



COIT29224 *Evolutionary Computation*

Term 2 - 2021

Profile information current as at 14/12/2025 12:39 pm

All details in this unit profile for COIT29224 have been officially approved by CQUniversity and represent a learning partnership between the University and you (our student). The information will not be changed unless absolutely necessary and any change will be clearly indicated by an approved correction included in the profile.

General Information

Overview

Evolutionary Computation, an area of Artificial Intelligence, comprises machine learning optimisation and classification paradigms based on principles from biological sciences. In this unit, you will explore how principles from theories of evolution and natural selection can be used to construct intelligent systems. You will learn the theoretical concepts of representation, selection, reproduction, and recombination. You will apply evolutionary algorithms, such as evolution strategies, genetic programming, and particle swarm optimisation to tackle science, engineering, social, and business problems and opportunities.

Details

Career Level: *Postgraduate*

Unit Level: *Level 9*

Credit Points: 6

Student Contribution Band: 8

Fraction of Full-Time Student Load: 0.125

Pre-requisites or Co-requisites

Pre-requisite: COIT20277 Introduction to Artificial Intelligence

Important note: Students enrolled in a subsequent unit who failed their pre-requisite unit, should drop the subsequent unit before the census date or within 10 working days of Fail grade notification. Students who do not drop the unit in this timeframe cannot later drop the unit without academic and financial liability. See details in the [Assessment Policy and Procedure \(Higher Education Coursework\)](#).

Offerings For Term 2 - 2021

No offerings for COIT29224

Attendance Requirements

All on-campus students are expected to attend scheduled classes – in some units, these classes are identified as a mandatory (pass/fail) component and attendance is compulsory. International students, on a student visa, must maintain a full time study load and meet both attendance and academic progress requirements in each study period (satisfactory attendance for International students is defined as maintaining at least an 80% attendance record).

Website

[This unit has a website, within the Moodle system, which is available two weeks before the start of term. It is important that you visit your Moodle site throughout the term. Please visit Moodle for more information.](#)

Class and Assessment Overview

Recommended Student Time Commitment

Each 6-credit Postgraduate unit at CQUniversity requires an overall time commitment of an average of 12.5 hours of study per week, making a total of 150 hours for the unit.

Class Timetable

[Regional Campuses](#)

Bundaberg, Cairns, Emerald, Gladstone, Mackay, Rockhampton, Townsville

[Metropolitan Campuses](#)

Adelaide, Brisbane, Melbourne, Perth, Sydney

Assessment Overview

1. **Practical Assessment**

Weighting: 25%

2. **Practical Assessment**

Weighting: 35%

3. **Written Assessment**

Weighting: 40%

Assessment Grading

This is a graded unit: your overall grade will be calculated from the marks or grades for each assessment task, based on the relative weightings shown in the table above. You must obtain an overall mark for the unit of at least 50%, or an overall grade of 'pass' in order to pass the unit. If any 'pass/fail' tasks are shown in the table above they must also be completed successfully ('pass' grade). You must also meet any minimum mark requirements specified for a particular assessment task, as detailed in the 'assessment task' section (note that in some instances, the minimum mark for a task may be greater than 50%). Consult the [University's Grades and Results Policy](#) for more details of interim results and final grades.

CQUniversity Policies

All University policies are available on the [CQUniversity Policy site](#).

You may wish to view these policies:

- Grades and Results Policy
- Assessment Policy and Procedure (Higher Education Coursework)
- Review of Grade Procedure
- Student Academic Integrity Policy and Procedure
- Monitoring Academic Progress (MAP) Policy and Procedure – Domestic Students
- Monitoring Academic Progress (MAP) Policy and Procedure – International Students
- Student Refund and Credit Balance Policy and Procedure
- Student Feedback – Compliments and Complaints Policy and Procedure
- Information and Communications Technology Acceptable Use Policy and Procedure

This list is not an exhaustive list of all University policies. The full list of University policies are available on the [CQUniversity Policy site](#).

Previous Student Feedback

Feedback, Recommendations and Responses

Every unit is reviewed for enhancement each year. At the most recent review, the following staff and student feedback items were identified and recommendations were made.

