National Unit Specification: general information

UNIT Computer Systems (Higher)

NUMBER DF2X 12

COURSE Computing (Higher)

SUMMARY
This Unit is designed to develop knowledge and understanding of the principles of computer systems and practical skills related to computer systems through the use of contemporary hardware and software. This knowledge, understanding and these practical skills may then be applied by the candidate to solve practical problems related to computer systems. It is designed for candidates undertaking the Higher Computing Course, but is also suitable for anyone wishing to extend and deepen their experience of computer systems beyond Intermediate 2 level, or candidates who are interested in supplementing practical skills in IT with a knowledge of how computer systems work.

OUTCOMES
1. Demonstrate knowledge and understanding of a range of facts, ideas and terminology related to the principles, features and purposes of computer systems.
2. Demonstrate practical skills in the context of computer systems using contemporary hardware and software.

RECOMMENDED ENTRY
While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- Intermediate 2 Computer Systems Unit
- Intermediate 2 Computing
- Standard Grade Computing Studies at Credit level

Administrative Information

Superclass: CD

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Version: 01

National Unit Specification: general information (cont)

UNIT Computer Systems (Higher)

CREDIT VALUE
1 credit at Higher (6 SCQF credit points at SCQF level 6*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

CORE SKILLS

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

National Unit Specification: statement of standards

UNIT Computer Systems (Higher)

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 the Scottish Qualifications Authority.

OUTCOME 1

Demonstrate knowledge and understanding of a range of facts, ideas and terminology related to the principles, features and purposes of computer systems.

Performance Criteria

a) A range of computing terminology is used appropriately.
b) Technically accurate descriptions and explanations are related to practical and familiar contexts.
c) Conclusions, predictions and generalisations are made from knowledge and understanding.

Evidence Requirements

Written or oral evidence that the candidate can describe and explain the principles, features and purposes of computer systems accurately and concisely. Evidence should be obtained using questions in a closed book test, under supervision, lasting no more than 45 minutes. The test must sample content (see Computing (Higher) Course content) in each of the following areas:

- data representation
- computer structure
- peripherals
- networking
- computer software

(The content statements are also reproduced for convenience as a table in the support notes for this Unit.)

The standard to be applied is illustrated in the National Assessment Bank items available for this Unit. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

National Unit Specification: statement of standards (cont)

UNIT Computer Systems (Higher)

OUTCOME 2

Demonstrate practical skills in the context of computer systems using contemporary hardware and software.

Performance Criteria

a) A range of appropriate features of hardware is used effectively and efficiently.
b) An appropriate range of features of software is used effectively and efficiently.
c) Practical tasks are planned and organised with minimal guidance.
d) Practical tasks are undertaken in an appropriate range of familiar contexts.

Evidence Requirements

Observation checklist showing that the candidate has demonstrated practical skills at an appropriate level in four of the following contexts:

- use of standard OS functions
- use of utility software
- use of standard file formats for graphics files
- accessing a LAN using a network client
- accessing the Internet for WWW, e–mail and file transfer

Hard copy evidence should be provided for **one** of these activities.

These practical skills may all be demonstrated in a single extended task, or in a number of smaller tasks.

The practical skills should be demonstrated in the context and at a level defined by the content statements (see Computing Higher Course content).

The candidate will be allowed access to books, notes and online help while completing the tasks.

(The content statements are also reproduced for convenience as a table in the support notes for this Unit.)

The standard to be applied is illustrated in the National Assessment Bank items available for this Unit. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

National Unit Specification: support notes

UNIT Computer Systems (Higher)

This part of the Unit Specification is offered as guidance.

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

The content for this Unit is detailed below (and also in the National Course Specifications: Course details.)

Content statements in the left–hand column describe the content covered in the corresponding Unit at Intermediate 2 level, and are included here to clarify the context for the new learning for this Unit. They indicate the prior learning required by the candidate before undertaking new learning within this Unit.

Content statements in the right-hand column define the content for this Unit.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

Content Statements: Data Representation	
Intermediate 2	Higher
Representation of positive numbers in binary using examples up to and including 8 bits.	Representation of positive numbers in binary including place values and range up to and including 32 bits. Conversion from binary to decimal and vice versa.
Advantages of using binary numbers.	
	Description of the representation of negative numbers using two's complement using examples of up to 8 bit numbers.
Description of floating point representation of real numbers using the terms mantissa and exponent.	Description of the relationship between the number of bits assigned to the mantissa/exponent and the range and precision of floating point numbers.
Conversion to and from bit, byte, Kilobyte, Megabyte (Kb ,Mb). *Description of file sizes, backing storage and main memory capacities using the terms: bit, byte, Kilobyte, Megabyte, Gigabyte, Terabyte (Kb, Mb, Gb, Tb).*	Conversion to and from bit, byte, Kilobyte, Megabyte, Gigabyte, Terabyte (Kb, Mb, Gb, Tb).
Description of the ASCII code including control characters. *Description of the term character set.*	Description of Unicode and its advantages over ASCII.
Description of bit map method of graphic representation using examples of black and white bit maps. *Calculation of storage requirements.*	Description of the bit map method of graphic representation using examples of colour/greyscale bit maps. Description of the relationship of bit depth to the number of colours using examples up to and including 24 bit depth (true colour).
	Description of the vector graphics method of graphic representation.
	Description of the relative advantages and disadvantages of bit mapped and vector graphics.
	Description of the relationship between the bit depth and file size.
	Explanation of the need for data compression using the storage of bit-map graphic files, as examples.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

