

## SQA Advanced Unit specification: general information for centres

**Unit title:** Computer Systems Fundamentals

**Unit code:** HP1T 47

**Superclass:** CB

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### Unit purpose

This unit is designed to provide candidates with the knowledge of the various hardware and software elements of a computer system, how to install an operating system and install and configure application and security software. Candidates will also be introduced to the theory and practical application of number systems in computing. It is not intended that the candidate will gain an in depth knowledge of any particular operating system or applications software. The unit provides a foundation for further study of particular operating systems.

On completion of the unit the candidate should be able to:

- 1 Explain the purpose of the elements of a computer system.
- 2 Manipulate and explain the uses of number and logic systems used in a computer.
- 3 Install a range of computer software.

### Recommended prior knowledge and skills

Entry is at the discretion of the centre. Candidates should have experience of using computer applications and an awareness of the function of a computer operating system, which may be evidenced by the candidate having appropriate practical experience. It would be beneficial for candidates to have the numerical skills evidenced by achieving the *Numeracy Core Skill* at SCQF level 4.

### Credit points and level

1 SQA credit at SCQF level 7: (8 SCQF credit points at SCQF level 7\*)

*\*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 National 1 to Doctorates.*

## **SQA Advanced Unit Specification**

### **Core Skills**

Achievement of this unit gives automatic certification of the following:

Complete Core Skills                      *Numeracy* at SCQF level 5

There are also opportunities to develop aspects of Core Skills which are highlighted in the support notes of this unit specification.

### **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.

As this unit is a unit within the SQA Advanced Certificate/Diploma in Computing group awards, it is recommended that the content provides general knowledge on the subject of computer systems.

The assessment exemplar for this unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable instrument of assessment. Centres wishing to develop their own assessments should refer to the assessment exemplar to ensure a comparable standard. Assessment exemplars are available on SQA's secure website.

## **Unit specification: statement of standards**

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The sections of the unit stating the outcomes, Knowledge and/or Skills, and evidence requirements are mandatory.

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. Candidates 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**

Explain the purpose of the elements of a computer system.

#### **Knowledge and/or Skills**

- ◆ Physical elements of a computer system
- ◆ Software elements of a computer system

#### **Evidence requirements**

Refer to Evidence requirements in Outcome 2.

### **Outcome 2**

Manipulate and explain the uses of number and logic systems used in a computer.

#### **Knowledge and/or Skills**

- ◆ Conversions between number systems
- ◆ Arithmetic in non-decimal number systems
- ◆ Computer logic

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### Evidence requirements for Outcomes 1 and 2

Evidence for the Knowledge and Skills required in Outcomes 1 and 2.

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe the use of the physical elements of a computer system for three different elements including the interpretation of information from two graphs which will be used in the construction of a table to communicate findings relating to computer hardware.
- ◆ describe the use of the software elements of a computer system for three different elements.
- ◆ apply conversions between two number bases from binary, decimal and hexadecimal using three different sets of integers to include working using a minimum of eight binary digits and four hexadecimal digits.
- ◆ apply addition and subtraction of integers in non-decimal number systems using three different sets of integers to include working using a minimum of eight binary digits in base 2 and four hexadecimal digits in base 16.
- ◆ apply logic operations from AND, OR, NOT, and XOR using three different sets of data.

The evidence should be generated in controlled supervised conditions. The questions should be unseen. Candidates may have access to unlimited notes and online materials. Care should be taken to ensure that the answers produced are in the candidate's own words and not copied from another source.

In any re-assessment, the candidate should be presented with a different set of questions covering the Knowledge and/or Skills bullets not achieved in the earlier assessment event.

### Outcome 3

Install a range of computer software.

#### Knowledge and/or Skills

- ◆ Install operating system software
- ◆ Install and configure applications software
- ◆ Install security software

#### Evidence requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ produce documentation of the installation and running of an operating system.
- ◆ produce documentation of the installation and running of a software application including two items which have been customised.
- ◆ produce documentation of the installation and running of security software on one occasion.

