SQA Advanced Unit specification: general information

Unit title: Systems Development: Introduction

Unit code: HR8M 47

Superclass:	CB
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Version:	01

Unit purpose

This Unit is about introducing candidates to the systems development process. It provides a broad knowledge of systems development and candidates will be able to apply the main techniques used within systems analysis and design. It is primarily intended to prepare candidates who expect to gain employment in an IT/Computing-related post at technician or professional level in a software development role. Candidates undertaking this Unit may be working towards completing a: SQA Advanced Certificate in Computing, SQA Advanced Diploma in Computing, SQA Advanced Diploma in Computing: Software Development, SQA Advanced Diploma in Computing: Networking, or SQA Advanced Diploma in Computing: Technical Support.

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

1 Describe systems development life cycle models.
2 Describe the techniques involved in systems requirements analysis.
3 Use modelling techniques on a given system.
4 Use relational data analysis and modelling techniques on a given system.

Recommended prior knowledge and skills

Access to this Unit is at the discretion of the centre, however it is desirable that the candidate possesses good communication and problem solving skills as well as the ability to manipulate text and graphical information, gained through either workplace experience or training at an appropriate level. A knowledge and understanding of Information Systems is also desirable. This may be evidenced by the possession of: the SQA Advanced Unit HR92 47 *Information Technology: Information Systems and Services*, relevant National Qualifications such as Information Systems at SCQF level 6, or practical experience. Entry can be given where a candidate has had considerable workplace experience.

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.

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes of 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.

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

Describe systems development life cycle models.

Knowledge and/or Skills

♦   Describe current system development life cycle models
♦   Describe strengths and weakness of traditional and current system development life cycle models

Evidence Requirements

Evidence for all the Knowledge and/or Skills in this Outcome will be assessed by a candidate completing 10 multiple-choice questions. This should be combined with Outcome 2, see assessment guidelines for additional information. All Knowledge and Skill bullet points must be covered.

This is a closed-book supervised assessment to be completed within 30 minutes. Candidates must give correct responses to a minimum of 60% of the questions.

Outcome 2

Describe the techniques involved in systems requirements analysis.

Knowledge and/or Skills

♦ Fact-finding methods
♦ Recording of information gathered using agreed documentation standards
♦ Feasibility study terminology
♦ Requirement specification terminology

Evidence Requirements

Evidence for all the Knowledge and/or Skills in this Outcome will be assessed by a candidate completing 10 multiple-choice questions. This assessment should be combined with Outcome 1, see assessment guidelines for additional information. All Knowledge and/or Skills bullet points must be covered.

This is a closed-book supervised assessment to be completed within 1 hour. Candidates must give correct responses to a minimum of 60% of the questions.

Outcome 3

Use modelling techniques on a given system.

Knowledge and/or Skills

♦ Use techniques in modelling processes/behaviour
♦ Use techniques in modelling data structure
♦ Organisational standards for documents/diagrams and their content

Evidence Requirements

The candidate will produce a use case diagram, an activity diagram and a class diagram using agreed organisational standards.

The use case diagram must show actors, use cases and links (associations).

The activity diagram must show workflow, activities, actions and constraints (if applicable).

The class diagram must show relationships, attributes, behaviours and generalisation (if applicable).

One error is acceptable in each of the created diagrams (use case, activity and class).

This evidence should be produced under open-book supervised conditions. Assessors should assure themselves of the authenticity of each candidate's submission.

The preferred method of assessment would be combining Outcome 3 and Outcome 4 into a single project based scenario, with candidates allowed a total of 3 hours to produce the required evidence.

Outcome 4

Use relational data analysis and modelling techniques on a given system.

Knowledge and/or Skills

♦   Develop a ER model to agreed organisational standards
♦   Normalisation: 1NF, 2NF and 3NF
♦   Relationships: one to many, one to one

Evidence Requirements

The candidate should normalise two data sources to Third Normal Form (3NF), produce an ER Model showing relationships produced to organisational standards.

ER Model must be produced showing a minimum of four entities detailing attribute name, type, display format, default values, valid ranges. The model must only show one too many relationships.

The candidate will produce the following evidence detailing all Knowledge and Skills.

This evidence should be produced under open-book supervised conditions. Assessors should assure themselves of the authenticity of each candidate's submission.

The preferred method of assessment would be combining Outcome 3 and Outcome 4 requirements into a single project based scenario, with candidates allowed a total of three hours to produce the required evidence.

Unit specification: support notes

Unit title: Systems Development: Introduction

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.