Content Statements: Computer Structure	
Intermediate 2	Higher
Description of the purpose of a processor. *List the parts of a processor as ALU, control unit and registers.*	A detailed description of the purpose of the ALU and control unit. Description of the purposes of registers: to hold data being processed, instructions being executed, and addresses to be accessed.
Representation of the structure of a computer in the form of a simple 5 box diagram representing: input devices, processor/main memory, output devices, and backing storage.	Description of the function of the data bus and the address bus. Description of the read, write and timing functions of the control lines. Identification of other control lines, including reset and interrupt lines.
	A simple description, referring to the appropriate buses and control lines, of the steps in the fetch-execute cycle.
Distinction between main memory and backing storage. *Description of the features and uses of RAM and ROM.*	Description of the following elements of computer memory: registers, cache, main memory, backing storage. Distinction between the above elements of memory according to function and speed of access.
	The concept of addressability.
Description of the uses of embedded, palmtop, laptop, desktop and mainframe computers. *Comparison of features of embedded, palmtop, laptop, desktop and mainframe computers: type and speed of processor, size of main memory, backing storage, input and output devices.*	Description and evaluation of the following measures of performance: clock speed, MIPS, FLOPS, and application based tests.
Description of clock speed as a simple indicator of system performance.	Description of the effect the following factors have on system performance: data bus width, use of cache memory, rate of data transfer to and from peripherals.
	Description of current trends in computer hardware, including increasing clock speeds, increasing memory and backing storage capacity.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

Content Statements: Peripherals	
Intermediate 2	Higher
Description of the features, functions and uses of the following input devices: keyboard, mouse, microphone, touchpad, digital camera, scanner, webcam.	Description of the use and advantages of buffers and spooling.
Comparison of input devices using appropriate characteristics including resolution, capacity, speed of data transfer, cost.	
Description of the features, functions and uses of a monitor, LCD panel, inkjet and laser printers, loudspeakers.	Description of a suitable selection of hardware, including peripherals, to support typical tasks including production of a multimedia catalogue, setting up a LAN in a school, development of a school website.
Comparison of output devices using appropriate characteristics including resolution, capacity, speed of data transfer, cost.	Justification of the hardware selected in terms of appropriate characteristics including resolution, capacity, speed, cost and compatibility.
Magnetic storage: description of the features, functions and uses of current magnetic storage devices and media including floppy drive, hard drive, zip drive, magnetic tape drive.	
Optical storage: description of the features, functions and uses of current optical storage devices and media including CD-ROM, CD-R, CD-RW, DVD-ROM, rewritable DVD.	Description of the features, uses and advantages of solid state storage devices including flash cards. Description of the development trends in backing storage devices.
Comparison of storage devices using appropriate characteristics including type of access, capacity, speed of data transfer, cost.	
Description of the need for interfaces with reference to the following functions: compensating for differences in speed between the CPU and peripherals, data conversion from analogue to digital forms and temporary data storage.	Description of the following functions of an interface: buffering, data format conversion (serial to parallel and analogue to digital), voltage conversion, protocol conversion, handling of status signals.
	Distinction between parallel and serial interfaces.
	Description and exemplification of current trends towards increasing interface speeds and wireless communication between peripherals and CPU.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

Content Statements: Networking	
Intermediate 2	Higher
Description of the following features of LANs, WANs and the Internet: transmission media, bandwidth, geographical spread and functions.	Comparison of LANs, WANs, Intranet and Internetwork in terms of transmission media, bandwidth, geographical spread and functions.
	Distinction between a mainframe with terminals and a network of computers.
Description of the functions of a client and server on a network.	Descriptive comparison of peer-to-peer networks and client server networks.
Description of the benefits of networks.	Description of the functions of file, print and web servers.
Description of the following features and functions of e–mail: sending, reading, replying, setting up an address book, setting up mailing lists, setting up folders.	Description of a node and a channel. Description of bus, star, ring and mesh topologies using the terms node and channel. Description of the consequences for each of the above topologies of node and channel failure.
Description of the features and functions of the World Wide Web: web pages, hyperlinks, browser, search engines.	Simple description of the functions and uses of a hub, switch and router.
	Identification of the need for a network interface card (NIC).
	Description and explanation of the trends towards higher bandwidth and wireless communications.
Description of the following economic factors which have led to the development of computer networks: ♦ *falling cost of telecommunication technologies and services* ♦ *shared access to expensive equipment* ♦ *geographic spread of organisations* ♦ *demand for up-to-date information*	Description of the following technical reasons for the increasingly widespread use of networks: ♦ advances in computer hardware, including processors, main memory capacity, backing storage, data transfer rates ♦ improved network related software, including browsers and network operating systems
Description of the main features of the Computer Misuse Act, the Copyright Designs and Patents Act and the Data Protection Act.	Description of the misuse of networks for the following illegal purposes: breaching copyright, hacking and planting viruses. Description of the application of the Computer Misuse Act, the Copyright Designs and Patents Act and the Data Protection Act to the misuse of networks.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