All installations will take place under supervised conditions. Candidates should be encouraged to make use of the online help and may have access to unlimited notes and online materials. The assessor should be satisfied that the documentation is the candidate's own work.

The candidate may be given the opportunity to produce any missing documentary evidence without the need to install other software.

### Unit specification: support notes

#### Unit title: Computer Systems Fundamentals

This part of the unit specification is offered as guidance. The support notes 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 is a constituent part of the SQA Advanced Certificate in Computing Graded Unit: Examination where the theoretical aspects of this unit will be examined. Centres should ensure that candidates are presented with sufficient theoretical information to succeed in the examination.

#### Outcome 1

This outcome is not intended to cover all available hardware and software, but provides an introduction to the physical and software elements of a computer system.

With regard to the physical elements of a computer system, the unit should provide the candidate with sufficient knowledge and understanding to gain an appreciation of the manner in which the CPU communicates with memory and I/O devices, the operating system layers and the internal registers in the CPU.

It is assumed that the candidate has knowledge of the physical layout of a stand-alone computer system and it is not expected that the range of available monitors, keyboards, printers, mice, etc. will be covered.

The various types of computer memory should be investigated to include the characteristics, relative speed, costs and uses within a computer system. Memory can be split into three types – ROM, RAM and hybrid. The order in which the CPU looks for information in the various types of memory should be included.

The function of the components of the CPU (ALU, registers, and control unit) can be introduced along with the methods used to communicate between the CPU and I/O devices, including direct memory addressing (DMA). The types of busses and the impact of bus width and I/O interfaces on the productivity of the CPU should be addressed. The various types of communication ports may also be included.

Interpreting and communicating graphical information should be covered within the context of this unit. This may be achieved by providing graphs, charts and tables from which information should be taken and the findings presented in tabular form, as a graph or a chart. The information presented for interpretation should range from simple to complex and could include multiple graphs some with logarithmic scales; tables with multiple columns; interpolation and extrapolation. There are opportunities to present the candidates with information on comparative memory speeds, bus widths, addressable memory, access speeds, cycle time, disk capacity, etc to allow the candidates to develop their numeracy skills.

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The approach to the software elements would cover types of software (operating systems, applications and security software), their installation and application.

Various type of operating systems software can be described including multi-user operating systems, network operating systems, real-time and distributed systems.

Applications software may range from bespoke software to suites of programs offered by software manufacturers.

Security software which prevents intrusion, such as Firewalls and anti-virus software, should be covered including the need for keeping such software up to date.

Other types of software including, for example, accessibility software, browsers, drivers, API, utilities and diagnostic tools may be introduced.

The manner in which information is stored and accessed is important to any user of a computer system. This would include file systems and formatting, file extensions, file structure, hierarchical structure, absolute and relative paths, attributes, user profiles, permissions and rights.

The function of the layers of the operating system and their interaction should be discussed. Within this topic there is the opportunity to discuss the pros and cons of different user interfaces, the role of the kernel, the manner in which the operating system manages memory and I/O including paging, thrashing, multitasking, interrupts and the tracking of files.

### **Outcome 2**

Candidates may be introduced to number bases by considering number systems they encounter every day, for example the conversion of seconds to minutes or hours to days.

As an introduction to number systems, the use of binary and hexadecimal systems within the computer should be explained. Approaches could include an explanation of ASCII and Unicode to illustrate the representation of characters and symbols or RGB values used in web design to demonstrate an application of hexadecimal numbers. The importance of base two in calculating available memory from the width of the address bus, the size of memory modules in powers of 2 and an explanation of bits, bytes, kilobytes, IP addressing, subnet masking, etc would also be useful as an introduction.

In order to meet the Knowledge and/or Skills the candidate must be able to convert numbers between bases 2, 10 and 16. This should not prevent other number bases being introduced, if time permits.

