Level 4 Diploma in Software Language (9628-02)

Version (3.0) December 2017

Qualification Handbook

Qualification at a glance

Industry area	IT Professional
City & Guilds number	9628
Age group	16+
Assessment	Evolve online test
Approvals	Approval application required. Please see www.cityandguilds.com for details.
Registration and certification	Registration and certification of this qualification is through the Walled Garden, and is subject to end dates.

Title and level	GLH	TQT	City & Guilds qualification number	Ofqual accreditation number
Level 4 Diploma in Software Language	90	450	9628-02	603/0410/8

Version and date	Change detail	Section
2.0 Jan 2017	Assessment method changed.	Assessment
3.0 Dec 2017	Test specifications added	Assessment

Contents

1   Introduction

This document tells you what you need to do to deliver the qualification:

Area	Description
Who is the qualification for?	This qualification is designed to support learners to develop a full range of underpinning knowledge that can be used in a variety of businesses and industries that demonstrate confidence and transferability in a Digital Technology Environment.
What does the qualification cover?	A Software Developer will typically be working as part of a larger team and the modules are designed to provide learners with the knowledge to enable them to interpret design documentation and specifications for which they will have responsibility as part of the elements of an overall project.
What opportunities for progression are there?	This qualification is part of the Digital Industries Apprenticeship programme and are not offered as standalone products. On achieving this qualification the learner will have completed a section of the knowledge element as part of their apprenticeship journey.
Who did we develop the qualification with?	It was developed in collaboration with employers, sector experts and training providers using the Standard as the baseline. The Standards have been created by The Tech Partnership and their Employer Groups for the specific areas. The qualification embodies the required learning for an apprentice to have the opportunity to successfully gain the relevant knowledge for their chosen career path in a Digital Technology environment.
Is it part of an apprenticeship framework or initiative?	Yes – 9648 Software Developer

Structure

Learners must complete the single unit 402 to gain this qualification.

Total Qualification Time

Total Qualification Time (TQT) is the number of notional hours which represents an estimate of the total amount of time that could reasonably be expected for a learner to achieve and demonstrate the achievement of the level of attainment necessary for the award of a qualification.

TQT is comprised of the following two elements:
*   The number of hours which an awarding organisation has assigned to a qualification for Guided Learning, and
*   an estimate of the number of hours a Learner will reasonably be likely to spend in preparation, study or any other form of participation in education or training, including assessment, which takes place as directed by - but, unlike Guided Learning, not under the Immediate Guidance or Supervision of - a lecturer, supervisor, tutor or other, appropriate provider of education or training.

Title and level	GLH	TQT
Level 4 Diploma in Software Language	90	450

2 Centre requirements

Approval

Fast Track Approval is offered to existing City & Guilds Centres offering the SASE framework for the Advanced and/or Higher Level Apprenticeship for IT, Software, Web and Telecoms, or the SASW framework for the Apprenticeship and/or Higher Level Apprenticeship for IT, Software, Web and Telecoms through City & Guilds. See the separate document on our website that provides details of the Fast Track Process and actions to be taken.

City & Guilds is offering the opportunity for existing City & Guilds centres delivering SASE framework for the Advanced and/or Higher Level Apprenticeship for IT, Software, Web and Telecoms, or the SASW framework for the Apprenticeship and/or Higher Level Apprenticeship for IT, Software, Web and Telecoms with other Awarding Organisations to gain approval for these Apprenticeship Standards through the Common Approval Framework. See the separate document at www.cityandguilds.com which provides details of the New Programme Process and actions to be taken.

Centres that are not currently with City & Guilds will need to complete a Customer Application Form and once accepted they will be asked to complete the Centre Approval Process. See the separate document on our website that provides details of the New Centre Approval Process and actions to be taken.

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualification before designing a course programme.

Resource requirements

Resources

Please see the individual unit information for any resources required.

Centre staffing

Staff delivering these qualifications must be able to demonstrate that they meet the following occupational expertise requirements. They should:
- be occupationally competent or technically knowledgeable in the areas for which they are delivering training and/or have experience of providing training. This knowledge must be to the same level as the training being delivered
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training.

While the Assessor/Verifier (A/V) units/TAQA are valued as qualifications for centre staff, they are not currently a requirement for these qualifications. However, City & Guilds encourage trainers and assessors to qualify to the current TAQA standard. Centre staff may undertake more than one role, eg tutor and assessor or internal verifier, but cannot internally verify their own assessments.