Feedback from Student evaluation

Feedback

Expect to see more examples for particle swarm optimisation.

Recommendation

Include more example solutions on particle swarm optimisation.

Unit Learning Outcomes

On successful completion of this unit, you will be able to:

1. Formulate an evolutionary computation search or optimisation problem by analysing an authentic case or scenario
2. Design an evolutionary algorithm for a problem applying the core evolutionary computation concepts and mechanisms
3. Build a software application to implement an evolutionary algorithm for a complex search or optimisation problem
4. Write an article that evaluates the performance and interprets the results of your software application of evolutionary computation paradigm to an authentic problem.

The Skills Framework for the Information Age (SFIA) standard covers the skills and competencies related to information and communication technologies. SFIA defines levels of responsibility and skills. SFIA is adopted by organisations, governments and individuals in many countries. SFIA is increasingly being used when developing job descriptions and role profiles. SFIA can be used by individuals for creating personal skills profile. The Australian Computer Society (ACS) recognises the SFIA and provides [MySFIA](#) for ACS members to build a skills profile.

This unit contributes to the following workplace skills as defined by [SFIA 7](#) (the SFIA code is included):

- Software design (SWDN)
- Programming/software development (PROG)
- Testing (TEST)
- Application Support (ASUP).

Alignment of Learning Outcomes, Assessment and Graduate Attributes

 N/A Level	 Introductory Level	 Intermediate Level	 Graduate Level	 Professional Level	 Advanced Level
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








Alignment of Assessment Tasks to Learning Outcomes

Assessment Tasks	Learning Outcomes			
	1	2	3	4
1 - Practical Assessment - 25%	•	•	•	
2 - Practical Assessment - 35%	•	•	•	
3 - Written Assessment - 40%				•

Alignment of Graduate Attributes to Learning Outcomes

Graduate Attributes	Learning Outcomes			
	1	2	3	4
1 - Knowledge				
2 - Communication				
3 - Cognitive, technical and creative skills				
4 - Research				
5 - Self-management				
6 - Ethical and Professional Responsibility				
7 - Leadership				
8 - Aboriginal and Torres Strait Islander Cultures				

Alignment of Assessment Tasks to Graduate Attributes

Assessment Tasks	Graduate Attributes							
	1	2	3	4	5	6	7	8
1 - Practical Assessment - 25%								
2 - Practical Assessment - 35%								
3 - Written Assessment - 40%								

Textbooks and Resources

Textbooks

COIT29224

Prescribed

Particle Swarm Optimization

(2006)

Authors: Maurice Clerc

Wiley

ISBN: 9780470612163

Binding: eBook

Additional Textbook Information

If you prefer to study with a paper text, it can be ordered on demand at the CQUni Bookshop here:

<http://bookshop.cqu.edu.au> (search on the Unit code).

IT Resources

You will need access to the following IT resources:

- CQUniversity Student Email
- Internet
- Unit Website (Moodle)
- Python (Version 3.8.1) available from <https://www.python.org/>
- Anaconda3-2021.05 (available from <https://www.anaconda.com/products/individual-c>)
- graphviz (version 0.16) available from <https://pypi.org/project/graphviz/>

Referencing Style

All submissions for this unit must use the referencing styles below:

- [Harvard \(author-date\)](#)
- [American Psychological Association 7th Edition \(APA 7th edition\)](#)

For further information, see the Assessment Tasks.

Teaching Contacts

There are no teaching contacts available for this unit

Schedule

Week 1 - 12 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
Particle Swarm Optimization (PSO): Basic Algorithm and Python	Lecture Notes and Chapter 3	

Week 2 - 19 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
PSO: Algorithmic Efficiency and Benchmarks	Lecture Notes and Chapters 1 and 6.	

