



## Higher National unit specification

### General information

**Unit title:** Game Technology (SCQF level 7)

**Unit code:** HH3F 34

**Superclass:** CB

**Publication date:** June 2017

**Source:** Scottish Qualifications Authority

**Version:** 02

### Unit purpose

This unit is designed for learners to gain a broad general knowledge and understanding of the technology behind game consoles and gaming computers. This includes the functions, concepts and mechanisms of internal system components and external peripheral devices. This includes the way in which the internal representation used within the machine can be translated to give human readable values.

This unit is primarily intended for learners who intend to follow a career within the computer games development industry, however it would also be of benefit to those studying technical support or computer programming.

### Outcomes

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

- 1 Manipulate data representations.
- 2 Explain the functions of the internal system components and external peripheral devices which make up gaming consoles and personal computers.
- 3 Evaluate current technologies in gaming.

### Credit points and level

1 Higher National unit credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

## Higher National unit specification: General information (cont)

**Unit title:** Game Technology (SCQF level 7)

### Recommended entry to the unit

Access to this unit is at the discretion of the centre. However, it is recommended that learners should have some basic knowledge of computer hardware and possess some numeracy skills. This could be demonstrated by the achievement of the Core Skills component *Numeracy: Using Number* at SCQF level 4.

### Core Skills

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

There is no automatic certification of Core Skills or Core Skill components in this unit.

### Context for delivery

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:** Game Technology (SCQF level 7)

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.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### Outcome 1

Manipulate data representations.

#### Knowledge and/or Skills

- ◆ Number bases
- ◆ Arithmetic operations
- ◆ Boolean logic operations
- ◆ American Standard Code for Information Interchange (ASCII) characters in computer storage
- ◆ ODD and EVEN parity at the binary level to ASCII
- ◆ Character encoding standards
- ◆ File formats
- ◆ Units of storage

### Outcome 2

Explain the functions of the internal system components and external peripheral devices which make up gaming consoles and personal computers.

#### Knowledge and/or Skills

- ◆ Main hardware components
- ◆ Main input output peripheral devices
- ◆ Central processing unit (CPU) fetch execute cycle and the registers inside CPUs
- ◆ Control unit and the internal buses
- ◆ Instruction sets and the purpose of the main instructions

### Outcome 3

Evaluate current technologies in gaming.

#### Knowledge and/or Skills

- ◆ Current key developments in game technology
- ◆ Research skills
- ◆ Critical analysis

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

**Unit title:** Game Technology (SCQF level 7)

### 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.

The Evidence Requirements for this unit will take **two** forms.

- 1 Evidence of cognitive competence (for Outcomes 1 and 2).
- 2 Evidence of practical competence (Outcome 3).

Sampling is permissible when the evidence for cognitive competence is produced by a test of knowledge and understanding. The test may take any form (including oral) but must be supervised, unseen and timed. The contents of the test must sample broadly and proportionately from the contents of the knowledge domain (see below). Access to reference material is not appropriate for this type of assessment.

For Outcomes 1 and 2, candidates will be required to demonstrate that they will be able to:

- ◆ perform addition between two 8-digit binary numbers.
- ◆ perform subtraction between two 8-digit binary numbers.
- ◆ perform addition between two 4-digit hexadecimal numbers.
- ◆ perform subtraction between two 4-digit hexadecimal numbers.
- ◆ convert a 4-digit base ten (denary) number to base sixteen (hexadecimal).
- ◆ convert a 4-digit base sixteen (hexadecimal) number to base ten (denary).
- ◆ convert an 8-digit base two (binary) number to base ten (denary).
- ◆ convert a 4-digit base ten (denary) number to base two (binary).
- ◆ convert an 8-digit base two (binary) number to base sixteen (hexadecimal).
- ◆ convert a 4-digit base sixteen (hexadecimal) number to base two (binary).
- ◆ apply a Boolean AND operation with binary inputs of not less than eight bits.
- ◆ apply a Boolean OR operation with binary inputs of not less than eight bits.
- ◆ apply a Boolean NOT operation with binary inputs of not less than eight bits.
- ◆ apply a Boolean XOR operation with binary inputs of not less than eight bits.
- ◆ convert a 7-bit ASCII character to an 8-bit binary value applying ODD or EVEN parity to it.
- ◆ convert a binary value to a 7-bit ASCII character.
- ◆ explain a multimedia file format.
- ◆ explain units of storage, such as Megabytes, gigabytes, kilobits, megabits.