Continuing Professional Development (CPD)

Centres are expected to support their staff in ensuring that their knowledge and/or practice remains current. This includes currency within the occupational area and of best practice in delivery,

mentoring, training, assessment and quality assurance. It should also take account of any national, international policy and legislative developments.

Internal quality assurance is key to ensuring that the assessment of evidence for units is of consistent and appropriate quality. They should:

- be occupationally competent or technically knowledgeable in the area for which they are internally quality assuring
- have recent relevant experience in the specific area they will be assessing
- have credible experience of providing training
- have a CV available demonstrating relevant experience and any qualifications held.

In certain circumstances, City & Guilds will recognise non-accredited learning and experience as equivalent as follows:

- If the Internal Quality Assurer does not hold a qualification they must be able to demonstrate evidence of working to their own organisation's internal quality assurance standards which clearly link to V1/TAQA or other equivalent standards for internal quality assurance.

Learner entry requirements

City & Guilds does not set entry requirements for these qualifications. However, centres must ensure that learners have the potential and opportunity to gain the qualifications successfully and that they have the full engagement of the employers for the full programme.

Age restrictions

City & Guilds cannot accept any registrations for learners under 16 as these qualifications are not approved for learners under 16.

3   Delivering the qualification

Initial assessment and induction

An initial assessment of each learner should be made before the start of their programme to identify:
*   if the learner has any specific training needs
*   support and guidance they may need when working towards their qualifications
*   any units they have already completed, or credit they have accumulated which is relevant to the qualifications
*   the appropriate type and level of qualification.

We recommend that centres provide an induction programme so the learner fully understands the requirements of the qualification[s], their responsibilities as a learner, and the responsibilities of the centre. This information can be recorded on a learning contract.

Recording documents

Learners and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds endorses several ePortfolio systems, including our own, Learning Assistant, an easy-to-use and secure online tool to support and evidence learners' progress towards achieving qualifications. Further details are available at: www.cityandguilds.com/eportfolios.

City & Guilds has developed a set of *Recording forms* including examples of completed forms, for new and existing centres to use as appropriate. Recording forms are available on the City & Guilds website.

Although new centres are expected to use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by learners and assessors at the centre. Amendable (MS Word) versions of the forms are available on the City & Guilds website.

4 Assessment

Summary of assessment methods

Candidates must:

- successfully complete one assessment for the mandatory unit

Assessment Types			
Unit	**Title**	**Assessment method**	**Where to obtain assessment materials**
402	Software Language	Evolve on-line test	www.cityandguilds.com

Assessment strategy

Assessment type: Multiple-choice online test
Assessment conditions: Invigilated examination conditions
Duration: 1 hour
Number of questions: 36
Pass mark: 25/36 (69%)
Grading: Pass/Fail

Learning Outcome	No of questions
1. Understand software design approaches	17
2. Understand how to interpret and implement a given design, compliant with security and maintenance requirements	10
3. Understand how to apply the mathematics required to be a software developer	9

Recognition of prior learning (RPL)

Recognition of prior learning means using a person's previous experience, or qualifications which have already been achieved, to contribute to a new qualification.

For this qualification, RPL is not allowed.

5 Administration

Quality assurance

Internal quality assurance

Registered centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications. Quality assurance includes initial centre registration by City & Guilds and the centre's own internal procedures for monitoring quality. Centres are responsible for internal quality assurance and City & Guilds is responsible for external quality assurance.

Standards and rigorous quality assurance are maintained by the use of:
- internal quality assurance
- City & Guilds external moderation.

In order to carry out the quality assurance role, Internal Quality Assurers must have appropriate.

Access arrangements

We can make arrangements so that learners with disabilities, special educational needs and temporary injuries can access the assessment. These arrangements must be made before the examination. For example, we can produce a Braille paper for a learner with visual impairment.

Language of examinations

We will provide this specification in English only.

Other issues

European Dimension

City & Guilds has taken account of the 1988 Resolution of the Council of the European Community in preparing this specification and associated specimen units.

Environmental Education

City & Guilds has taken account of the 1988 Resolution of the Council of the European Community and the Report Environmental Responsibility: An Agenda for Further and Higher Education 1993 in preparing this specification and associated specimen units.

Avoidance of bias

City & Guilds has taken great care in the preparation of this specification and specimen units to avoid bias of any kind.

6 Units

Availability of units

The unit information can be found in this document.

Structure of the units

These units each have the following:
* City & Guilds reference number
* Title
* Level
* Guided learning hours (GLH)
* Learning outcomes, which are comprised of a number of topics

Centres must deliver the full breadth of the range. Specialist equipment or commodities may not be available to all centres, so centres should ensure that their delivery covers their use.

