Wollongong College Australia

A College of the University of Wollongong

Australia

Wollongong

Diploma in Information Technology

(CRICOS course codes: 057233A, 057234M)

Subject Outline

Summer 2009/10

WUCT103

Algorithms & Problem Solving

ITC Education Ltd trading as
Wollongong College Australia
CRICOS 02723D
ABN 14105312329

WCA-WUCT103-S0/5

Algorithms & Problem Solving

Subject Description

This subject introduces the basic concepts of algorithms and their relationship to data structures and problem solving. It emphasises problem solving techniques leading to the development of algorithms rather than their implementation or a formal mathematical treatment of algorithms.

It is a precursor to formal algorithm analysis and to the learning of any specific computer programming language. The subject structure reflects an awareness of the need for students to comprehend 'what' will be written in a computer program, prior to learning 'how' to write it. Thus, students gain an appreciation of the principles of general problem solving and algorithm construction before their conceptions of such matters can be pre-loaded and restricted by the assumptions inherent in any specific computer programming language.

Topics include sorting, searching and counting problems and the principal algorithms used in their solution. Common approaches to algorithm development and analysis will be examined.

Subject structure

Algorithms & Problem Solving is delivered in a face-to-face format of 7 (seven) hours per week. The subject consists of 2 x 2 hour lectures and 3 hours of tutorial/ practical classes each week. The session is of 14 week's duration with face-to-face classes scheduled for the first 12 weeks and a study/examination period in Weeks 13 and 14.

Students may be required to access computer laboratories outside normal laboratory class time in order to complete assignments. Furthermore, students will be required to undertake supplementary reading from relevant textbooks.

The subject uses a number of teaching and learning strategies to allow students to fulfill the objectives and be able to transfer the skills to their future work and study most effectively.

The teaching strategies will include lectures, tutorials, small group discussions and class exercises.

Students would be expected and encouraged to use learning strategies that encourage deep understanding of topics and concepts. These include reflective readings, class discussion, mind mapping, explorations of new ideas and discussion with content experts.

The abstract nature of the material requires a discursive delivery designed to transfer a conceptual rather than a specific skill set. Classes use lecture time to carefully explain a given concept, with heavy use of multiple worked examples and metaphors.

Students are taught techniques for simple 'on-paper' processes which implement the concept at hand and provide a general understanding of how a given strategy or algorithm works. Students are set a number of practice problems to complete in class and/or at home.

In addition to scheduled class sessions, students are expected to spend additional time in individual study and research. As a general guideline students will need to spend at least 1 hour in private study (including completing homework and revision) for every two hours of scheduled class time.

Teachers will be available for a consultation time each week. Students will be notified of the time and location of the consultation session during Week 1 of the Session. It is recommended that students experiencing difficulty with this subject arrange to consult with the teacher as difficulties are encountered.

Some students may require tutorial support to improve language/literacy skills. Where this is recommended, students will be advised to use the College's self-access facilities in the Multimedia Centre in their own time. These facilities are located upstairs in building 30.

Learning resources

Students are not required to purchase a specific text but should use the following as a guide to reading:

Berman, K.A. and Paul, J.L., 2005, *Algorithms: Sequential, Parallel, and Distributed*, Thomson Course Technology, Boston.

Brassard, G. and Bratley, P., 1996, *Fundamentals of Algorithmics*, Prentice Hall, Englewood.

Forouzan, B.A., 2004, *Foundations of Computer Science From Data Manipulation to Theory of Computation*, Brooks/Cole, Belmont, California.

Gilberg, R. and Forouzan, B.A., 2001, *Data Structures: A Pseudocode Approach with C++*, Brooks/Cole, Belmont, California.

Levitin, A., 2003, *Introduction to the Design and Analysis of Algorithms*, Addison Wesley, Boston.

Subject outcomes

Successful completion of Algorithms & Problem Solving will enable students to:

- apply knowledge of algorithms in the problem solving process;
- create algorithms and apply them to solve simple problems;
- evaluate the concept of recursion and analyse its use;
- compare and evaluate the base case and the general case of a recursively defined problem;
- determine the appropriate solution technique for a given problem;
- demonstrate an understanding of the concepts of time and space complexity as applied to simple algorithms;
- analyse and evaluate the computational efficiency of the principal algorithms for sorting and searching;
- demonstrate an understanding of the relationship of trees to data structures, algorithms and counting;
- analyse issues logically, evaluate different options and viewpoints and implement decisions.

Subject outline in weeks

The following guide to lessons and activities may be adjusted to suit the needs of the group as long as subject outcomes and assessment criteria are met.

