SQA Advanced Unit Specification

General information for centres

Unit title: Multi User Operating Systems

Unit code: HR77 47

Unit purpose: This Unit is designed to provide candidates with a practical introduction to, and understanding of, the main concepts of a Multi User Operating System. In particular, the Unit concentrates on the practical skills required to manipulate Operating Systems facilities effectively. This practical work is supported by an introduction to the main theoretical concepts of multi user operating systems, including resource management, process management, memory management, and the main hardware and software components.

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

1. Describe the characteristics of a multi user operating system.
2. Use the facilities of a multi user operating system.
3. Compose scripts to carry out routine tasks.

Credit value: 1 SQA Credit at 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.

Recommended prior knowledge and skills: Access to this Unit will be at the discretion of the Centre, however it is strongly recommended that candidates should have achieved the Communication Core Skill at SCQF level 5 and the Numeracy Core Skill at SCQF level 5. Knowledge of Mathematics at National 5 is also desirable. This may be demonstrated by the achievement of appropriate National Units or Courses or by the SQA Advanced Unit HP1H 47: *Mathematics for Computing 1*.

Core skills: There may be opportunities to gather evidence towards core skills in this Unit, although there is no automatic certification of core skills or core skills components.

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 most appropriate approach for delivery is lecturer exposition supported by hands on tutorial sessions.

This Unit is part of the SQA Advanced Certificate in Computing Group Award but could also be delivered as a stand alone operating system Unit, where exposure to a multi user operating system is required.

Assessment: This Unit places emphasis on the practical aspects of a multi user operating system and the assessments must be suitably practical in its nature. Outcome 1 is assessed by 20 multiple choice questions covering all knowledge and skills conducted under closed book conditions. Candidates are required to demonstrate a number of essential practical skills in Outcomes 2 and 3 and the assessments are open book which must be assessed under supervised conditions, although not necessarily by a single event. Assessors should assure themselves of the authenticity of each candidate's submission.

Some of the evidence requirements may be produced using e-assessment. This may take the form of e-testing (for knowledge and understanding) and/or e-portfolios (for practical abilities). There is no requirement for you to seek prior approval if you wish to use e-assessment for either of these purposes so long as the normal standards for validity and reliability are observed. Please see the following SQA publications for further information on e-assessment: (1) "SQA Guidelines on Online Assessment for Further Education" (March 2003) and (2) "Assessment & Quality Assurance in Open & Distance Learning" (Feb. 2001).

If a centre is presenting Outcome 1 online the following assessment methods, where appropriate, may be selected:

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

It is expected that the questions will be of the multiple choice variety. Centres may consider the use of alternative questions types, particularly if using Computer Assisted Assessment approaches. However, care should be taken that the questions are valid and at an appropriate level. The use of simple true/false question responses is unlikely to achieve this.

Unit specification: statement of standards

Unit title: Multi User Operating Systems

Unit code: HR77 47

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

Describe the characteristics of a multi user operating system

Knowledge and/or skills

♦ Features of a multi user operating system
♦ Types of multi user operating system
♦ Hardware and software components of a multi user operating system

Evidence requirements

Evidence for all the knowledge and/or skills in this Outcome will be assessed using a representative sample of 20 multiple choice questions. All knowledge and skills bulleted points must be covered. The questions presented must change on **each** assessment occasion.

Assessment must be undertaken in supervised conditions and is closed book. A candidate should complete this assessment within one hour. Candidates may not bring to the assessment event any notes, textbooks, handouts or other material (calculators are not allowed).

Candidates must answer at least 60% of the questions correctly.

Assessment guidelines

There is an opportunity for candidates to be assessed online subject to meeting the prescribed assessment conditions.

If a centre is presenting this assessment online 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 2

Use the Facilities of a Multi-User Operating System

Knowledge and/or skills

♦ Navigate file-system(s)
♦ Manipulate files and directories
♦ Follow given file naming conventions
♦ Controlling process management
♦ Use and monitor printing facilities
♦ Terminal types
♦ Online help systems
♦ Device and file systems status
♦ Use of mail facilities
♦ Use of redirection facilities
♦ Creating regular expressions
♦ Selecting and using filters

Evidence requirements

Assessment for this outcome will be in the form of practical assignment(s). Candidates must produce evidence that at least seven of the twelve knowledge and skills items have been utilised. A different sample of seven from the twelve must be selected on each assessment occasion.

The assessment must be accompanied with a proforma which requires the candidate to give the exact commands for certain operations. The candidate checklist must hold the candidate name, date and assessor endorsement to confirm that the work is the candidate's own.

Assessment is open book. Assessors should assure themselves of the authenticity of each candidate's submission.