A suggested time allocation for each part of the Unit would be:

Outcome 1

♦	Describe current system development life cycle models	3 hours
♦	Describe strengths and weakness of traditional and current system development life cycle models	2 hours

Outcome 2

♦	Fact-finding methods	2 hours
♦	Recording of information gathered using agreed documentation standards	1 hour
♦	Feasibility study terminology	2 hours
♦	Requirement specification terminology	2 hours

Outcome 3

♦	Use techniques in modelling processes/behaviour	6 hours
♦	Use techniques in modelling data structure	4 hours
♦	Organisational standards for documents/diagrams and their content	3 hours

Outcome 4

♦	Develop a ER model to agreed organisational standards	3 hours
♦	Normalisation: 1NF, 2NF and 3NF	6 hours
♦	Relationships: one to many, one to one	2 hours

Assessment

♦	Outcome 1 and Outcome 2	1 hour
♦	Outcome 3 and Outcome 4	3 hours

Guidance on the content and context for this Unit

It is recommended that this Unit should be taught and assessed in the context of the Group Award to which it contributes. Although the Unit may be delivered on its own, it is part of the SQA Advanced Certificate and SQA Advanced Diploma in Computing Group Awards, and is aimed at candidates on such programmes of study.

This Unit is primarily intended to introduce candidates to the systems development process. It provides a broad knowledge of systems development and candidates will be able to apply the main techniques used within systems analysis and design.

Although this Unit is expressed in generic terms, it should be related to a context that is familiar to candidates. If necessary the terminology used in this Unit could be adapted to suit the candidates learning environment, such as system may be modified to database system.

Outcome 1 allows the candidate to gain knowledge about systems development life cycle models.

♦ Describe current system development life cycle models — iterative model, incremental model, agile development model.
♦ Describe strengths and weakness of traditional and current system development life cycle models — include waterfall, spiral and v-shaped modelling comparing advantages and disadvantages of each and how the modern models appear to have solved some disadvantages.

Outcome 2 allows the candidate to gain knowledge of techniques involved in systems requirements analysis.

♦ Fact-finding methods — interview, questionnaire, observation and record view.
♦ Recording of information gathered using agreed documentation standards — depending on centres choice.
♦ Feasibility study terminology — financial, time, economic, operational, performance and resources.
♦ Requirement specification terminology — scope, non/functional and physical requirements and natural language.

Outcomes 3 and 4 could be combined into a single carefully designed assessment. Using a real life scenario would be the most favourable approach. Candidates should be given access to contemporary software modelling tools required to carry out the Unit. Alternatively a pen and paper exercise would be acceptable as Evidence Requirements.

Outcome 3 the candidate uses modelling techniques on a given system.

♦ Use techniques in modelling processes/behaviour — UML standards, Use Case, Activity Diagrams.
♦ Use techniques in modelling data structure — UML standards, Class Diagram
♦ Organisational standards for documents/diagrams and their content - documentation depends on centre choice.

Outcome 4 the candidate uses relational data analysis and modelling techniques on a given system.

♦   Develop a relational data model to agreed organisational standards — 1NF, 2NF, 3NF and Entity Relationship Modelling. Including entities relationships and attributes.

Guidance on the delivery of this Unit

This Unit is likely to form part of a Group Award designed to provide candidates with technical or professional Knowledge and/or Skills for a specific occupational area.

This Unit is designed as an Introduction to Systems Development therefore this Unit should be introduced early in the course to allow for progression within this topic area.

The Unit should be delivered in the following order: Outcome 1, then progress to Outcome 2, then Outcomes 3 and 4 could be delivered together depending on scenarios or case studies used, alternatively Outcome 3 could be delivered, then finally Outcome 4.

Outcome 1 should provide a good base understanding of current life cycle models and candidates should be able to compare and contrast with more traditional methods.

Outcome 2 should provide candidates knowledge and understanding of how to fact find and gather system information. Candidates should understand the basic terminology used in feasibility studies and requirement specifications.

Outcome 3 should provide candidates with the knowledge and skills required to model systems processes and behaviour. Candidates should become competent in modelling techniques and documenting diagrams using appropriate organisational standards. Candidates should be exposed to UML modelling techniques.

Outcome 4 should provide the candidate normalisation knowledge and skills to develop an Entity Relationship diagram based on the normalisation process to 3NF and modelled to organisational standards.

With relevance to Outcomes 3 and 4, candidates should always be encouraged to consider alternative solutions to problems.

The candidates should be given ample practice scenarios and solutions to help build their knowledge and understanding.

Candidates should have access to the relevant tools to complete the modelling required.

Guidance on the assessment of this Unit

It is recommended that Outcomes 1 and 2 are combined into one assessment. Questions must be equally taken from Outcome 1 and 2 Knowledge and/or Skills.