Arithmetic in number bases 2 and 16 must include addition and subtraction applying 2's complement. This should not preclude the introduction of multiplication and division which would provide an opportunity to include the accuracy of calculations.

Logical operators need not be confined to those itemised in the Knowledge and/or Skills section. It may help to illustrate the operation of the operators by using electrical circuits containing switches, power source and a light bulb.

Logical operators should be presented using both words and symbols for gates. Practical applications can be introduced, for example, using truth tables to simplify code or circuitry, logic gate diagrams to show equivalencies, using masks to change data from lower to upper case or determining a network address from an IP address and subnet mask.

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### Outcome 3

Prior to installation, the candidate should have knowledge and/or experience of system tools (including formatting and partitioning disks), content of the control panel, navigation, file sharing, workgroups, licencing issues, system requirements and in utilising the in-built help of software.

Any theoretical elements for this outcome may be covered in Outcome 1 and reprised prior to installations. It is for the centre to determine when it is appropriate to deliver the theoretical knowledge required to successfully install software.

The practical tasks undertaken must cover all the Knowledge and/or Skills bullets listed and the evidence requirements. Candidates should have access to a range of software and should not be confined to any particular manufacturer or supplier. There is an opportunity to allow candidates to research suitable free or trial software available on the Internet.

### Resources

At the time of writing there are a number of free courses available from The Open University which would be suitable as additional material for this unit. The catalogue is available to view at <http://openlearn.open.ac.uk/> where you can follow the links to Mathematics and Statistics and Computing and ICT.

Courses which may be of particular interest:

- ◆ Computers and computer systems
- ◆ Data and processes in computing
- ◆ Diagrams, charts and graphs
- ◆ Exploring data: Graphs and numerical summaries

Education Scotland provide many numeracy resources

<http://www.educationscotland.gov.uk/>

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### Guidance on the delivery of this unit

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

Physical elements of a computer system	8 hours
Software elements of a computer system	9 hours
Conversions between number systems	4 hours
Arithmetic in non-decimal number systems	4 hours
Computer logic	3 hours
Install and configure operating system software	4 hours
Install and configure applications software	2 hours
Install utility software	2 hours
Assessment	4 hours

### Guidance on the assessment of this unit

#### Outcomes 1 and 2

The assessment of Outcomes 1 and 2 can be combined as a single assessment. This could be conducted at a single assessment event lasting two hours and be carried out in supervised conditions.

It is suggested the assessment consists of five short response questions for each bullet point listed under Knowledge and/or Skills, twenty five questions in total.

In the assessment, candidates will be required to correctly answer sufficient questions to cover the Knowledge and/or Skills described in the evidence requirements.

Although the interpretation and communication of graphical information is included in the physical elements of the computer system, this should not restrict questions regarding graphical information from any of the other bulleted points, if appropriate.

#### Outcome 3

The installed software should not be confined to a particular manufacturer.

It is suggested the candidate should install any operating system and produce a short log of the installation. It is expected the candidate will be required to partition a disk; select a file system and format the partition as part of the installation process. The candidate is not required to perform a custom install.

The installation of application software should allow the candidate to customise at least two components of the application, during or after completion of the installation.

If a suite of programmes were to be installed this would provide the opportunity to customise by selecting one, or some, of the available components of the suite. Customisation could include keyboard, language date/time settings or later removal of components of the installation.

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Many operating systems have security software built in. It may be necessary for a candidate to remove an installed component in order to install other security software. Any such removal could be counted as customisation and should be included in the candidate log.

The time for the installations is not expected to exceed two hours.

There may be an opportunity to integrate assessments between units if the candidate is required to install an operating system, application and/or security software as part of another unit. The resulting documentation may be used as evidence for this unit providing the Knowledge and/or Skills for this unit are covered in their entirety.