Week 3 - 26 Jul 2021

Module/Topic	Chapter	Events and Submissions/Topic
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PSO: Parameter Settings

Lecture Notes and Chapter 7

Week 4 - 02 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
PSO: Problems and Applications - Part One	Lecture Notes	

Week 5 - 09 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
PSO: Problems and Applications - Part Two	Lecture Notes	

Vacation Week - 16 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
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Week 6 - 23 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Evolution Strategy (ES)	Lecture Notes	Assignment 1 Due: Week 6 Tuesday (24 Aug 2021) 11:45 pm AEST

Week 7 - 30 Aug 2021

Module/Topic	Chapter	Events and Submissions/Topic
The Basic ES Algorithm	Lecture Notes	

Week 8 - 06 Sep 2021

Module/Topic	Chapter	Events and Submissions/Topic
Adaptation of Strategy Parameters and Co-variance Matrix	Lecture Notes	

Week 9 - 13 Sep 2021

Module/Topic	Chapter	Events and Submissions/Topic
Covariance Matrix Adaptation Evolution Strategy	Lecture Notes	

Week 10 - 20 Sep 2021

Module/Topic	Chapter	Events and Submissions/Topic
Introduction to Tree-based Genetic Programming	Lecture Notes	Assignment 2 Due: Week 10 Tuesday (21 Sept 2021) 11:45 pm AEST

Week 11 - 27 Sep 2021

Module/Topic	Chapter	Events and Submissions/Topic
Genetic Programming Preparatory Steps	Lecture Notes	

Week 12 - 04 Oct 2021

Module/Topic	Chapter	Events and Submissions/Topic
Automatically Defined Functions	Lecture Notes	

Review/Exam Week - 11 Oct 2021

Module/Topic	Chapter	Events and Submissions/Topic
		Assignment 3 Due: Review/Exam Week Tuesday (12 Oct 2021) 11:45 pm AEST

Exam Week - 18 Oct 2021

Module/Topic	Chapter	Events and Submissions/Topic
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Assessment Tasks

1 Assignment 1

Assessment Type

Practical Assessment

Task Description

In this assignment you will demonstrate your ability to analyse the given scenario, and identify the optimization problem. You will model the optimization problem as a Particle Swarm Optimization (PSO). You will design and build the software solution applying PSO techniques. This assessment task is to design, code, debug, and test a software application using the topics learnt in Weeks 1 - 5. Further details are in the Assignment 1 specification document available from the Unit website.

Assessment Due Date

Week 6 Tuesday (24 Aug 2021) 11:45 pm AEST

Return Date to Students

Week 8 Tuesday (7 Sept 2021)

Weighting

25%

Assessment Criteria

1. Clear analysis of the given scenario or case study and identify the optimization problem
2. Correct identification of parameters from the scenario
3. Development of the particle swarm optimization (PSO) model
4. Implementation of a working software solution for the identified problem
5. Report documenting testing, and specific aspect of PSO as required.

Referencing Style

- [Harvard \(author-date\)](#)
- [American Psychological Association 7th Edition \(APA 7th edition\)](#)

Submission

Online

Submission Instructions

Submit one zip file containing the source code files (.py) and the report file (.doc).

Learning Outcomes Assessed

- Formulate an evolutionary computation search or optimisation problem by analysing an authentic case or scenario
- Design an evolutionary algorithm for a problem applying the core evolutionary computation concepts and mechanisms
- Build a software application to implement an evolutionary algorithm for a complex search or optimisation problem

Graduate Attributes

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Self-management

2 Assignment 2

Assessment Type

Practical Assessment

Task Description

In this assignment you will demonstrate your ability to analyse the given scenario, and identify the optimization problem. You will identify the parameters and model an evolution strategy optimization technique. You will design and implement a software solution that applies Evolution Strategies (ES) for the identified optimization problem. This assessment task is to assess your understanding of the topics learnt in Weeks 6 - 9. Further details are in the

Assignment 2 specification document available from the Unit website.

Assessment Due Date

Week 10 Tuesday (21 Sept 2021) 11:45 pm AEST

Return Date to Students

Week 12 Tuesday (5 Oct 2021)

Weighting

35%

Assessment Criteria

1. Clear Analysis of the given case study or scenario and identification of the optimization problem
2. Correct identification of strategy parameters and modeling of the solution
3. Correct implementation of the software solution
4. Comparison of PSO and ES.

