



## Higher National unit specification

### General information

**Unit title:** Computer Games: Programming Fundamentals  
(SCQF level 7)

**Unit code:** HH57 34

**Superclass:** CB

**Publication date:** December 2016

**Source:** Scottish Qualifications Authority

**Version:** 02

### Unit purpose

The purpose of this unit is to introduce learners to the fundamental programming techniques used in creating computer games. Learners will develop an understanding of the concepts and principles of programming and gain practical experience in applying fundamental programming techniques in the context of computer games development. Learners will develop problem-solving and computational thinking skills as they learn to create games inside a current games development engine, using a modern integrated development environment (IDE) and object oriented programming language.

The unit is primarily intended for learners who intend to follow a career within the computer games development industry, however the skills developed will be applicable to all areas of software development.

### Outcomes

On successful completion of the unit the learner will be able to:

- 1 Apply fundamental programming techniques in the context of computer games development.
- 2 Implement a solution from a given game design.
- 3 Test and debug a completed solution.
- 4 Evaluate a completed solution.

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## **Credit points and level**

3 Higher National unit credits at SCQF level 7: (24 SCQF credit points at SCQF level 7)

## **Recommended entry to the unit**

Access to this unit is at the discretion of the centre and the unit is suitable for those with no previous programming experience. However, it is recommended that learners should have some previous experience of programming, even if this is at a very basic level. This could be through a relevant qualification such as National 5 Computer Science or a relevant National Progression Award or National Certificate, such as the NPA in Computer Games Development or the NC in Computer Games Development. The recommended SCQF level for these would be 5 or 6.

## **Core Skills**

Achievement of this Unit gives automatic certification of the following:

Complete Core Skill                      Problem Solving at SCQF level 6

Core Skill component                      None

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

## **Context for delivery**

The unit sits within the mandatory section of the HNC and HND Computer Games Development Group Award. However, it may also be delivered as a stand-alone unit. If this unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

The Assessment Support Pack (ASP) for this unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

## **Equality and inclusion**

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

## Higher National unit specification: Statement of standards

**Unit title:** Computer Games: Programming Fundamentals  
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Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

### Outcome 1

Apply fundamental programming techniques in the context of computer games development.

#### Knowledge and/or Skills

- ◆ Variables and data types
- ◆ Operators
- ◆ Sequence
- ◆ Selection
- ◆ Iteration
- ◆ Data Structures
- ◆ Functions
- ◆ Parameter passing
- ◆ Input/Output
- ◆ Implementation of digital media within a game environment
- ◆ Comments

### Outcome 2

Implement a solution from a given game design.

#### Knowledge and/or Skills

- ◆ Variables and data types
- ◆ Operators
- ◆ Sequence
- ◆ Selection
- ◆ Iteration
- ◆ Scope
- ◆ Casting and Type Conversions
- ◆ Data Structures
- ◆ Classes and objects
- ◆ Functions/Methods
- ◆ Parameter passing
- ◆ Co-ordinate systems for positions of game objects
- ◆ Random number generation
- ◆ Collisions between game objects
- ◆ Input/Output
- ◆ Coding style, comments and naming conventions
- ◆ Implementation of digital media within a game environment
- ◆ Computational thinking
- ◆ Problem solving

## Higher National unit specification: Statement of standards

**Unit title:** Computer Games: Programming Fundamentals  
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### Outcome 3

Test and debug a completed solution.

#### Knowledge and/or Skills

- ◆ Appropriate test strategies
- ◆ Debugging techniques and tools
- ◆ Problem solving
- ◆ Approaches to tracking changes

### Outcome 4

Evaluate a completed solution.

#### Knowledge and/or Skills

- ◆ Evaluation approaches and techniques
- ◆ Evaluation criteria
- ◆ Reflection on effectiveness of a solution
- ◆ Self-reflection on performance
- ◆ Recommendations for future projects

#### Evidence Requirements for this unit

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills across all Outcomes.

The evidence for this unit may be written or oral or a combination of these. Evidence may be captured, stored and presented in a range of media (including audio and video) and formats (analogue and digital). Particular consideration should be given to digital formats and the use of multimedia. It is expected that the game(s) created for this unit will be submitted electronically, it is not necessary to print code listings.

## Higher National unit specification: Statement of standards (cont)

**Unit title:** Computer Games: Programming Fundamentals  
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**Outcome 1** — Apply fundamental programming techniques in the context of computer games development.