Outcome 3

Compose scripts to carry out routine tasks

Knowledge and/or skills

- Use editor(s)
- Passing arguments
- Using environment variables
- Selecting and using control structure(s)

Evidence requirements

Additional clarity is offered in defining the term 'routine' in this outcome and suitable examples would include the creation of a –

- directory structure from a given specification with due regard for existing files
- selective back-up routine
- log file reporting on two aspects of machine status. Such a log should be time and date stamped (eg users logged on, printer status, disk usage).

Evidence for the knowledge in this Outcome will be provided in the format of a practical assessment in which the candidate will be asked to write a script which covers all the knowledge and/or skills section. The candidate must either email a copy of the scripts to the assessor or hand in a listing of the script. Additionally, the candidate must demonstrate that the script actually works. Scripts should show that the candidate has identified the correct commands or constructs in order to complete the task, and should adhere to indentation rules and be suitably commented.

Assessment is open book. Assessors should assure themselves of the authenticity of each candidate's submission.

Assessment guidelines

Candidates should be shown how to use online help and encouraged to make use of any operating system manuals which may be available. Additionally, it may be beneficial to suggest a number of supporting texts or electronic sources of information.

Administrative Information

Unit code: HR77 47

Unit title: Multi User Operating Systems

Superclass category: CD

Date of publication: August 2017

Version: 01

Source: SQA

Unit specification: support notes

Unit title: Multi User Operating Systems

This part of the Unit 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

The Unit is primarily intended to provide the candidate with a practical introduction to, and understanding of, the main concepts of a Multi User Operating System, essential underpinning knowledge and skills which will be invaluable during employment or further study. The candidate should attain the level of competence required to use routinely a multi-user operating system in a professional situation. It is essential that emphasis be placed on the transferability of skills such that a candidate should readily be able to use a different operating system from the one used during the delivery of the Unit.

The practical Outcomes should be achieved in the context of a recognised multi-user operating system such as Unix (or derivatives, such as Linux) or similar. It is not anticipated that operating systems derived from single user operating systems (eg Windows) will provide the full range of facilities required.

Achievement of the Outcomes will require individual access to a server or workstation running a multiple user operating system. Some situations may require the use of terminal emulation software running on a workstation running a single user operating system. It would be beneficial for candidates to have experience of alternative operating systems wherever practicable.

Due to the predominately practical nature of this Unit, candidates are likely to work with practical or tutorial type material. If candidates have experience they should be encouraged to enhance their current knowledge by tackling more advanced practical exercises. Less experienced candidates should have practical exercises which introduce the topic in discrete components and which can subsequently be combined to provide the required skills. However, it should be noted that the exercises must still attempt to embed the skills required to meet the evidence requirements of the Unit. The exercises where appropriate should also be delivered within the context of the group award.

Although the Unit is expressed in generic terms, it should be delivered within the context of the group award to which this Unit contributes. It is therefore inadvisable to alter any of the subject's associated nomenclature, as this may lead to confusion, especially when using reference materials.

Suggested reading/reference lists are given for each Outcome. It should be noted, though, that these are not comprehensive and may be overtaken by new publications.

Outcome 1 considers the whole operating system, taking each of the major components and splitting it into manageable topics which can be further divided into discrete areas for more detailed investigation. Candidates should become familiar with the relevant terminology and make use of this terminology appropriately. In particular candidates should be introduced to:

♦ Features: resource sharing; multi-tasking; background processing
♦ Types: multi-processor; time-sliced; distributed
♦ Physical Components: processors; memory; data storage devices; terminals; output devices
♦ Software Components: kernel; device handlers; spoolers; user interface.

Candidates are encouraged to read materials provided and use textbooks, journals, papers and electronic sources of information.

Outcome 1 Reading/Reference List
A suggested reading list is provided below.

Bach, M. J. (1986) <u>The Design of the UNIX Operating System</u>. New Jersey: Prentice-Hall, Inc.
Glass, G (1993) <u>UNIX For Programmers and Users: A Complete Guide</u>. New Jersey: Prentice-Hall, Inc.
Miller, C. (1990) <u>Unix for Users (2nd ed.).</u> Great Britain: Blackwell Scientific Publications
Silbershatz A., Galvin P. B. (1994) <u>Operating Systems Concepts (4th ed.).</u> Massachusetts: Addison-Wesley Publishing Company
Sobell, M. G. (1995) <u>UNIX System V: A Practical Guide (3rd ed.).</u> California: The Benjamin/Cummings Publishing Company, Inc.
Tanenbaum, A. S. (1992) <u>Modern Operating Systems.</u> New Jersey: Prentice-Hall, Inc.

