1 Prerequisites

COMP1110 or COMP1140, or COMP1600; 6 units of 2000-level COMP courses and 6 units of 2000-level MATH courses or COMP2600.

2 Syllabus

This course deals with the study of algorithms for solving practical problems and data structures used in the implementations of algorithms. Detailed analysis of the resource requirements of algorithms will be an important issue.

A large variety of algorithms are candidates for study. These include, but are not limited to, the following: greedy algorithms, dynamic programming, divide-and-conquer paradigm, basic graph algorithms like BFS and DFS trees, topological sort, minimum spanning tree algorithms, single source shortest path algorithms, all pairs of shortest paths algorithms, advanced data structures such as hash tables, binary search trees, red-black trees, and disjoint-set. The mathematical tools used to study the resource usage of algorithms will be considered, too.

3 Course Description

A good knowledge of algorithms and algorithmic theory is essential for finding efficient solutions to real life problems, and for determining whether such a solution exists in the first place. This course aims to expose students to a variety of algorithms that have practical applications, while conducting detailed analysis of the resource requirements required by the algorithms.

4 Rationale

Aim to give the students an exposure to a variety of algorithms that can be used for solving real life problems. This should help them acquire necessary skills to recognize problem scenarios where such algorithms can be used, to modify an existing algorithm or develop a new one for new problems, and to show that the given problem does not lead itself to an efficient solution, if such is the case. It will also provide further experience in the development of efficient software for nontrivial purposes.

5 Ideas

This course will carry the main responsibility as follows

- Expose students to a variety of algorithms that can be used to solve real problems, as well as doing a detailed resource analysis of algorithms
- Give them examples where such algorithms can be used
• Provide them the knowledge of how to design, select and evaluate algorithms

6 Topics

The topics covered could include the following:

• Mathematical tools: analysis of algorithm resource usage, counting and recurrence techniques
• General algorithm paradigms: divide-and-conquer, greedy algorithms, and dynamic programming
• Data structures: hash tables, heaps, binary search trees, red-black trees, and disjoint-sets, DFS and BFS
• Graph algorithms: connected components, minimum spanning trees, a single source shortest path, all pairs of shortest paths, transitive closure, and topological sort

7 Skills

Will acquire a good knowledge of a variety of algorithms that have real-life applications; will further develop skills in the analysis of algorithms; will get some hands-on experience in the design, analysis and implementation of algorithms for some non-trivial problems; will get an exposure to the theory of intractability; will get some experience in how one can go about showing that certain problems are intractable.

8 Objectives

Upon completion of this course, the student will

• have a thorough understanding of a variety of algorithms with real-life applications and the resource requirements
• be able to apply the algorithmic techniques including dynamic programming, greedy policy, and divide-and-conquer and data structures such as hash tables, binary search trees, priority heaps, to solve some practical problems
• be able to analyze time and space complexities of algorithms
• have some experience in the design and implementation of algorithms for practical problems, using languages like C, C++, Java, Python, etc

9 Assessment

There will be four quizzes (Q), two assignments (\(a_1\) and \(a_2\)) (A), one mid-semester exam (M), and one final exam (F). It must be emphasized that both assignments and exams are compulsory assessment components in this course assessment, should you miss any assignment submissions or missing either of the two examinations, you fail this course automatically.

Following the School assessment policy, the final mark of this course will be calculated by the following formula, subject to necessary adjustments during the School examination meeting.

\[
Total = 0.15 \times Q + 0.35 \times A + 0.2 \times M + 0.3 \times F,
\]
where \( Q = Q_1 + Q_2 + Q_3 + Q_4 \) with \( Q_1 = 3 \), \( Q_2 = 3.5 \), \( Q_3 = 4.5 \) and \( Q_4 = 4 \) while \( A = a_1 + a_2 \) with \( a_1 = 15/35 \) and \( a_2 = 20/35 \). In order to pass the course, the final marks for both assignments and examinations are no less than 45% of their corresponding final mark allocations, i.e., your final score on assignments and examinations are no less than 16/35 and 22/50, respectively, and all assignments and examinations are compulsory to pass the course.

The detailed due dates are as follows.

1. The four quizzes due dates are August 4, August 18, September 29, and October 13, respectively.
2. The two assignments due dates are September 1 (Friday) and October 27 (Friday).
3. The mid-semester exam is expected to be scheduled in week 7 (September 18 to September 22) and the final exam is expected to be scheduled in the 1st examination week.

Notice that the university-wide late submission penalty policy will be applied, i.e., 5% mark deduction per working day (from Monday to Friday) except public holidays after a submission deadline.

Also, if there is any dispute on the marking and marking score of an assessment item, the request for the reassessment of that item (quizzes and assignments) must proceed within TWO weeks after the marks and solutions of that item have been released. Beyond this two-week period, no further reassessment requests will be considered.

10 Plagiarism issues

The School’s policy on plagiarism will be enforced. A student in this course is expected to be able to explain and defend any submitted assessment item. The course convener can conduct or initiate an additional interview about any submitted assessment item for any student. If there is a significant discrepancy between the two forms of assessment, it will be automatically treated as a case of suspected academic misconduct.

11 Lectures, Laboratories and Consultations Time Scheduling

The course consists of about 28 lectures, 6 tutorials/labs (two hours each) which run together. The detailed arrangement is as follows.

**Three** one-hour lectures are offered per week. They are on Mondays, Wednesdays, and Thursdays. The lectures are scheduled at

- 1:00pm – 2:00pm on Monday, RN Robertson T (Building 46E)
- 1:00pm – 2:00pm on Wednesday, RN Robertson T (Building 46E)
- 12:00pm – 1:00pm on Thursday, RN Robertson T (Building 46E)

**Eight** tute/lab will be offered, which are run on Weeks 2, 4, 6, 8, 10 and 12, and there are eight tute/lab groups. The times for the tutorials and labs are scheduled at

- 3:00pm – 5:00pm on Monday, CSIT N115/N116 (Tutor: Mr Mojtaba Rezvani and Mr Meitian Huang)
- 3:00pm – 5:00pm on Wednesday, CSIT N112 (Tutor: Mr Meitian Huang)
- 5:00pm – 7:00pm on Wednesday, CSIT N111 (Tutor: Mr Meitian Huang/Yu Ma)
• 9:00am – 11:00am on Thursday, CSIT N112 (Tutor: Mr Mojtaba Rezvani)
• 3:00pm – 5:00pm on Thursday, CSIT N114 (Tutor: Mr Yu Ma)
• 9:00am – 11:00am on Friday, CSIT N114 (Tutor: Mr John Zhang)
• 11:00am – 1:00pm on Friday, CSIT N114 (Tutor: Mr Yu Ma)
• 1:00pm – 3:00pm on Friday, CSIT N109 (Tutor: Mr John Zhang)

The consulting times are as follows.

• 10:00am – 12:00pm on Fridays (Weifa Liang), CSIT N334

12 Textbook and Reference Books

The following textbook will be used for this course:


The following reference books are recommended for this course:


13 Staff

The course manager is Prof Weifa Liang. The course lecturers are Prof Weifa Liang (N334, CSIT Building, phone: 6125-3019) and A/Prof Peter Strazdins (N217, CSIT Building, phone: 6125-5140).

The course tutors are Mr Mojtaba Rezvani (Room N329, CSIT Building, email: Mojtaba.Rezvani@anu.edu.au), Mr Meitian Huang (Room N329, CSIT Building, email: u4700480@anu.edu.au), Mr Yu Ma (Room 320, u5108648@anu.edu.au), John Zhang (John.Zhang@anu.edu.au)