Candidates will need to provide evidence to demonstrate their knowledge of the fundamental concepts and principles of programming within a games development environment by showing that they can apply fundamental programming techniques and produce suitable segments of program code, covering examples of all the following, by means of a series of open-book practical assignments, forming a small portfolio:

- ◆ Variables and data types
- ◆ Operators:
  - Arithmetic
  - Logical (AND, OR, NOT, etc)
  - Assignment (=, +=, -=, etc) and relational (==, <, >, <=, >=, !=)
- ◆ Sequence
- ◆ Selection:
  - Conditional statements (eg IF THEN ELSE)
  - Case statements
- ◆ Iteration:
  - Loops such as FOR, FOREACH, WHILE, DO WHILE
- ◆ Data Structures:
  - Arrays
  - Lists
  - Structs
  - Classes
- ◆ Functions
- ◆ Parameter passing
- ◆ Input/Output:
  - Keyboard
  - Mouse
  - Gamepad
  - Headset
  - Speakers
- ◆ Implementation of digital media within a game environment:
  - 2D graphics such as JPEG, PNG
  - 3D models and/or animations
  - Audio files (WAV, MP3 etc)
  - Comments

Candidates do not need to evidence all the sub points listed above, just the main points. For instance, for iteration, if they have demonstrated a FOR loop then they wouldn't require to have a FOREACH loop as well.

**Outcomes 2, 3 and 4** require that candidates to demonstrate that they will be able to implement a solution from a given game design and then test, debug and evaluate the completed solution. It is recommended that a holistic approach to assessment is taken and that the practical skills required for Outcomes 2, 3 and 4 are assessed by a single assessment instrument.

## Higher National unit specification: Statement of standards (cont)

**Unit title:** Computer Games: Programming Fundamentals  
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**Outcome 2** — Implement a solution from a given game design.

Candidates will need to provide evidence to demonstrate their Knowledge and Skills by showing that they can produce a completed solution in the form of a game with a clear objective that has user interaction and a scoring system. The game must satisfy the given specification requirements and include the following:

- ◆ Declare and initialise at least four separate variables with at least two different data types.
- ◆ Use a minimum of two arithmetical operators.
- ◆ Use a minimum of two logical operators.
- ◆ Use sequence and selection.
- ◆ Perform at least one type conversion.
- ◆ Use at least one array or list.
- ◆ Create and use at least one struct or class.
- ◆ Use at least one function or method from an existing library.
- ◆ Create and use at least one user defined function or method with parameter passing.
- ◆ Use at least three 2D graphics or 3D models.
- ◆ Use a co-ordinate based system to position and move game objects such as 2D graphics or 3D models. This could include 2D and 3D vectors.
- ◆ Use at least one random number generator.
- ◆ Check for collisions between game objects.
- ◆ Read input from keyboard, mouse or gamepad.
- ◆ Include at least one audio file which will be played as a sound effect at an appropriate point in the game.
- ◆ Add comments that aid readability and understanding of code.
- ◆ Use an appropriate naming convention or variables, functions, classes etc.
- ◆ Correctly apply indentation, spacing and bracket placement.

**Outcome 3** — Test and debug a completed solution.

Candidates will need to provide evidence to demonstrate their Knowledge and Skills by showing that they can undertake the following tasks:

- ◆ Create a test plan with an appropriate test strategy.
- ◆ Record any errors detected.
- ◆ Debug a game using appropriate techniques and the tools of the chosen game development environment.
- ◆ Track any changes made including how errors were rectified.

## Higher National unit specification: Statement of standards (cont)

**Unit title:** Computer Games: Programming Fundamentals  
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**Outcome 4** — Evaluate a completed solution.

Candidates will need to provide evidence to demonstrate their Knowledge and Skills by showing that they can undertake the following tasks:

- ◆ Evaluate the effectiveness of a completed solution against a clearly defined set of criteria.
- ◆ Carry out a self-evaluation of their performance, which should include analysis of the following:
  - Chosen approach
  - Problem solving
  - Time management
- ◆ Make conclusions and recommendations for future projects.

The assessment for all **Outcomes** will be open-book. Assessors must assure themselves of the authenticity of each candidate's submission.



## Higher National unit Support Notes

**Unit title:** Computer Games: Programming Fundamentals  
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Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 120 hours.