Electronic Sources
http://cm.bell-labs.com/cm/cs/who/dmr/hist.html Retrieved from the Internet 19/10/2000
http://backofficesystems.com/tips/os/Default.htm Retrieved from the Internet 19/10/2000
http://backofficesystems.com/tips/os/unix.htm Retrieved from the Internet 19/10/2000
http://www.howstuffworks.com/operating-system.htm Retrieved from the Internet 19/10/2000

It should be noted when retrieving electronic material that due to the dynamic nature of the Internet, the sites listed might not remain active indefinitely.

Outcome 2 concentrates on providing candidates with practical skills. The knowledge and sills should form the basic subset of commands which candidates will use as a platform on which to build and enhance their skill set. An example of the basic subset of commands which must be covered are shown below – the example uses the UNIX operating systems commands:

♦ Navigation - 'cd' 'pwd' using **absolute** and **relative** paths
♦ Listing inspection, creation, deletion, renaming and modification of files - 'ls' 'more' 'cat' 'pg' 'touch' '>' '>>' 'cp' 'rm' 'mv'
♦ Adhering to naming conventions - eg maximum of 14 characters, no spaces, no invalid characters, leading capital for directory names.
♦ Checking status and cancellation of print jobs - 'lpq' 'lprm'
♦ Checking status of devices - 'lpstat'

♦ Login, logout, running virtual screens and defining terminal types - 'xterm' 'tset' set vt100 or vt52 terminal settings as required

♦ Using online help systems, check status of devices - 'man' ,'stat', 'df', 'du'.
♦ Controlling processes and locating files - 'ps' 'grep'
♦ Displaying and changing file and directory permissions - 'ls' 'chmod'
♦ Using mail facilities to send messages to single and multiple recipients - 'elm' 'mail'
♦ Using redirection facilities including pipes and filters with UNIX utilities - '>' '>>' '|' 'sort'
♦ Creating regular expressions - using simple regular expressions '.nd' '^.nd' 'sw.*ng' 'a.' a.$' '[a-d]'
♦ Selecting and using filters - 'egrep' 'grep' 'fgrep' 'uniq'
♦ Utilising files - using files as input and output from shell scripts 'sort +3n -o sortednames names'
♦ Controlling process management - 'ps'

Candidates are encouraged to use the online help system, materials provided, textbooks, journals, papers and electronic sources of information.

Outcome 2 Reading/Reference List

Gilly, D. (1992) <u>UNIX in a Nutshell (2nd ed. revised)</u> Sebastapol: O'Reilly Associates, Inc.
Glass, G (1993) <u>UNIX For Programmers and Users: A Complete Guide</u>. New Jersey: Prentice-Hall, Inc.
Miller, C. (1990) <u>Unix for Users (2nd ed.).</u> Great Britain: Blackwell Scientific Publications
Peek, J., Todino, G., Strang, J. (1998) <u>Learning the UNIX Operating System (4th ed.)</u> O'Reilly Associates, Inc.
Sobell, M. G. (1995) <u>UNIX System V: A Practical Guide (3rd ed.).</u> California: The Benjamin/Cummings Publishing Company, Inc.

Outcome 2 Reading/Reference List
Electronic Sources
http://homer.providence.edu/help/unix-help/ Retrieved from the Internet 19/10/2000
http://www.bell-labs.com/history/unix/tutorial.html Retrieved from the Internet 19/10/2000

Outcome 3 Introduces elementary scripting to the candidates. At this level it is not anticipated that candidates will produce sophisticated scripting solutions, but will be able to automate routine tasks.

A suggested task is that of creating a directory structure for a new user on a multi user operating system. Such a script should be parameterised, such as with the location of the root for the new structure, and may need to copy templates to specified locations within the structure. The importance of checking for the existence of files should be stressed.

The focus is on the candidates' analysis of the given problem and ability to synthesise a suitable design which will produce a solution to the problem. The implementation stage must be completed individually. Authenticity of scripts may be problematic if group work is permitted. Oral questioning of the contents of the script should help with authentication. An example of the basic subset of commands which must be covered are shown below − the example uses the UNIX operating systems commands:

♦ Using editors - for example 'vi' or 'emacs' or any other available editor to modify text files

♦ Passing Arguments - passing arguments from the command line

♦ Using Environment Variables - '$HOME' '$PATH' '$PRINTER' '$HISTSIZE'

♦ Selecting and using control structure(s) - Selection -'if'-'elif' 'fi' 'select' 'case' 'esac' Sequence 'while' 'do' 'done' 'for' 'until'

Outcome 3 Reading/Reference List
Gilly, D. (1992) UNIX in a Nutshell (2nd ed. revised) Sebastapol: O'Reilly Associates, Inc.
Glass, G (1993) UNIX For Programmers and Users: A Complete Guide. New Jersey: Prentice-Hall, Inc.
Kochan, S. G., Wood, P. H., (1990) UNIX Shell Programming (revised ed.)
Miller, C. (1990) Unix for Users (2nd ed.). Great Britain: Blackwell Scientific Publications
Peek, J., Todino, G., Strang, J. (1998) Learning the UNIX Operating System (4th ed.) O'Reilly Associates, Inc.
Sobell, M. G. (1995) UNIX System V: A Practical Guide (3rd ed.). California: The Benjamin/Cummings Publishing Company, Inc.