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

### Unit title: Game Technology (SCQF level 7)

- ◆ explain the functions of the main hardware components in gaming consoles and computers including:
  - Motherboards
  - Central processing units (CPU)
  - Random Access Memory (RAM)
  - Read only memory (ROM)
  - Cache memory
  - Arithmetic and Logic units (ALU)
  - Graphics processing units (GPU)
  - Video cards or on-board video
  - Sound cards or on-board sound
  - Networking cards or on-board networking including both wired and wireless versions
  - Hard drives, optical drives, flash drives and storage media
- ◆ explain the functions of the main input output peripheral devices that are used with gaming consoles and computers including:
  - Game controllers
  - Web cameras
  - Keyboards
  - Mice
  - Gaming Headsets
  - Motion sensing devices
  - Monitors and televisions including touchscreens
- ◆ explain central processing unit (CPU) fetch execute cycle and the registers inside CPUs, such as:
  - Memory Address Register (MAR)
  - Memory Data Register (MDR)
  - Instruction Register (IR)
  - Program Counter (PC)
- ◆ explain Control unit and the internal buses (control bus, front-side bus, data bus and address bus) and how they communicate with the CPU and the Random Access Memory (RAM).
- ◆ explain instruction sets and the purpose of the main instructions such as MOV, ADD and SUB.

For Outcome 3, candidates are required to identify, research and evaluate at least two current key developments in game technology. Candidates will need to record and present their findings in the form of written or oral evidence. The evidence produced by candidates must include:

- ◆ What purpose does the technology perform and how effective is it at it?
- ◆ How does the technology work?
- ◆ How is the technology likely to change the way games are played in the present or will be played in the future?
- ◆ Which of the technologies are likely to have a bigger impact on the gaming industry?

Evidence of practical competence for Outcome 3 may be produced over an extended period of time under open-book conditions; but where it is generated without supervision some means of authentication must be carried out.

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

**Unit title:** Game Technology (SCQF level 7)

The Guidelines on Approaches to Assessment (see the Support Notes section of this specification) provides specific examples of instruments of assessment.



## Higher National unit Support Notes

**Unit title:** Game Technology (SCQF level 7)

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 40 hours.

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

This unit has been developed to form part of the HNC/HND Computer Games Development and is suitable for learners who are proposing to follow a career in the games industry, although the topics covered would also be applicable to learners studying computer hardware. It is anticipated that the unit would be delivered in the first year of the award if traditional delivery schedules are being observed.

The unit is intended to provide an insight into the operation and functionality of current games consoles and gaming computer systems. The unit will provide learners with information about the inner working of a central processing unit, such as the fetch execute cycle and general knowledge of instruction sets. Learners will gain an increased understanding of the functionality and relationships between all of the main internal and external components which make up current games consoles and computer gaming systems.

The unit will also cover the relevant numbering systems that computers use and how basic arithmetic and logical operations are carried out. This is relevant to software developers who need to understand the implications of number systems so that informed decisions can be made about the choice of variable types when programming.

The precise content of this unit will change over time, as technologies develop and new devices are introduced. The following guidance exemplifies the standards in terms of contemporary technology.

### Guidance on approaches to delivery of this unit

It is anticipated that this unit will be delivered as a stand-alone unit in the context of the HNC/HND Computer Games Development.

