SCOTTISH QUALIFICATIONS AUTHORITY

National Unit Specification: general information

UNIT Computer Systems (Higher)

NUMBER D093 12

COURSE Computing (Higher)

SUMMARY

This unit is designed to develop knowledge and understanding of the principles of computer systems and provide an opportunity to apply this knowledge through the use of contemporary hardware and software.

OUTCOMES

1 Demonstrate knowledge and understanding of the principles of computer organisation.
2 Demonstrate knowledge and understanding of computer software.
3 Demonstrate knowledge and understanding of the input, storage and output of data.
4 Select a computer system to match specific operational requirements.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following qualifications (or possess equivalent experience):

- the corresponding unit at Intermediate 2
- Intermediate 2 Computing
- Intermediate 2 Information Systems
- Grade 1 or 2 at Standard Grade in Computing Studies.

Administrative Information

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Version: 04

National Unit Specification: general information (cont)

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CREDIT VALUE

1 credit at Higher.

CORE SKILLS

There is no automatic certification of core skills or core skills components in this unit.

Additional information about core skills is published *in Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

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 the principles of computer organisation.

Performance criteria

(a) Explanation of the principles of computer organisation is accurate and concise.
(b) Description of methods of data representation is technically accurate
(c) Description of characteristics of different computer systems is technically accurate.
(d) Description of the factors that affect system performance is accurate and concise.

Note on range for the outcome

Principles: two-state machine; structure of CPU; memory; stored program concept; fetch-execute cycle; interfaces.
Data representation: text; integer; real; bit-mapped graphic; vector graphic.
Computer systems: desktop; portable; networked; mainframe.
Characteristics: processor; peripherals; resource sharing; topology
Factors: bus width; clock speed; memory; buffers; data integrity.

Evidence requirements

Written or oral evidence that the candidate can explain the principles of computer organisation as detailed in PCs (a) to (d) across all classes in the range. In describing data representation, the candidate should exemplify the representation of each type of data for two systems with a different data word length.

National Unit Specification: statement of standards (cont)

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OUTCOME 2

Demonstrate knowledge and understanding of computer software.

Performance criteria

(a) Description of the types and purposes of system software is correct.
(b) Description of the types and purposes of programming languages is correct.
(c) Description of the system requirements for application software is technically correct.
(d) Use of computer software to set up and customise a computer system is efficient and effective.

Note on range for the outcome

System software: single-user operating systems; network operating systems; utility software; compiler; interpreter.
Types of programming language: procedural; declarative; event-driven; scripting.
Purposes of programming language: general-purpose; scientific; commercial; artificial intelligence; system.
Types of application software: text; number; data; communications (including Internet); graphics; multimedia (including sound and video); integrated.
Computer software: operating system; utility software; application software.

Evidence requirements

Written or oral evidence that the candidate can describe the software characteristics of different computer systems as detailed in PCs (a) to (c) for all classes in the range.

Performance evidence that the candidate can use computer software to set up and customise a computer system as detailed in PC (d). For the purposes of core skill certification, the candidate must use virus checking software.

OUTCOME 3

Demonstrate knowledge and understanding of the input, storage and output of data.

Performance criteria

(a) The characteristics of input, storage and output devices are correctly explained.
(b) The comparison of the characteristics of contemporary products is accurate.
(c) Organisation of backing storage is efficient and data backup is systematic and secure.
(d) Retrieval and storage of data matching compound search criteria are performed efficiently and responsibly.

Evidence requirements

Written or oral evidence that the candidate can explain the characteristics of input, storage and output devices as detailed in PC (a). The explanations must relate to at least two input devices selected from modified keyboards, digitisers, sound, video, digital cameras; at least two storage devices selected from magnetic, optical, magneto-optical, DAT tape; and at least two output devices selected from sound, video, printer, colour printer, film, multiscan monitors.

Written or oral evidence that the candidate can compare the characteristics of contemporary products as detailed in PC (b) for all classes in the range. At least two input devices and two output devices and two storage devices must be compared with respect to these characteristics.

For the purposes of explanation and comparison the characteristics must include cost, and as appropriate, access, accuracy, capacity and speed.

Performance evidence that the candidate can use system software to organise backing storage efficiently as detailed in PC (c). The candidate must provide evidence of use of data backup and virus protection software.