Content Statements: Computer Software	
Intermediate 2	Higher
Distinction between an operating system and an application program with examples of each.	Description of the function of a bootstrap loader.
	Description and exemplification of the main functions of a single user operating system: interpreting users commands, file management, memory management, input/output management resource allocation, managing processes.
	Definition of a utility program. Description of four utility programs (including virus checker and disc editor and defragmenter).
Explanation of the need for standard file formats. *Description of the standard file formats for text files: text, ASCII, rich text file.*	Description of the standard file formats for graphics files: jpeg, gif, TIFF.
Identification of data objects and operations in the context of word processing, databases, spreadsheets and graphics packages.	Description of a suitable selection of software to support typical tasks including production of a multimedia catalogue, setting up a LAN in a school, development of a school website.
	Description and exemplification of software compatibility issues (including memory and storage requirements, and OS compatibility).
Definition of a virus. *Description of how a virus operates.* *Description of common symptoms of virus infection: displaying unwanted messages, unusual visual/sound effects, computers rebooting unexpectedly, unwanted generation of e-mails.* *Description of how viruses are spread via floppy disk, homemade CDs,'fun' websites and e–mail attachments.*	Classification of viruses by type of file infected: file virus, boot sector virus, macro virus, program virus. Description of the following virus code actions: replication, camouflage, watching, delivery.
	Distinction between a virus, a worm and a trojan horse.
Explanation of the need for anti-virus software.	Description of anti-virus software detection techniques: use of checksum, searching for virus signature, heuristic detection and memory resident monitoring.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Candidates will require individual access to appropriate computer hardware and software throughout this Unit. While the learning may be achieved in the context of one computer system, candidates will benefit from having some experience of an alternative operating system.

The two Outcomes should be delivered in an integrated way rather than sequentially. For Outcome 2, the practical activities should be taught and used to illustrate and exemplify the knowledge and understanding required for Outcome 1.

Candidates who have completed the *Computer Systems* Unit at Intermediate 2 level should already have covered the content listed in the left–hand column of the content grids, but may need to revise this material before progressing to the right–hand column.

The amount of time spent on each area of content will vary depending on the teaching methodology used and the ability and prior experience of the candidates. However, the following times may act as a rough guide:

data representation	6 hours
computer structure	7 hours
peripherals	5 hours
networking	9 hours
computer software	9 hours

1½ hours should be set aside to:

- administer the Outcome 1 test
- gather evidence for Outcome 2

A further 2½ hours is allowed for remediation and re-assessment if required.

If the Unit is delivered as part of a Course, the Course documentation will provide further information on teaching and learning in a Course context, including the identification of a number of ‘themes’ to facilitate holistic learning across the Course.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

National Assessment Bank tests have been created specifically to assess Outcome 1 of the Unit. This assessment consists of a closed book test, and must be conducted under examination conditions. In order to gain success in this Outcome, the candidate must achieve at least the cut-off score for the test. If a centre wishes to design its own assessments for this Unit, they should be of a comparable standard.

Outcome 2 requires the candidate to demonstrate practical skills while using contemporary hardware and software. These practical skills may be demonstrated in the context of a number of relatively small tasks. The skills will normally be demonstrated by the candidate during the teaching and learning activities of the Unit, rather than as separate formal assessment activities. The candidate will be allowed access to books, notes and online help while completing the tasks.

To gain success in this Outcome, the candidate must demonstrate practical skills at an appropriate level in four of the following contexts, defined in the content statements (see Computing Higher Course content).

- use of standard OS functions
- use of utility software
- use of standard file formats for graphic files
- accessing a LAN using a network client
- accessing the Internet for WWW, email and file transfer

Hard copy evidence should be provided for any **one** of these activities. Note that this need not be formal documentation — print outs and screen shots showing appropriate activities are adequate.

A pro-forma observation checklist for Outcome 2 is provided in the National Assessment Bank materials.

All evidence must be retained by the centre. The assessment of this Unit is subject to moderation by SQA.

SPECIAL NEEDS

This Unit Specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, September, 2003).