lecture 2	Divide and Conquer: Binary search, mergesort, recursive algorithms	Chapter 5: 5.1
Week 5 (Dr. Li)	Lecture1	Graph, BFS and DFS algorithms	Chapter 3: 3.5
Week 6 （Dr. Fan）	Lecture1/lecture 2	Greedy Method: Prim's algorithm, Kruskal's algorithms	Chapter 9: 9.1. 9.3
Week 7 （Dr. Fan）	Lecture1	Dijkstra algorithms	Chapter 9: 9.3
Week 9 （Dr. Fan）	Lecture1/lecture 2	Dynamic Programming: Assembly line Schedule, Knapsack Problem	Chapter 8 8.4
Week 10 （Dr. Fan）	Lecture 1	Dynamic Programming: Sequence Alignment	Chapter 8 8.2,
Week 11 (Dr. Wang)	Lecture1/lecture 2	Space and time trade-offs	Chapter 7, 7.1 and 7.2
Week 12 (Dr. Wang)	Lecture 1	Introduction to Computational Complexity Theory	Chapter 11 11.3
Week 13 (Dr. Wang)	Lecture1/lecture 2	Coping with the Limitations of Algorithm Power	Chapter 12 12.1, 12.2
Week 14 (Dr. Wang)	Lecture	Introduction to Approximation Algorithms	Chapter 12 12.3

*Textbook: INTRODUCTION TO THE DESIGN AND ANLYSIS OF ALGORITHMS

❑ Tutorial Schedule

Student Group	Time	Day	Venue	Lecturer/Instructor
Group 1	11:00 - 12:50	Friday, Week 2, 4, 6,9,11,13	Science Building-SC176	Dr. Pengfei Fan, Dr. Yushi Li Dr. Jia Wang, etc.
Group 2	14:00 - 15:50	Friday, Week 2, 4, 6, 9,11,13	Science Building-SC176	Dr. Pengfei Fan, Dr. Yushi Li Dr. Jia Wang, etc.

❑ Reading Materials

Required (Essential) Textbook:

Recommended Texts: INTRODUCTION TO THE DESIGN AND ANLYSIS OF ALGORITHMS A. V. LEVITIN

Additional Readings: INTRODUCTION TO ALGORITHMS T. H. CORMEN C. E. LEISERSON R. L. RIVEST AND C. S WILEY

SECTION C: Further Information

- **Student Feedback**
  The University is keen to require student feedback to make improvements for each module in every session. It is University policy that the preferred way of achieving this is by means of an Online Module Evaluation Questionnaire Survey.Students will be invited to complete the questionnaire survey for this module at theend of the semester.

You are strongly suggested to read policies mentioned below very carefully, which will help you better perform in your academic studies.
All the policies and regulations related to your academic study can be found in Student Academic Services section under the heading "Policies and Regulations" on E-bridge.

- **Plagiarism, Cheating, and Fabrication of Data.**
  Offences of this type can result in attendance at a University-level committee and penalties being imposed. You need to be familiar with the rules. Please see the "Policy for Dealing with Plagiarism, Collusion and Data Fabrication" document available on e-Bridge in the Student Academic Services section under the heading 'Policies and Regulations'.

- **Rules of submission for assessed coursework**
  The University has detailed rules and procedures governing the submission of assessed coursework. You need to be familiar with them. Details can be found in the "Code of Practice for Assessment" document available on e-Bridge in the Student Academic Services section under the heading 'Policies and Regulations'.

- **Late Submission of Assessed Coursework**
  The University attaches penalties to the late submission of assessed coursework. You need to be familiar with the University's rules. Details can be found in the "Code of Practice for Assessment" document available on e-Bridge in the Student Academic Services section under the heading 'Policies and Regulations'.

- **Mitigating Circumstances**
  The University is able to take into account mitigating circumstances such as illness or personal circumstances which may have adversely affected student performance on a module. It is the student's responsibility to keep their Academic Adviser, Programme Director or Head of Department informed of illness and other factors affecting their progress during the year and especially during the examination period. Students who believe that their performance on an

examination or assessed coursework may have been impaired by illness, or other exceptional circumstances should follow the procedures set out in the Mitigating Circumstances Policy, which can be found on e-Bridge in the Student Academic Services section under the heading 'Policies and Regulations'.

- **Learning Mall**

  Copies of lecture notes and other materials are available electronically through Learning Mall, the University's virtual learning environment.