Performance evidence that the candidate can retrieve and store data that matches compound search criteria (involving the use of Boolean operators) as detailed in PC (d). The evidence should demonstrate that the candidate has adhered to legal and health requirements. For the purposes of core skill certification, at least two different sources of information should be searched.

OUTCOME 4

Select a computer system to match specific operational requirements.

Performance criteria

(a) Analysis of the operational requirements correctly identifies the nature of the problem and the main features relevant to the solution are clearly described.
(b) System specification is clear and complete, and satisfies the operational requirements.
(c) The system specification is justified in terms of functionality, compatibility and cost.

Note on range for the outcome

System specification: computer hardware; computer software.

Evidence requirements

Written or oral evidence that the candidate can select a computer system to match specific operational requirements as detailed in PCs (a) to (c) for all classes in the range. Evidence will be in the form of a system specification together with a report which provides justification of the selection.

National Unit Specification: support notes

UNIT Computer Systems (Higher)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

This unit may be delivered as a stand-alone unit or in combination with other units as part of the Computing course at Higher level. The details of content given earlier provide information on the delivery and assessment of this unit within a course context.

Corresponding to Outcomes 1–4

This unit is the fourth in a series of units relating to Computer Systems and other units are available at Access, Intermediate 1, Intermediate 2 and Advanced Higher levels. As such, candidates should possess knowledge and skills in computer systems prior to undertaking this unit or be capable of accelerated learning in order to accomplish the outcomes in the recommended time.

Reference may be made to specific Internet resources within this unit specification; whenever possible a related URL has been supplied.

Outcome 1

This outcome relates to the principles of computer systems. In relation to Von Neumann architecture, the candidate should be able to:

- describe the organisation of a computer as a two-state (binary) machine
- explain the organisation of a computer to include CPU, memory, storage, I/O devices, buses (address data and control)
- explain the organisation of a computer memory to include the concept of addressability
- explain the organisation of the CPU as ALU, control unit and registers - the details of what each of these registers is for is NOT required
- describe the stored program concept including the idea of a fetch-execute cycle
- explain the need for interfaces between the CPU and peripheral devices.

Candidates will be expected have a knowledge of binary to allow them to appreciate the internal representation of data. Candidates should be able to describe this internal representation for:

- graphics: bit-mapped and vector in terms of advantages and disadvantages
- text: character set and the common standard (ASCII)
- number: integer - accuracy and size; floating point - implications of mantissa and exponent for range and accuracy.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

At this level the candidate should be able to describe and distinguish between the hardware characteristics in terms of input, process, storage and output devices for single-user (desktop, laptop, palmtop), multi-user (mainframe) and networked systems. Additionally, the candidate should be able to describe networked systems in terms of their topology.

The candidate should be able to explain that different factors can have an impact on system performance. These factors will include bus width and processor clock speed.

Outcome 2

This outcome concerns the different types of software involved in computer systems. The candidate should be able to describe the main functions of an operating system and to be aware that one model of an operating system considers it to be composed of several layers (although the specific nature of each layer need not be known). The candidate should be able to describe the additional features of a network operating system with particular reference to multi-user access, security, file and print services and data sharing.

The candidate should be able to describe the types of programming languages suitable for education (including teaching programming), science, communications, data processing, artificial intelligence, Internetworking and real-time systems. The candidate should be aware of the different features of compilers and interpreters.

The candidate should develop awareness of commercially available software and the de facto standards which are used by the software. These standards could include standards for graphics, video, audio and communication. The candidate should be able to identify contemporary software and typical system requirements for document processing, numerical processing, data storage and retrieval, multimedia and Internet access. The candidate should be encouraged to research contemporary configurations for these applications (using internal and external sources of information such as textbooks and magazines) based on actual hardware and software products. Only the major components of each system should be identified (such as type of system, peripherals, system and application software); there is no requirement to identify low-level characteristics of the system such as word size or clock speed.