### Guidance on the content and context for this unit

This unit has been developed as a mandatory three credit unit for the HNC Computer Games Development award and the first year of the HND Computer Games Development award. The unit is designed to introduce learners to the fundamental concepts of games programming and no previous programming experience is required, although some coding experience would be beneficial. Although the unit is delivered in the context of a games environment the skills gained are generic to software development and is therefore suitable for learners who wish to gain programming skills not necessarily for the games industry.

The unit is intended to give as much practical experience to the learner as possible and the amount of written evidence has deliberately been reduced to a minimum. The three credits are required to allow the learner enough practical experience to become proficient and confident in using a programming language. The idea of this unit is to concentrate on the hands-on experience of coding and not to over-burden the learner with consideration of the planning stage of project development. For this reason, it is recommended that the learner should be assessed with a given project specification, or ideally a choice of project from a given range of specifications, that are realistic and achievable. It is not the scope of this unit to assess the learner on project planning. The importance of testing should be emphasised, but not heavily assessed. The unit should give the learner enough practical experience to gain the confidence to progress to F86A 35 *Games Development: Object Oriented Programming* in the second year of the HND.

The project should be a game which includes both audio and either 2D or 3D graphics. The graphics may be supplied to the learner or the learner may source or create their own graphical content. Ideally the learner will create graphics on another unit on their course for use in their game. It is envisaged that a 2D arcade game would be best suited for assessing this unit, however that is at the discretion of the centre and the games development environment being used will influence this.



## Higher National unit Support Notes (cont)

**Unit title:** Computer Games: Programming Fundamentals  
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The language used for this unit is at the discretion of the centre, however an object-oriented programming language will be required to meet the minimum Evidence Requirements of the unit. Learners should have access to a modern IDE and a current games development engine. At the time of writing, suitable games development engines which meet the requirements would be Unity, Unreal and MonoGame, however this is not an exhaustive list. These engines allow coding using C# or C++ both of which meet the requirements of the unit. Learners will also need to acquire skills in how to properly utilise the games development tools within their chosen games engine.

It is important that learners are given the opportunity to developing problem-solving and computational thinking skills as they learn to create games.

### Guidance on approaches to delivery of this unit

If this unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award in which it contributes. If taught as part of the HNC or HND Computer Games Development Group Award it is anticipated that learners could create graphics and/or audio in other units which could then be used within their game(s).

For **Outcomes 1 and 2** learners should spend the majority of their time learning how to program and create games using a current games engine. Learners should first be introduced to the theory of programming and then follow it up with practical programming exercises. It is anticipated that the delivery will be broken down into topics and each topic will be explained and then followed up with practical exercises.

Although the focus is on programming in this unit, it is anticipated that learners will need to become familiar with the various games design tools in the engine they are utilising. This can vary from engine to engine, from almost non-existent, where nearly everything is done in code, to the drag and drop approach for building a game environment in engines like Unity and Unreal. If this unit is delivered as part of a Group Award learners could become familiar with the design tools within the chosen game engine by doing F869 34 *3D Level Editing*, although this would only be applicable if it is a 3D games engine being used and this unit does not require the engine to be 3D.

All the Knowledge and Skills points from the Evidence Requirements for Outcomes 1 and 2 should be covered and put into practice in practical exercises where learners will create small games or complete a partially created game. These games may be used in the creation of the portfolio of games required as evidence for Outcome 1.

To provide the best possible learning experience, consideration should be given to utilising a variety of methods of content delivery. These various methods could include (but should not necessarily be limited to) the following:

- ◆ Tutor-led presentations on games programming and computational thinking.
- ◆ Videos about games programming and design.
- ◆ Practical coding exercises, perhaps using partially completed games.

## Higher National unit Support Notes (cont)

**Unit title:** Computer Games: Programming Fundamentals  
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For **Outcome 3** learners should spend the majority of their time learning how to debug via practical exercises where they are given code with errors which they must then debug. They should also become familiar with the debugging tools within their game engine and IDE. Learners must also study the various approaches to testing (test strategies) that can be taken.

For **Outcome 4** learners should study how to set realistic criteria in order to effectively evaluate. Learners should also be introduced to various evaluation approaches and strategies, these could involve practical exercises where learners look at existing games and evaluate them.

### Guidance on approaches to assessment of this unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to candidates.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where candidates experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

Assessment evidence is required at all stages and Outcomes. It must be documented and recorded electronically or in written/printed form, however it is encouraged to look at alternate approaches such as web blog, video blog, pod casts and even social media. Alternate approaches making use of modern technology is encouraged.