Referencing Style

- [Harvard \(author-date\)](#)
- [American Psychological Association 7th Edition \(APA 7th edition\)](#)

Submission

Online

Submission Instructions

Submit one zip file containing the source code files (.py) and the report file (.doc).

Learning Outcomes Assessed

- Formulate an evolutionary computation search or optimisation problem by analysing an authentic case or scenario
- Design an evolutionary algorithm for a problem applying the core evolutionary computation concepts and mechanisms
- Build a software application to implement an evolutionary algorithm for a complex search or optimisation problem

Graduate Attributes

- Knowledge
- Communication
- Cognitive, technical and creative skills
- Self-management
- Leadership

3 Assignment 3

Assessment Type

Written Assessment

Task Description

In this assignment you will research on the current state of genetic programming in terms of its development and practical applications. You will report your findings concisely and clearly. You will also analyse application of optimization techniques to improve performance of a computational intelligence application for a problem. You will evaluate the application and write a report describing the merits and de-merits.

Assessment Due Date

Review/Exam Week Tuesday (12 Oct 2021) 11:45 pm AEST

Return Date to Students

Results will be published on certification date.

Weighting

40%

Assessment Criteria

1. Clear analysis of the current developments in genetic programming
2. Concise and clear reporting of contemporary developments and applications of genetic programming

3. Description of optimization techniques applied to a chosen case study for achieving optimization
4. Critical analysis of the optimization technique used, and reporting of the merits and de-merits.

Referencing Style

- [Harvard \(author-date\)](#)
- [American Psychological Association 7th Edition \(APA 7th edition\)](#)

Submission

Online

Submission Instructions

Submit a (.doc/.docx) file.

Learning Outcomes Assessed

- Write an article that evaluates the performance and interprets the results of your software application of evolutionary computation paradigm to an authentic problem.

Graduate Attributes

- Knowledge
- Communication
- Research
- Ethical and Professional Responsibility

Academic Integrity Statement

As a CQUniversity student you are expected to act honestly in all aspects of your academic work.

Any assessable work undertaken or submitted for review or assessment must be your own work. Assessable work is any type of work you do to meet the assessment requirements in the unit, including draft work submitted for review and feedback and final work to be assessed.

When you use the ideas, words or data of others in your assessment, you must thoroughly and clearly acknowledge the source of this information by using the correct referencing style for your unit. Using others' work without proper acknowledgement may be considered a form of intellectual dishonesty.

Participating honestly, respectfully, responsibly, and fairly in your university study ensures the CQUniversity qualification you earn will be valued as a true indication of your individual academic achievement and will continue to receive the respect and recognition it deserves.

As a student, you are responsible for reading and following CQUniversity's policies, including the [Student Academic Integrity Policy and Procedure](#). This policy sets out CQUniversity's expectations of you to act with integrity, examples of academic integrity breaches to avoid, the processes used to address alleged breaches of academic integrity, and potential penalties.

What is a breach of academic integrity?

A breach of academic integrity includes but is not limited to plagiarism, self-plagiarism, collusion, cheating, contract cheating, and academic misconduct. The Student Academic Integrity Policy and Procedure defines what these terms mean and gives examples.

Why is academic integrity important?

A breach of academic integrity may result in one or more penalties, including suspension or even expulsion from the University. It can also have negative implications for student visas and future enrolment at CQUniversity or elsewhere. Students who engage in contract cheating also risk being blackmailed by contract cheating services.

Where can I get assistance?

For academic advice and guidance, the [Academic Learning Centre \(ALC\)](#) can support you in becoming confident in completing assessments with integrity and of high standard.

What can you do to act with integrity?



Be Honest

If your assessment task is done by someone else, it would be dishonest of you to claim it as your own



Seek Help

If you are not sure about how to cite or reference in essays, reports etc, then seek help from your lecturer, the library or the Academic Learning Centre (ALC)



Produce Original Work

Originality comes from your ability to read widely, think critically, and apply your gained knowledge to address a question or problem