It is recommended that Outcomes 3 and 4 are integrated into one holistic assessment which takes the form of a project or case study. It would also be possible to offer this assessment as 2 separate assessments that assess each Outcome individually, where possible, it would be best to use the same case study/scenario for each.

The assessments should be completed on an individual basis under supervised conditions. Assessors should ensure themselves of the authenticity of the candidate's evidence.

SQA Advanced Unit Specification

Outcomes 1 and 2 are closed-book assessments with Outcomes 3 and 4 being open-book assessments. Outcomes 1 and 2 should be assessed first as this gives the basic knowledge and understanding required to build upon for Outcomes 3 and 4. It is suggested that multiple choice style questions could be used. The multiple choice style assessment could be a mixture of multiple choice, drag and drop and fill the blank style questions.

For Outcomes 3 and 4, a single project assessment is recommended, with the model broken down into identifiable and assessable stages allowing the tutor the opportunity for regular monitoring of the candidate's progress and allowing time for remediation if/when required. It is suggested that Unified Modelling Language (UML) Techniques are used for Outcome 3. The assessment requires that the candidate be given a brief. This brief should be detailed enough to allow the candidate to model the complete system using a case diagram, activity diagram and class diagram. The candidate would then take the identified system data, normalise it to 3NF and development of the corresponding relationship model. The assessment should cover all evidence for Outcomes 3 and 4.

A simple example system may be:

♦   You have been asked to model the 'Enrol in College' scenario.
♦   You have multiple applicants, who apply to college and the typical candidate details (these can be provided by the tutor) are captured in an application form.
♦   The application form needs to be validated by the registration team. If validated, a candidate record is created, checking if eligible and not already in the system.
♦   The candidate fees are then collected by finance. If the fees are paid the candidate is then enrolled. The candidate is enrolled in their selected course by the school administrator and is given a subject timetable.

This example can be expanded and modified to by centres. The specific data and types to be stored in a database should be given to the candidate. Alternatively you could create this as a simulated 'real life' scenario where the tutor could be the client giving the team an initial specification. The next stage could be setting up an interview with your client to glean further details in this manner. Although this would mean a little extra preparation on the tutors' behalf, it would make the situation realistic and more enjoyable for the candidates. The candidates although not required for assessment purposes could complete a requirements specification which could be used.

For Outcome 3 and Outcome 4 candidates should have all the following documentation completed at each step.

At the Modelling stage (Outcome 3) candidates should have the following documentation:

♦   Use case diagram, activity diagram and class diagrams. Ensure agreed organisational standards are met.
♦   At the relational data analysis and modelling techniques stage (Outcome 4) candidates should have the following documentation:
♦   Documentation detailing original data source being processed through 1NF, 2NF and finally 3NF.
♦   An Entity Relationship Model showing entities using agreed organisational standards.

Alternatively Outcomes 3 and 4 could be assessed using two separate assessments, although it would be easier to manage if the same case study was used throughout the Unit.

Assessment Guidelines

Outcome 1

The assessment of this Outcome should be combined with Outcome 2 as part of a single assessment for the Unit, details of which are given under Outcome 2.

Outcome 2

Evidence for all the Knowledge and/or Skills in this Outcome will be assessed using a representative sample of 10 questions. This should be combined with Outcome 1 where a test with 20 questions covering both Outcome 1 (10 questions) and Outcome 2 (10 Questions) will be used. All knowledge and skills bulleted points must be covered.

Questions could come from the following topics:

♦ Describing a life cycle model
♦ Stages of the life cycle model
♦ What does a life cycle model provide?
♦ Design strategies
♦ Benefits of certain life cycle models
♦ Requirement terminology
♦ Data/information gathering
♦ Feasibility terminology
♦ Documentation standards
♦ Documentation and relevance

The questions presented must change on **each** assessment occasion. Assessment must be undertaken in supervised conditions and as closed-book. A candidate should complete this assessment within one hour, Outcome 1 and Outcome 2 questions are combined (ie 30 minutes for each Outcome's 10 questions). Candidates may not bring to the assessment event any notes, textbooks, hand-outs or other material. Candidates must answer at least 60% of the total questions correctly.

Outcome 3

This Outcome lends itself well to a case study or scenario based open-book assessment. The carefully designed assessment could be combined with Outcome 4.

Candidates must produce a case diagram, activity diagram and a class diagram to the agreed organisational standards.

One error is acceptable in each of the created diagrams (use case, activity and class).

This assessment should be open-book although held in supervised conditions. Assessors should assure themselves of the authenticity of each candidate's submission.

Outcome 4

This Outcome lends itself well to a case study or scenario based open-book assessment. The carefully designed assessment could be combined with Outcome 3.