Unit 402 Software Language

LEVEL	4
GLH	90

What is this unit about?

This unit provides learners with an understanding of the software development lifecycle, the choices that have to be made when selecting a software development methodology, and an appreciation of how software developers need to work effectively in teams to produce software.

The role of software developer is to build and test high-quality code across front end, logic and database layers. A developer will typically be working as part of a larger team, in which they will have responsibility for some of the straightforward tasks and deliverables of the overall project. The developer will interpret design documentation and specifications. Customer requirements will typically be defined and agreed by more experienced or specialist members of the team, such as a business analyst or technical architect.

- Upon completion of this unit, learners will have gained the knowledge to support the competencies of a Software Developer. Competencies supported by this unit include being able to undertake the following tasks:

- Reviews requirements and specifications, and defines test conditions. Designs test cases and test scripts under own direction, mapping back to pre-determined criteria, recording and reporting outcomes. Analyses and reports test activities and results. Identifies and reports issues and risks associated with their own work.

- Designs, codes, tests, corrects, and documents moderately complex programs and program modifications from supplied specifications, using agreed standards and tools. Conducts reviews of supplied specifications, with others as appropriate.
  Applies ergonomics tools and methods to develop users' tasks, interaction and interfaces to meet users' requirements.

- Applies data analysis and data modelling techniques to establish, modify or maintain a data structure and its associated components (entity descriptions, relationship descriptions, attribute definitions).

- Develops specialist knowledge of database concepts, object and data modelling techniques and design principles. Translates object and data models into appropriate database schemas within design constraints. Interprets installation standards to meet project needs and produces database components as required. Evaluates potential solutions, demonstrating, installing and commissioning selected products.

- Produces software builds from software source code. Conducts tests as defined in an integration test specification, records the details of any failures, and carries out fault diagnosis relating to simple failures, reporting the results of the diagnosis in a clear and concise manner.

Learning outcomes

In this unit, learners will be able to

1   Understand software design approaches
2   Understand how to interpret and implement a given design, compliant with security and maintenance requirements
3   Understand how to apply the mathematics required to be a software developer

Scope of content

Learning outcome

1   Understand software design approaches

Topics

1.1   Software design approaches
1.2   Interpreting a given design
1.3   Programming paradigms

Depth

Topic 1.1

Learners will explore a range of software design concepts through the use of examples and practical exercises. The learner will learn why design trade-offs have to be made and how different design methods can facilitate re-use.

Software design approaches
- Describe the role of software design in the software development lifecycle
- The refinement of specifications to enable code development that meets the requirements of the project/client.
- Explain different design approaches
- Compare the design trade-offs (advantages and disadvantages) such as modularity over performance
- Explain the role of performance modelling and simulation
- Describe the differences between structured design and OO design
- Explain how to utilise design patterns

Topic 1.2

Learners will explore a range of development choices available to them through the use of examples and practical exercises. The learner will learn how to implement re-use and design patterns in software code.

Interpret a given design
- Explain a range of development choices available eg:
- Encapsulation and modularisation
- Information hiding using abstract data types and interfaces
- Coupling and cohesion
- Component reuse
- Implementation of standard patterns

Topic 1.3

Learners will need to explain the difference between at least two programming paradigms (which must include Structured and Object-Orientated), and where it is appropriate to use specific paradigms.

Programming paradigms
- Describe the advantages and disadvantages of different programming paradigms
- Explain when it is appropriate to use specific programming paradigms
- Explain how each paradigm is able to support code re-use
- Contrast the maintainability of code from different paradigms

It is important to highlight to learners how the object-orientated paradigm facilitates code re-use more readily than structured languages and that the learner can explain the advantages of reusing previously tested code.

Learning outcome

2   Understand how to interpret and implement a given design, compliant with security and maintenance requirements

Topics

2.1   Security requirements
2.2   Maintenance requirements

Depth

Topic 2.1

Learners will learn the importance of considering security requirements when implementing software.

2.1 Describe how and where security requirements should be considered in the software development lifecycle
- Explain the importance of considering security as part of the software implementation (development) process
- Explain the principle of "least privilege" (i.e. that no process is ever running with more than the bare minimum access that it needs to accomplish its function)
- Explain the advantages of reusing previously tested code
- Describe the type of security threats that may be encountered and how they can be mitigated through code

Topic 2.2

Learners will be able to appreciate that software has a lifecycle after release. The learner needs to understand that software will need to be maintained, often by individuals who are support professionals rather than software developers.