This unit could be delivered on a daily, weekly or bi-weekly basis at the discretion of the centre.

## Higher National unit Support Notes (cont)

**Unit title:** Game Technology (SCQF level 7)

### Outcome 1

#### Topic 1 (4 hours) — Numbering systems

Learners should be taught how to convert between different number bases using integer numbers. These should include denary to hexadecimal, hexadecimal to denary, denary to binary, binary to denary, binary to hexadecimal and hexadecimal to binary.

Learners should be set a number of exercises in which they must carry out all of the conversions mentioned above.

#### Topic 2 (4 hours) — Arithmetic operations in different number bases

Learners should be taught how to perform arithmetic operations in different number bases. These should include addition and subtraction in binary, as well as addition and subtraction in hexadecimal.

Learners should be set a number of exercises in which they must carry out all of the arithmetic operations mentioned above.

#### Topic 3 (3 hours) — Boolean logic operations

Learners should be taught how to perform Boolean logic operations. These should include Boolean AND, OR, NOT and XOR operations on binary inputs of not less than eight bits.

Learners should be set a number of exercises in which they must carry out all of the logic operations mentioned above.

#### Topic 4 (1.5 hours) — Character encoding standards

Learners should be taught about different character encoding standards and how they are represented in computer storage. American Standard Code for Information Interchange (ASCII) and Unicode should be covered. This should include teaching them how to read ASCII and Unicode look up tables. How ODD and EVEN parity is applied at the binary level to ASCII should also be covered.

Learners should be set the task of converting a character from ASCII into binary and binary into ASCII, taking account of ODD or EVEN parity at the same time.

#### Topic 5 (1.5 hours) — File formats and sizes

Learners must gain knowledge of the main units of storage including bits, bytes, kilobits, gigabits, megabits, gigabytes, kilobytes, megabytes, terabytes, petabytes and so on. The various multimedia file formats for images/graphics, audio and video used within games should also be covered.

Learners should be able to identify multimedia file formats from file extensions. They should also be able to understand file sizes, for instance can a 4GB high definition.wmv file fit on a 700MB CDR disk. Exercises on these tasks should be set for the learners.



## Higher National unit Support Notes (cont)

**Unit title:** Game Technology (SCQF level 7)

### Outcome 2

#### Topic 1 (4 hours) — Hardware Components

Learners should gain knowledge of the functions and relationships between the main hardware components within gaming consoles and computers. These should include motherboards, Central processing units (CPU), Random Access Memory (RAM), Read only memory (ROM), Cache memory, Arithmetic and Logic units (ALU), Graphics processing units (GPU), video cards, sound cards, networking cards (wired and wireless), hard drives, optical drives, flash drives and storage media.

#### Topic 2 (2 hours) — Input/output peripherals

Learners should gain knowledge of the functions of the input/output peripheral devices used in gaming. These should include game controllers, web cameras, keyboard, mice, gaming headsets, motion sensing devices, monitors, televisions and touchscreens.

#### Topic 3 (6 hours) — Central processing unit fetch execute cycle

Learners should gain knowledge of the Central processing unit (CPU) fetch execute cycle and the registers inside CPUs, such as Memory Address Register (MAR), Memory Data Register (MDR), Instruction Register (IR), Program Counter (PC). They should learn about the control unit and the internal system buses (control bus, front-side bus, data bus and address bus) and how they communicate with the CPU and the Random Access Memory (RAM). They should also gain knowledge of instruction sets and the purpose of the main instructions such as MOV, ADD and SUB.

### Outcome 3 (4 hours) — Current technologies in gaming

Discuss with learners the latest technologies in gaming, including developments in both software and hardware. Some current examples of developments in game technology are motion sensing controllers and cameras, Unreal Engine 4, DirectX 12, virtual reality headsets, augmented reality headsets, full body motion capture, facial recognition and voice recognition.

Learners should research this topic and identify game technologies that they deem to be important, interesting and revolutionary.