Candidates must show they can normalise two data sources to Third Normal Form (3NF) using agreed organisational standards and produce an Entity Relationship Model derived from the 3NF relations. Evidence should show the modifications from original data source through 1NF, 2NF and finally 3NF. The Entity Relationship Model must show entities and only one-to-many relationships. The model should have a minimum of four entities. At least one many-to-many relationship must be refined.

The candidate will produce evidence to show that they can document at least two entities using agreed organisational standards defining — attribute name, type, display format, default values, valid ranges.

Minor errors are acceptable but must be kept to a minimum, eg one relationship error would be acceptable.

This assessment should be open-book but held in supervised conditions.

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

The total time allowed for completion of required assessment for Outcomes 3 and 4 is three hours.

Online and Distance Learning

This Unit could be delivered by distance learning. However, it would require planning by the centre to ensure the authenticity of candidate evidence. Arrangements would need to be made to ensure that the assessments for Outcomes 1, 2, 3 and 4 are delivered in a controlled supervised environment.

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit and is detailed within the section 'Guidance of Assessment for 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 this Unit, candidates will develop the knowledge needed to enable them to describe life cycle models and the techniques involved in systems requirements analysis. Candidates will also learn various modelling techniques and relational data analysis techniques.

Candidates will:
♦ research current system development life cycle models
♦ describe strengths and weakness of traditional and current system development life cycle models
♦ research fact-finding methods
♦ present information gathered using agreed documentation standards
♦ explain feasibility study and requirement specification terminology
♦ apply techniques used in modelling processes/behaviour and data structure
♦ create documents/diagrams ensuring compliance with organisational standards
♦ create a relational data model to agreed organisational standards

As candidates are doing this Unit they will be developing aspects of the Core Skills in *Problem Solving* and *Communication*. The Core Skill of *Information and Communication Technology (ICT)* can be developed when completing Outcome 3 and Outcome 4 if contemporary software tools were used to develop the modelling techniques.

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.

History of changes to Unit

Version	Description of change	Date

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: Systems Development: Introduction

In this Unit you will develop the knowledge and learn the skills required to help you understand systems development modelling and the techniques involved in systems requirements gathering. You will also gain skills in modelling techniques relating to typical problems within a computing context. Using relational data analysis and modelling techniques will enable you to understand data and the structural implications within a system.

You will learn about how methodologies provide a framework or procedure within which Systems Development can be performed. Most methodologies cover the entire span of development activities from project initiation through post-implementation review and the organisation of these phases and the steps within them, are also called the development, or project life cycle.

During this Unit you will learn that designing a system is key to the overall structure and maintenance of a product. Requirements analysis and design phases within a system life cycle look at real world problems, whilst analysts develop skills to extract important data and activities/processes which must be incorporated into the new system from a specification. One major decision is what life cycle methodology to follow; the methodology provides you with a set of tools, procedures and documentation standards to follow, making this creation process easier.

Outcome 1 and 2 cover this area and will provide you with the knowledge of how to investigate a system and create requirements using different techniques. You will also have developed an understanding of various systems life cycle models, learning about the strengths and weaknesses of each after completion of the Unit.

You will learn about Unified Modelling Language (UML) which is a graphical language used within systems design. UML can graphically describe many things about a system such as the overall structure, system interactions and behaviours. Business processes and how users interacted with the system can also be modelled with ease. UML gives the designers and developers an outline for software design, development and maintenance. Outcome 3 will allow you to learn about UML standards and you will gain skills in modelling Use Case, Activity and Class diagrams. Use case diagrams describe the interaction between the user and the system, so models the functionality of the system. Activity diagrams are used for modelling business processes and logic/workflow of a single Use Case. Class diagrams describe the overall static structure of the system.

Outcome 4 will give you knowledge and understanding of the Normalisation processes and you will learn how to model the data in a relational system. Normalisation is used to reduce redundancy and create smaller but well-formed relations. This process solves the issue of data inconsistency within a system. Having data stored in the correct location will permit modifications, updates and deletions to be made in one location. The system will know about this change through defined relationships. The Entity Relationship model uses the normalised data to create a graphical view of the system. This will show the main entities, attributes and the relationships within the system which is a useful aid in implementing the data structure.

To complete this Unit successfully you will need to achieve a satisfactory level of performance on all four of the Unit Outcomes. You will have to show that you understand systems development modelling and techniques. You will also be expected to demonstrate the skills needed to create the Models required for Outcome 3 and Outcome 4.

The skills you will learn in this Unit should prepare you for any Unit in Systems Development which may be studied and serve as an initial foundation in planning a solution within systems development. Careful attention to good design and thorough understanding of modelling techniques will allow an easy creation of a solution to a problem. This will form a solid basis in the production of high quality, reliable and efficient models.