2.2 Describe how and where maintenance requirements should be considered in the software development lifecycle

- Describe an example lifecycle of software after development – testing, deployment, maintenance
- Explain the maintenance need for comprehensive software documentation (both within the code and in supporting materials)
- Explain the importance of complying with standards for the maintenance of software

This topic should emphasis the importance of documentation and that this should incorporate use cases and results as well as code level documentation.

Learning outcome

3   Understand how to apply the mathematics required to be a software developer

Topics

3.1   Key concepts
3.2   Tools and techniques for creating abstractions that represent a problem and devising algorithms that solve a problem efficiently
3.3   Standard data structures and algorithms for sorting, searching and optimisation

Depth

Topic 3.1

Learners will learn the key concepts of what a computable problem is and how computable problems can be implemented through the use of software. In this, learners will need to be able to describe examples of non-computable problems.

3.1 Describe the key concepts of computational problems, algorithms and abstraction

- Learners will be given examples of computational problems and their solutions in a wide variety of fields
- Learners will learn about the limitations of computational problem solving (non-computability and computational complexity)

Topic 3.2

Learners must learn how to solve computational problems through the creation of abstractions and implementation of algorithms.

3.2 Explain a range of tools and techniques for creating abstractions that represent a problem and devising algorithms that solve a problem efficiently

- Learners will need to be introduced to sets, functions, logic and proofs
- Learners will be able to explain how to present the algorithms using formal mathematical notation

Topic 3.3

Learners will need to describe common data structures and algorithms for standard computable problems such as sorting, searching and optimization. The learner will implement common algorithms and data structures in software code through the use of examples and practical exercises.

3.3 Describe a range of standard data structures and algorithms for sorting, searching and optimisation
- Learners will need to encounter common algorithms
- Learners will need to identify common sources for algorithms and data structures

It is important to highlight the significance of works such as Donald Knuth's "The Art of Computer Programming" that describes many kinds of programming algorithms and their analysis.

Employer engagement

Employer engagement is essential in order to maximise the value of learners' experience. A partnership approach should be adopted where possible with employers with whom the consortium has links, and with employers used for work experience placements.

It would be helpful for teachers to develop a method of maintaining contact with a range of employers in the sectors may be able to help with keeping the examples of legislation, policies and codes of practice used in the taught content, up to date.

- Local branches of BCS The Chartered Institute for IT can often provide access to local employers, since many members will be senior practitioners and leaders in organisations that employ IT professionals. The BCS has an extensive branch network of volunteers operating across the UK, Channels Islands and Isle of Man. http://www.bcs.org/category/5897

- Invite local businesses to visit the delivery centre to talk about their experience in using Digital Technology for commercial advantage, especially in respect of their dealing with suppliers, customers and employees. Ask the students to identify aspects of the IT practices of local business that may be considered 'good practice'.

- Identify local small businesses that have no IT governance policy or guidelines. Invite them to attend a short presentation and discussion event wherein students outline by way of presentation and demonstration a short set of (maximum 10 items) good practices for IT governance and be prepared to answer questions from the audience.

- Invite the local constabulary to come and speak on examples of where businesses and individuals have been victims of crime as a result of their use of IT, and how IT is used in law enforcement (e.g., the Automatic Number Plate Recognition System (ANPR)).

- Approach the local chamber of commerce to attend a student debate on the need for greater awareness and engagement with the Digital Economy on the part of small business where. Choose a debatable question that can be supported or opposed such as 'This house believes that Internet sales channels are of equal importance to small/local retailers as they are to global corporates.'

- Larger enterprises and central government agencies with local offices are likely to have formalised IT governance policies, especially in technology enabled industries such as Banking, Insurance, Telecommunications and Logistics. These organisation may be willing to offer the time of their Chief Information Officer, an IT manager or technical professional to present to learners on the steps their organisation takes to protect against IT security threats.

- Website designers working in the local economy will often have extensive links with small business that have commissioned them to design, develop and maintain ecommerce sites. Invite a local web designer to come and speak about the challenges their clients face in implementing an online presence.

- The Computing/IT faculty of every university will have links to employers in the local economy and their faculty staff may be willing to introduce delivery centres to major employers of IT skilled graduates and apprentices. Such links should be developed by FE colleges so as to better understand the skills needs and career options for IT practitioners at all levels from school leaver to graduate (i.e., think of how your learners can develop their career beyond the FE stage, and open their eyes to a full career).