## 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.

## Higher National unit Support Notes (cont)

**Unit title:** Game Technology (SCQF level 7)

**Outcome 1** may be assessed by a single closed-book test (multiple-choice would be acceptable), consisting of 20 questions which sample the topics listed above. The test must contain questions from each topic, but does not need to contain questions on every sub-topic listed above. All items listed earlier in the Evidence Requirements section should be included. Candidates may not bring to the assessment event any notes, textbooks, handouts, calculators or other material, nor may candidates use an on-screen or on-line calculator.

Candidates should complete the test within **1 hour** and should answer at least **60%** of the questions correctly.

**Outcome 2** should be assessed by a single closed-book test (multiple-choice would be acceptable), consisting of 20 questions which sample the topics listed above. The test must contain questions from each topic, but does not need to contain questions on every sub-topic listed above. It is recommended that 14 of the questions should contain questions from Topics 1 and 2 and that the remaining six questions should cover Topic 3.

Candidates should complete the test within **1 hour** and should answer at least **60%** of the questions correctly.

If a centre is presenting the closed-book assessments for Outcomes 1 and 2 on-line the following assessment methods, where appropriate, may be selected:

- ◆ Multiple-choice
- ◆ Drag and drop
- ◆ Multiple response
- ◆ Mix and match
- ◆ A combination of the above

**Outcome 3** should be assessed by a single open-book assessment, in which the candidates are required to identify, research and evaluate current key developments in game technology.

The findings should be recorded in a written report with a minimum of 1,200 words, or alternatively a verbal or signed presentation of around 10 minutes in length, describing the findings of research into current key developments in Game technology. It must describe at least two key developments in game technology. The report must also explain how these developments are changing or will change the way games are played. Evidence can be submitted electronically or in written/printed form. It would be acceptable in the case of a verbal presentation for the candidate to submit an electronic video recording, rather than presenting live in class.

If the candidate chooses to write a report, it should contain a title page, table of contents, conclusions and a bibliography. The report should contain text and at least two graphics to illustrate it. If the candidate chooses to present, they should create an electronic presentation to accompany their presentation which should contain text and at least two graphics to illustrate it. The word count in the electronic presentation should be far less than in the case of a written report. In both cases all the key points above must be addressed.

## Higher National unit Support Notes (cont)

**Unit title:** Game Technology (SCQF level 7)

Assessors must assure themselves of the authenticity of each candidate's submission. 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

There are opportunities to develop the Core Skill of *Numeracy: Using Number* at SCQF level 5 in this unit, although there is no automatic certification of Core Skills or Core Skills components.

Learners could meet the *Numeracy: Using Number* component by performing conversions between different number bases and by performing arithmetic on hexadecimal and binary numbers, as required in Outcome 1.

## History of changes to unit

Version	Description of change	Date
02	Minor change to wording in outcome 3	05/06/17

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## General information for learners

### Unit title: Game Technology (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.

In this unit you will acquire a broad general knowledge and understanding of the technology behind game consoles and gaming computers. This includes the functions, concepts and mechanisms of internal system components and external peripheral devices. This also includes the way in which the internal representation used within the machine can be translated to give human readable values.

The study of this unit is primarily intended for those who intend to follow a career within the computer games development industry; however it would also be of benefit to those studying technical support or computer programming.

You may be assessed for the knowledge and understanding required in the unit through a test under closed-book conditions. You may also need to carry out practical activity to identify, research and evaluate current technologies in gaming. You will then write a report or produce a presentation for your findings.

This unit requires no previous knowledge, however it is recommended that you should have some basic knowledge of computer hardware and have some basic numeracy skills. Numeracy skills could be demonstrated by the achievement of the Core Skills component *Numeracy: Using Number* at SCQF level 4.

This unit will provide you with opportunities to develop the Core Skill of *Numeracy: Using Number* at SCQF level 5.