It is recommended that **Outcome 1** consists of a series of open-book practical assignments forming a small portfolio of games, which aim to develop the skills needed to progress to subsequent Outcomes.

Assessment for Outcome 1 should not take place until the learner has had the opportunity to gain experience of coding covering all the Evidence Requirements for Outcome 1.

It is recommended that a holistic approach to assessment is taken and that the practical skills required for **Outcomes 2, 3 and 4** are assessed by a single assessment instrument. This will be an open-book assessment where learners will implement a solution from a given game design and then test, debug and evaluate that solution.

The game design provided to candidates must provide the candidates with the opportunity to implement all the Evidence Requirements of Outcomes 2, 3 and 4.

Assessment should not take place until the learner has had the opportunity to gain experience of games programming, testing, debugging and evaluation, covering all the Evidence Requirements and Knowledge and Skills for all Outcomes.

## Higher National unit Support Notes (cont)

**Unit title:** Computer Games: Programming Fundamentals  
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It is recommended that the evidence for Outcomes 1 and 2 is submitted electronically, suitable methods include submission via the cloud, a virtual learning environment or via a USB drive. This list is not extensive and does not exclude other valid methods of submission. Physical printing of code is not recommended and is unnecessary.

The test documentation for Outcome 3 will most likely consist of a completed test plan and a log of errors and changes made. It is recommended that this is all completed electronically and submitted that way.

The evaluation document for Outcome 4 may take the form of a word-processed report which would ideally be submitted digitally via an online plagiarism checker. The evaluation report could also take the form of a digital video, which could be submitted in a suitable digital format. Clear guidance should be given to ensure that the learner carries out an evaluation of the effectiveness of the completed solution as well as a self-evaluation of their own performance. Candidates must also make suitable conclusions and recommendations for future projects.

The evidence for these Outcomes should be generated under open-book conditions. Whether this need be under supervised or unsupervised conditions is at the discretion of the assessor and the centre; however, evidence should be produced under controlled conditions whenever possible and where appropriate. Where the amount of control is low, the amount of authentication should rise. It is not acceptable to produce evidence in lightly controlled conditions with little authentication.

Authentication may take various forms including, but not limited to, oral questioning and plagiarism checks. Some forms of evidence generation (such as video recordings) have intrinsic authentication and would require no further means of verification.

### Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

This Unit has the Core Skill of Problem Solving embedded in it, so when learners achieve this Unit their Core Skills profile will be updated to show that they have achieved Problem Solving at SCQF level 6.

## History of changes to unit

Version	Description of change	Date
02	Core Skill Problem Solving at SCQF level 6 embedded.	21/02/17

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## General information for learners

### **Unit title:** Computer Games: Programming Fundamentals (SCQF level 7)

This section will help you decide whether this is the unit for you by explaining what the unit is about, what you should know or be able to do before you start, what you will need to do during the unit and opportunities for further learning and employment.

The purpose of this unit is to introduce you to the fundamental programming techniques used in creating computer games. You will develop an understanding of the concepts and principles of programming and gain practical experience in applying fundamental programming techniques in the context of computer games development. You will develop problem-solving and computational thinking skills as you learn to create games inside a current games development engine, using a modern integrated development environment (IDE) and object oriented programming language.

The unit is suitable for you if you intend to follow a career within the computer games development industry, however the skills developed will be applicable to all areas of software development.

The unit sits within the mandatory section of the HNC and HND Computer Games Development Group Award. However, it may also be delivered as a stand-alone unit.

In **Outcome 1** you will be required to demonstrate an understanding of the fundamental concepts and principles of programming. This will be assessed by means of an open-book assessment, where you will need to provide evidence to demonstrate your knowledge of the fundamental concepts and principles of programming within a games development environment by showing that you can apply fundamental programming techniques and produce suitable segments of program code in the creation of a small portfolio of simple games.

In **Outcome 2** you will implement a solution from a given game design. You will need to provide evidence to demonstrate your Knowledge and Skills by showing that you can produce a completed solution in the form of a game with a clear objective that has user interaction and a scoring system.

In **Outcome 3** you will test and debug the completed solution from Outcome 2.

In **Outcome 4** you will evaluate the completed solution from Outcome 2. This will include how effective the solution was, as well as self-evaluation and recommendations for the future.

All Outcomes will be carried out under open-book conditions and will be practical in nature.

This Unit has the Core Skill of Problem Solving embedded in it, so when you achieve this Unit your Core Skills profile will be updated to show that you have achieved Problem Solving at SCQF level 6.