### **Online and distance learning**

This unit may be suitable for delivery for distance or online learning. The practical aspects of the unit could be demonstrated and assessed by the utilisation of screen capture software.

### **Opportunities for the use of 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 candidate evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*.

### **Opportunities for developing Core Skills**

In Outcome 1 teaching and delivery in the interpretation and communication of graphical information in regard to memory speeds, bus widths, addressable memory, access speeds, cycle time, disk capacity, etc. Candidates would be given multiple opportunities to practice the analysis and interpretation of graphical information which would include tables, graphs and diagrams. The information presented should range from simple (two column tables, simple line graphs, simple logic diagrams) to complex (multiple column tables, logarithmic scales, complex graphs) to allow the candidate to develop their skills.

Information would be interpreted and findings presented by use of an appropriate graph, table or diagram which it is expected may be simpler than those used for analysis or interpretation, eg a table with three columns. Both formative and summative assessment will be undertaken with candidates presented with multiple or complex graphs.

This unit has the Core Skill of *Numeracy* embedded in it. This means that when candidates achieve the unit, their Core Skills profile will also be updated to show that they have achieved *Numeracy* at SCQF level 5.

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In Outcome 2 the candidate will be given the opportunity to investigate number bases in everyday situations prior to learning to convert integers between bases 2, 10 and 16 and to apply arithmetic operators to base 2 and base 16 integers. Application of base 2 and 16 will be carried out in, for example, calculation of addressable memory and RGB values. Logic operators will be applied to binary and hexadecimal integers and candidates will apply logic operations in the use of masks, calculations of network addresses, simplification of truth tables and Boolean expressions. In many of these tasks the candidate will have to decide on the steps and operations to be carried out. Candidates will have multiple opportunities to practice these skills with all topics being presented in both formative and summative assessments.

### **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).

## History of changes

Version	Description of change	Date

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

**FURTHER INFORMATION:** Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our [Centre Feedback Form](#).

### General information for candidates

#### Unit title: Computer Systems Fundamentals

This unit is designed to provide you with knowledge about the fundamentals of computer systems and focuses on how the various software and hardware elements interact. The unit has three main areas, the physical and software elements of a computer system, the number systems and logic used within a computer system and the installation of various types of software. The first two areas are theoretical and the third area is practical.

While studying Outcome 1 you will gain knowledge on the ways in which the central processing unit communicates with memory and input/output devices. Communication channels such as busses will also be covered. You will also learn about the layers of the operating system. Computer memory can be of many types and you will learn to distinguish the features of different types of memory. Computer software will cover different types of operating systems, application and security software as well as file systems and structures. Some of the many ways to secure a computer system such as rights, permissions and security software will be introduced. Some of the information will be presented to you in graphical form so that you can learn to interpret information from, for example, manufacturers' documentation.

The main focus of Outcome 2 is in the application of number systems and logic. You will be introduced to the binary and hexadecimal number systems and learn to add and subtract in these systems and to convert between these systems and decimal numbers. You will learn about computer logic and the applications in which it can be used such as using masks in calculating network addresses and changing the case of letters.

Outcome 3 focuses on the practical tasks of installing software. You will have the opportunity to apply the theory that you learned in Outcome 1 to install operating system, application and security software.

If you are studying for a group award in which this unit is mandatory then the knowledge gained in studying this unit will be examined in the graded unit examination.

To complete this unit successfully, you will have to achieve a satisfactory level of performance in both the theoretical and practical outcomes of the unit. You will be allowed unlimited access to paper-based and online resources during the assessments. The assessments will take place under supervision. The theoretical assessment is expected to last two hours. The practical assessments, comprising three installations, are likely to be spread across a number of occasions.

On completion of this unit you should be able to:

- ◆ explain the purpose of the elements of a computer system.
- ◆ manipulate and explain the uses of number and logic systems used in a computer.
- ◆ install a range of computer software.

You will also gain the Core Skill of *Numeracy* at SCQF level 5.