



Australian Government

Department of Education, Employment and Workplace Relations

ICAGAM509A Design interactive 3-D applications for scientific and mathematical modelling

Release: 1

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Modification History

Release	Comments
Release 1	This Unit first released with <i>ICA11 Information and Communications Technology Training Package version 1.0</i>

Unit Descriptor

This unit describes the performance outcomes, skills and knowledge required to design interactive 3-D applications for scientific and mathematical modelling.

Application of the Unit

This unit applies to individuals with object-oriented programming skills working in any industrial context that requires 3-D computer simulation of a well-defined environment, system or set of relationships.

Licensing/Regulatory Information

No licensing, legislative, regulatory or certification requirements apply to this unit at the time of endorsement but users should confirm requirements with the relevant federal, state or territory authority.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Element	Performance Criteria
<i>Elements describe the essential outcomes of a unit of competency.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.</i>

Elements and Performance Criteria

1. Determine and confirm business expectations and needs	1.1 Apply skills to determine business requirements and verify the accuracy of the information gathered 1.2 Determine critical environmental, systemic relationships that require simulation in a 3-D environment 1.3 Identify critical data sources required by simulations or modelling 1.4 Document critical environmental, systemic relationships and data sources that require simulation in a 3-D environment
2. Design an interactive 3-D application for scientific or mathematical modelling	2.1 Use prototyping tools to provide proof of concept for environmental and systemic relationships 2.2 Identify technologies and platforms suitable for the deployment of scientific or mathematical modelling 2.3 Apply object-oriented programming principles to design classes and algorithms to support scientific or mathematical modelling in an interactive 3-D environment
3. Design a 3-D environment that simulates a scientific or mathematical model	3.1 Select appropriate visual representation for elements of a 3-D scientific or mathematical model 3.2 Analyse required interaction between user and a 3-D environment 3.3 Design a graphical user interface (GUI) to support required interaction between use and a 3-D environment
4. Develop procedures to test a scientific or mathematical model	4.1 Develop testing procedures and standards that verify modelling integrity 4.2 Document testing procedures and standards that verify modelling integrity

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

- analytical skills to interpret documentation and images to inform implementation of game specifications
- communication skills to:
 - check and confirm brief requirements
 - communicate clearly using speech and text
 - communicate technical requirements related to software development, graphics requirements, code development and testing procedures to supervisors and other team members
 - give constructive feedback
- literacy and numeracy skills to:
 - document testing procedures
 - read briefs, game documentation, scripts, storyboards, scenarios and images
 - develop technical and conceptual information
- planning and organisational skills to:
 - refer decisions to a higher project authority for review and endorsement
 - balance talent, experience and budget
 - delegate tasks and responsibility appropriately
 - establish clear roles and goals to achieve required game development outcomes
 - meet project deadlines
- problem-solving skills to recognise and address quality issues and problems
- teamwork skills to:
 - contribute to and work in a collaborative team
 - realise a unified vision of the completed project
- technology skills to:
 - design programming solutions for specified problems
 - use a GUI.

Required knowledge

- documentation techniques
- object-oriented 3-D programming design methodologies
- object-oriented 3-D programming principles
- data sources and business expectations and needs
- techniques for using a GUI to interact with a user
- testing procedures.

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Evidence of the ability to: - determine business requirements and determine data to be used in a 3-D computer simulation or mathematical modelling application - design an interactive 3-D environment that reflects scientific or mathematical modelling.
Context of and specific resources for assessment	Assessment must ensure access to: - suitable 3-D equipment, software and hardware - technical manuals - appropriate learning and assessment support when required - modified equipment for people with special needs.
Method of assessment	A range of assessment methods should be used to assess practical skills and knowledge. The following examples are appropriate for this unit: - evaluation of work samples or simulated workplace activities - observation of design activities - verbal questioning or interview concerning aspects of design development, including: - capability of engines and software tools to meet the requirements of the brief - evaluating prototypes from technical, design and interactive perspectives - simulation testing and trialling procedures - maintaining integrity of the design brief and design document - risk assessment and critical path planning - translating design and technical specifications into working simulation prototypes.
Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended, where appropriate. Assessment processes and techniques must be culturally appropriate, and suitable to the communication skill level,

	language, literacy and numeracy capacity of the candidate and the work being performed. Indigenous people and other people from a non-English speaking background may need additional support. In cases where practical assessment is used it should be combined with targeted questioning to assess required knowledge.
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Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Data sources may include:	• analog devices • databases • digital devices • process controllers • spreadsheets • web-based data sources • XML documents.
Prototyping tools may include:	• 3-D prototyping applications • existing simulation and modelling software • flow chart applications • scientific calculators • spreadsheet applications.
Technologies and platforms may include:	• Berkeley Madonna • DeSolve • EMACS • ESS • Maple • Mathematica • MatLab • MMNP • networked computers • R • Stella • Supercomputers.
Classes and algorithms may include:	• application of Taylor series as convergent and asymptotic series • Cholesky factorisations • computing derivatives by: • automatic differentiation (AD) • finite differences • Discrete Fourier transform • graph theoretic suites • high order difference approximations • LU factors with Gaussian elimination

	• methods for integration on a uniform mesh • molecular dynamics • Monte Carlo methods • Newton's method • numerical linear algebra • Runge Kutta method for solving ordinary differential equations • time stepping methods for dynamical systems.
<i>Elements of a 3-D scientific or mathematical model</i> may include:	• computer animation • computer simulation • information visualisation • interface technology and perception • surface rendering • volume rendering • volume visualisation.
<i>Testing procedures</i> may include:	• expected results • parallel processing • test data.
<i>Document</i> may include:	• architecture • design • release • requirement • test • user manuals.

Unit Sector(s)

Game development