This outcome also relates to the candidate's use of computer systems. The candidate should be able to set up and customise a system for efficient use for a particular application At this level candidates would be expected to change hardware and/or software parameters to make efficient and effective use of the computer system. For example, candidates might experiment with threshold settings while scanning a graphic or may choose the resolution of a printer or may increase the memory allocated to an application. These can be used to exemplify the control the user has over a system. In some cases system parameters may be changed but clearly this should only be carried out where it is safe. Centres will make their own decision about which parameters can be changed, depending on the hardware/software platform available and their technical support resources. For the purposes of core skill certification, candidates must use virus checking software on the customised system.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

Outcome 3

This outcome relates to the characteristics of input and output devices in contemporary use, contemporary storage devices and the organisation of storage. Candidates should be able to make comparisons between the products from different manufacturers for each type of input device. The criteria for each comparison will be those appropriate to the input device. The use of the word contemporary is deliberate and will require candidates to access current product information. For many manufacturers this data can be obtained from the company Web site. This will therefore involve the candidates in accessing data from a remote source and capturing it to local storage. A similar approach should be taken for the output devices and storage devices.

In discussing the input and output of sound and video, the candidate should familiarise himself/herself with the standards for data compression associated with the input and output of such data. The resolution of scanners and digitisers should also be covered

The candidate should be aware that there are different standards available in backing storage and be able to describe the general characteristics of these standards. The same knowledge should be demonstrated for output devices. Candidates should be encouraged to consider the most appropriate criteria for the discussion of system components, for example printing devices might be considered in terms of cost, dots per inch and pages per minute.

Candidates would be expected to organise backing storage efficiently using a hierarchical filing system, giving due regard to the balance between breadth and depth and appropriate names for files and folders (directories). Candidates should make regular backups of their own files and frequently check their files for viruses. The candidate should be able to search a remote source for data and download this data to local storage. For the purposes of core skill certification, at least two sources must be used, one of which may be local (such as CD ROM). The candidate should be aware of the wider implications of using systems. This will include health and safety issues related to the design and use of computers as well as the financial and legal implications of obtaining data from these sources.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

Outcome 4

This outcome relates to the selection of computer systems to match specific applications. Suitable applications include office applications, financial applications, entertainment, publishing applications, educational uses, research and communications.

Candidates should be able to analyse an operational requirement specification and communicate clearly the critical system requirements and the boundaries of the problem.

Candidates are then required to select hardware and software (including system and application software). It is anticipated that candidates will use a variety of internal and external sources of information to identify suitable systems. It is likely that a case study may form a suitable context for this outcome. The candidates should be able to describe the resulting system in terms of hardware and software.

Candidates must be able to evaluate and justify the solution and assess critically its adequacy in terms of functionality, compatibility and cost, and be able to suggest possible enhancements. So, for example, selecting incompatible hardware and software is not acceptable; similarly, the hardware and software must be capable of carrying out the required tasks at an acceptable speed; and the cost of the system must be within a defined budget.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

This is the fourth in a series of units relating to Computer Systems. The content/context section (above) provides additional guidance on the delivery of the outcomes. This section focuses on learning and teaching.

Candidates will require access to appropriate computer hardware and software at various stages within this unit. To enliven learning, the use of video, audio and multimedia learning aids is recommended. While the distribution of time between the outcomes will vary, candidates may be expected to complete each outcome within the following time scale:

Outcome 1 ..... 8 hours
Outcome 2 ..... 12 hours
Outcome 3 ..... 12 hours
Outcome 4 ..... 8 hours

If this unit is delivered as part of a course (or programme of units), then the course documentation will provide further information on teaching and learning in a course context. This documentation will identify a number of ‘themes’ to facilitate holistic learning and teaching across the course.

National Unit Specification: support notes (cont)

UNIT Computer Systems (Higher)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Centres may use the instruments of assessment which are considered to be most appropriate. Examples of instruments of assessment which could be used are as follows:

Outcome 1	Extended-response questions on the principles of computer organisation.
Outcome 2	Extended-response questions on the types and purposes of computer software.
Outcome 3	Extended-response questions on the characteristics of peripheral devices.
Outcome 4	Practical assignment involving the selection of a computer system to match operational requirements.
Outcome 5	Practical assignment involving the set-up, customisation and organisation of a microcomputer system.

During the work of the unit, candidates should have several opportunities to develop their practical skills and should be assessed at appropriate points. Terminology should be presented in context throughout the module. Where the candidate is unsuccessful in achieving an outcome, provision should be made for remediation and re-assessment.

Written evidence may take various forms including hand-writing and word-processed text or other forms of written communication that are more suited to candidates with physical disabilities. Candidates should not be required to produce a specific form of written text (such as word-processed text) unless this is stipulated within the unit specification or instrument of assessment

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 alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements for Candidates with Special Needs/Candidates whose First Language is not English* (SQA, 1998).