- Tech Partnership, the UK sector skills council for the IT/Telecoms industry, have an extensive list of small/medium sized employers of IT skilled apprentices and college leavers. They also provide a wealth of free resources for FE colleges to enable better engagement with local employers. https://www.thetechpartnership.com/

Suggested learning resources

Books

Software Engineering: A Practitioner's Approach	Pressman, R.S. & Maxim B.R.
Published by: McGraw-Hill Higher Education	
ISBN: 978-0-07-802212-8	

Software Engineering for Students	Bell, D.
Published by: Addison Wesley	
ISBN: 978-0-32- 126127-4	

Journals and magazines
- iTNow - http://www.bcs.org/category/17705

Websites
BCS – The Chartered Institute for IT   www.bcs.org

Appendix 1   Relationships to other qualifications

Links to other qualifications

Centres are responsible for checking the different requirements of all qualifications they are delivering and ensuring that candidates meet requirements of all units/qualifications.

Literacy, language, numeracy and ICT skills development

This qualification can develop skills that can be used in the following qualifications:

- Functional Skills (England) – see www.cityandguilds.com/functionalskills
- Essential Skills (Northern Ireland) – see www.cityandguilds.com/essentialskillsni
- Essential Skills Wales – see www.cityandguilds.com/esw

Appendix 2   Sources of general information

The following documents contain essential information for centres delivering City & Guilds qualifications. They should be referred to in conjunction with this handbook. To download the documents and to find other useful documents, go to the Centres and Training Providers homepage on www.cityandguilds.com.

Centre Manual - Supporting Customer Excellence contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification, as well as updates and good practice exemplars for City & Guilds assessment and policy issues.

Specifically, the document includes sections on:
- The centre and qualification approval process
- Assessment, internal quality assurance and examination roles at the centre
- Registration and certification of candidates
- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Management systems
- Maintaining records
- Assessment
- Internal quality assurance
- External quality assurance.

Our Quality Assurance Requirements encompasses all of the relevant requirements of key regulatory documents such as:

- SQA Awarding Body Criteria (2007)
- NVQ Code of Practice (2006)

and sets out the criteria that centres should adhere to pre and post centre and qualification approval.

Access to Assessment & Qualifications provides full details of the arrangements that may be made to facilitate access to assessments and qualifications for candidates who are eligible for adjustments in assessment.

The **centre homepage** section of the City & Guilds website also contains useful information on such things as:

- **Walled Garden**: how to register and certificate candidates on line
- **Events:** dates and information on the latest Centre events
- **Online assessment**: how to register for e-assessments.

Centre Guide – Delivering International Qualifications contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve 'approved centre' status, or to offer a particular qualification.

Specifically, the document includes sections on:
- The centre and qualification approval process and forms
- Assessment, verification and examination roles at the centre
- Registration and certification of candidates

- Non-compliance
- Complaints and appeals
- Equal opportunities
- Data protection
- Frequently asked questions.

Useful contacts

UK learners General qualification information	**E: learnersupport@cityandguilds.com**
International learners General qualification information	F: +44 (0)20 7294 2413 **E: intcg@cityandguilds.com**
Centres Exam entries, Certificates, Registrations/enrolment, Invoices, Missing or late exam materials, Nominal roll reports, Results	F: +44 (0)20 7294 2413 **E: centresupport@cityandguilds.com**
Single subject qualifications Exam entries, Results, Certification, Missing or late exam materials, Incorrect exam papers, Forms request (BB, results entry), Exam date and time change	F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) **E: singlesubjects@cityandguilds.com**
International awards Results, Entries, Enrolments, Invoices, Missing or late exam materials, Nominal roll reports	F: +44 (0)20 7294 2413 **E: intops@cityandguilds.com**
Walled Garden Re-issue of password or username, Technical problems, Entries, Results, e-assessment, Navigation, User/menu option, Problems	F: +44 (0)20 7294 2413 **E: walledgarden@cityandguilds.com**
Employer Employer solutions, Mapping, Accreditation, Development Skills, Consultancy	T: +44 (0)121 503 8993 **E: business@cityandguilds.com**
Publications Logbooks, Centre documents, Forms, Free literature	F: +44 (0)20 7294 2413

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About City & Guilds

As the UK's leading vocational education organisation, City & Guilds is leading the talent revolution by inspiring people to unlock their potential and develop their skills. We offer over 500 qualifications across 28 industries through 8500 centres worldwide and award around two million certificates every year. City & Guilds is recognised and respected by employers across the world as a sign of quality and exceptional training.

City & Guilds Group

The City & Guilds Group is a leader in global skills development. Our purpose is to help people and organisations to develop their skills for personal and economic growth. Made up of City & Guilds, City & Guilds Kineo, The Oxford Group and ILM, we work with education providers, businesses and governments in over 100 countries.

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