	Lecture Series A Algorithms	Lecture Series B Problem Solving
Week 1		
	Introduction to algorithms and problem solving Pseudocode and Flowcharts	Invariants; identifying the invariant as a means to solving problems
Week 2		
	Elementary algorithms	Brute Force vs. Finesse
Week 3		
	Records, arrays, lists	Games: Winning Strategies
Week 4		
	Sorting and searching algorithms	Exploiting symmetry in problem Solving
Week 5		
	Linked list	Calculational Logic
Week 6		
	Queue and stack	Induction
Week 7		
	Recursion	Use induction to prove a hypothesis
Week 8		
	Trees	Towers of Hanoi: examining recursive solutions
Week 9		
	Graphs	Backtracking, Game Trees
Week 10		
	Algorithm analysis: empirical measurement, performance comparison	Knight's tour, Kings tour
Week 11		
	Algorithmic strategies: Brute force, greedy, divide and conquer	More on Knight's tour, Kings tour
Week 12		
	Algorithmic strategies: Backtracking, heuristics	A sensible way to discuss the complexity of a problem
Week 13 & 14 Final examination Period		

Examination and study period. Please refer to examination timetable for the exact date, time and location of the final exam.

Assessment

Assessment and plagiarism policy

All written assessment tasks, with the exception of examinations and in-class tasks, must be word-processed unless students are otherwise advised.

Students must keep copies of all assessment tasks submitted for marking with the exception of class tests and examinations.

Plagiarism is a form of cheating or stealing that happens when a student uses someone else's work and presents it as his/her own without showing where it comes from. To avoid this, students are expected to submit their own original work for assessment and to accurately acknowledge all references and sources used in essays and assignments.

For information regarding assessment, plagiarism, acknowledging sources and examination rules, please refer to the Wollongong College Australia Student Handbook http://www.wca.uow.edu.au/handbook

Assessment Schedule

Task	Due	Weighting	Length/Time
Assignment 1	Week 2	5%	
Assignment 2	Week 4	5%	
Assignment 3	Week 6	10%	
Assignment 4	Week 8	10%	
Assignment 5	Week 10	5%	
Assignment 6	Week 12	5%	
Final Examination	Week 13/14	50%	3 hours
Participation	Ongoing	10%	Weeks 1 - 12

Note: A final mark of 50% or higher is required to pass ALL Diploma subjects. A mark between 45% and 49% is NOT a pass.

Marking Guidelines

WCA best practice is that students can normally expect to have assessment tasks handed back within two weeks, and before the next assessment task is due. On occasion there may be exceptions to this time frame due to, for example, the size of the task, the size of the class, teacher illness or teacher leave.

Where there are several teachers marking a major assessment task, tasks will be handed back by all the teachers within the same week.

Assessment criteria and explanation of components

Assignments 40%

There will be a total of 6 assignments released on **e-learning** in weeks 1, 3, 5, 7, 9 and 11. Each assignment is due at **23:59** on **Wednesday the following week,** ie in weeks 2, 4, 6, 8, 10 and 12.

The assignments are NOT equally weighted. Refer to the Assessment Schedule for details of assignment weightings.

All assignments must be **submitted via e-learning** (no exceptions).

The following penalties will apply to late assignments (in accordance with the Student Handbook):

1 day late: - 10%

2 days late: - 20%

3 days late: - 30%

Work submitted more than three days late will be graded as 0 marks

For each assignment, no submission will be possible beyond 23:59 Saturday of the week due.

Final Examination 50%

The final exam is of 3 hours duration plus reading time. You will be given more information on the format of the final exam during the session.

Students who receive a grade of less than 40% in the final exam may be awarded a fail in this subject regardless of the total final mark.

Non-English speaking background students in the Diploma Programs may use foreign language dictionaries for their final exams. Diploma students who wish to use a dictionary must complete the Dictionary Use Application Form available at reception. This form and the dictionary must be submitted to reception **no later than 5pm Friday week 11** for approval.

Please note the following regulations regarding dictionary use:

- The only dictionaries permitted are language dictionaries, with word to word translations only.
- English-English dictionaries, Electronic dictionaries, Terminology dictionaries, or other are not permitted. The dictionary **must not** include English translations or explanations. Any dictionary that includes English explanations or phrases is not acceptable and will not be approved.

Participation 10%

Active participation in tutorials is expected of all students. Participation in class discussions will help develop the student's confidence in questioning and commenting on material presented, encourage critical thinking and allow the tutor to evaluate the student's progress.

Participation marks may be allocated according to the following criteria:

- Proactive consultation with class teacher
- Completion of non-assessable tasks including homework and practice tasks
- Preparation for teacher-student consultation sessions
- Active participation in group work and class discussions