Electronic Sources
http://homer.providence.edu/help/unix-help/
http://www.bell-labs.com/history/unix/tutorial.html

Guidance on the delivery and assessment of this Unit

This Unit forms part of the SQA Advanced Certificate in Computing, which is primarily designed to provide candidates with knowledge and skills in computing and information technology. It would be expected that those who successfully complete the group award progress either to employment within the IT sector or alternatively carry on to study at SQA Advanced Diploma level or Scottish Degree Level year 2. The Unit is biased towards the practical aspect of multi user operating systems and therefore focuses on the candidates' ability to carry out practical tasks. Wherever possible, the tutor should provide the candidates with examples of situations that they will understand. The candidate may be required to produce a hard copy of the files in Outcome 2 as well as sending them by email to the addresses supplied.

Outcome one is a closed book assessment. For other outcomes in this unit reference to textbooks, handouts or other material prepared by candidates is permitted during assessment.

It is stipulated that the assessments are carried out individually.

Open learning

If this Unit is delivered by open or distance learning methods, additional planning and resources may be required for candidate support, assessment and quality assurance. A combination of new and traditional authentication tools may have to be devised for assessment and re-assessment purposes. For further information and advice, please see *Assessment and Quality Assurance for Open and Distance Learning* (SQA, February 2001 — publication code A1030).

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.

General information for candidates

Unit title: Multi User Operating Systems

This Unit is designed to provide you with a practical introduction to, and understanding of, the main concepts of a Multi User Operating System. In particular, the Unit concentrates on the practical skills that you will require to make effective use of a multi user operating system. The practical work is supported by an introduction to the main theoretical concepts of a multi user operating system.

Units are broken down into a number of **Outcomes**; each Outcome covers a discrete topic or area within a Unit. The completion of the taught material within an Outcome is usually followed by an **assessment**. An assessment (which may be practical or theoretical in nature) will produce some **evidence** of having carried out the assessment. Your evidence allows you to be measured against an assessment **test specification** (some evidence that we know already meets certain criteria). Your evidence is marked against this test specification and you are given results and feedback.

This Unit has three such Outcomes and on completion of the Unit you should be able to:

1.   Describe the characteristics of a multi user operating system

2.   Use the facilities of a multi user operating system

3.   Compose scripts to carry out routine tasks

The three Outcomes are described below:

Outcome 1: You will be given an overview of the main characteristics of a multi user operating system. This part of the Unit provides an introduction to the main theoretical concepts of a multi user operating system. Concepts include how the operating system deals with its resources; how processes (a unit of measurement for a number of tasks) are allocated and de-allocated resources; how memory is allocated to processes; and the main hardware components, such as the processor, memory, storage devices, terminals and output devices. Outcome 1 is assessed by a series of objective (usually multiple choice) questions under closed book conditions.

Outcome 2: The Unit now takes a more practical approach by means of a series of lectures and tutorials which will build up your skills making you proficient in using a multi user operating system. The lectures/tutorials for Outcome 2 concentrate on your ability to manipulate files and directories. Files are the governing concept within many multi user operating systems. And you will be introduced to the more advanced features such as file permissions, sorting and process management.

The lectures/tutorials are followed by an assessment of your abilities by means of a practical assignment which are open book and carried out in the lab/class under supervised conditions. The assignment will involve your being asked to use commands to produce evidence of your ability to utilise commands, files and file permissions. You may also be required to use the email facilities provided by a multi user operating system.

Outcome 3: The final stage of the Unit involves the integration of the skills and knowledge from the first three Outcomes to produce a scripted solution which will carry out a routine task. This third and final assessment is assessing your ability to analyse a given problem and devise, design and implement a solution. You must draw on all of the knowledge and skills gained from the first two Outcomes in order to provide a suitable solution. Group work is permitted to an extent in this Outcome, with the exception of the implementation component. This essentially means that you may work as a team through the analysis, and design stages but not whilst writing and testing the actual scripts files.

The evidence requirements for this Outcome are a physical printed copy of the script and a demonstration of the script executing either correctly or partially, with the correct commands and structures being identified and selected for use. This assessment is open book and carried out in the lab/class under supervised conditions