Digital Industries Apprenticeship: Occupational Brief

Software Tester

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Level 4 Software Tester Apprenticeship

Minimum Standards and Grading Criteria

This paper defines the minimum requirements for the knowledge, skills and behaviours defined in the standard, which are required for a pass. It also defines the criteria to be used for awarding the grade for merit or distinction. This paper should be read in conjunction with the Standard and Assessment Plan for the Level 4 Software Developer Apprenticeship

Overview of Grading

There are three sets of criteria on which the assessment and grading is made. The three criteria are

> The What: what the apprentice has shown they can do,

> The How: the way in which the work has been done

> The With Whom: The personal and interpersonal qualities the apprentice has brought to all their work relationships

Each of these three criteria has minimum (expected) requirements, which must be satisfied for a pass.

Each of these criteria has a number of dimensions which should be considered to determine if the apprentice is significantly above the minimum (expected) level of quality

The purpose of grading is to differentiate between those apprentices whose work is at the expected level of quality against the totality of the skills, knowledge and behaviours specified in the standard and those whose work is significantly above this expected level

> For a pass, each of the three sets of criteria must demonstrate at least the expected (minimum requirement) level of quality

> For a merit, the What has to be significantly above the level of quality and one of either the How or the With Whom has to be significantly above the level of quality expected

> For a distinction, each of the three sets of criteria must be significantly above the expected level of quality

The assessor takes a holistic judgement of whether or not their assessments demonstrate that the apprentice is "significantly above the expected level of quality" in each of these three areas and can then determine which grade should be awarded

The what – what the apprentice has shown they can do

Minimum Requirements

The following table shows what the minimum, expected requirements are for a pass on this criteria

Competency Standard	Minimum, expected, requirements for a pass

Implements software testing procedures on software applications (including desktop, web, mobile, embedded, mainframe) to ensure agreed errors and security issues are identified, recorded, prioritised and corrected before release	Apprentices should be competent in implementing a wide range of software testing procedures for their employer context to achieve the desired test outcomes (desktop, web, mobile apps, games, business solutions etc) to identify, prioritise and correct software defects before release.
	
	Apprentices should be familiar with the range of industry standard software test management and automation tools that are available and in particular those for their employer context.
	
	a. causes of defects
	b. role of software testing
	c. software testing processes, procedures, tools and techniques
	d. the collation and documentation of information relating to software testing activities
	e. the range of software testing activities commonly implemented
	f. test levels:
	     • component testing
	     • integration testing
	     • system testing
	g. acceptance testing

Reviews software requirements and specifications for software functionality and security, and defines comprehensive tests and conditions.	Apprentices need to be able to analyse software requirements so that they understand the intended purpose of software being developed. They need to be able to review and validate that each requirement can be tested for so that they can define tests and test conditions, identifying any requirement ambiguities ensuring that they are fixed early in the development life cycle. a. test analysis and design b. reviewing functional software requirement specification (SRS) documents c. requirements testing d. software tests, test conditions and exit criteria for each requirement e. testing for security

Designs simple test strategies for non-complex projects	Apprentices should be able to design simple test strategies. A Test strategy defines the *testing approach to be taken, and identifies the objectives of testing and how they will be achieved*. The test strategy is usually defined in a document as an early deliverable in software testing. a. the components of the test strategy, typically including: - testing scope - the testing process and the level of testing - test type and the testing approach - test environment setup - test data requirements - test management and automation tools - risk identification and analysis - release control
Analyses test requirements and designs and prepares a test plan.	Apprentices need to be able to interpret and understand test plans and be able to create a test plan from scratch.The test plan serves as the primary means of communication with members of the software testing project team, testers, peers, managers and other stakeholders. The test plan also helps to manage change during early phases of the project when, as we gather more information, we need to revise the plan a. requirements analysis b. test planning process c. creating a test plan d. the components of a test plan: - test scenarios/test objectives that will be validated. - test schedules - roles and responsibilities - deliverables - test environments - tools - defect management - risks and risk management - completion and exit criteria
Designs and builds test cases, test scripts, and test procedures, with expected results	Test cases are documented while the software development team builds the software system that help test the system once it is ready, Test cases focus on how to test each requirement in the software requirements specification and defines the expected results.

	a. functional and non functional testing
	b. creating detailed test cases and test scripts
	c. test conditions for test cases
	d. the expected results for each test case
Develops and collects representative and realistic test data	Preparing realistic test data is a core part of defining the test environment setup. Software testers should create their own test data additional to the existing standard production data. Test data should be defined as the ideal data set in terms of testing quality, cost and time. Test cases need input data for any kind of test that is to be implemented. Testers should check and update the test data before execution of any test case a. test data types b. test data preparation c. the testers responsibility in creating their own test data according to testing needs d. the role of common test data e. cost, quality and time constraint for preparing test data and running tests.
Conducts a range of different software testing types (including Unit Testing, Integration Testing, Functional and Non-Functional Testing, System Testing, Stress Testing, Performance Testing, Usability Testing, Acceptance Testing, Regression Testing and Exploratory Testing); interpreting and executing sets of moderately complex test scripts using agreed methods and standards.	Test execution includes the execution of test cases or test scripts, manually or in an automated way, the logging of test results, comparison of the expected and actual results, reporting the incidents and retesting the fixed bugs. Test execution follows the defined process of the test execution activities a. software testing techniques b. executing different types of test as defined in the testing plan c. assigning the test cases in each test suite to testers for execution d. defect and bug reporting e. reporting status, and dynamic planning and prioritisation f. report testing test cycle findings and status.
Accurately records the outcomes of test activities and maintains accurate test records and reports	In software testing there are two outcomes, a test pass or fail. If a test fails then the details need to be recorded and archived so that they can be reviewed quickly and accurately to analyse the error that caused the test to fail. If a test passes the test pass record becomes the evidence that the test was executed and passed. a. documenting testing activities and test outcomes b. recording test executions, test passes and test failures c. logging new defects into the defect tracking system d. user acceptance testing results should be recorded including the user interaction leading up to a test failure
Assesses test results against expected results and acceptance criteria and through traceability to requirements.	It is important to assess test results to identify any arising defects or bugs. There are a wide variety of causes of software defects (errors and bugs) which may cause software not to operate as intended. a. determining and reporting root causes for test failures

	b. compare actual results with expected results
	c. report discrepancies as incidents
Presents and communicates results effectively using appropriate communication styles and media.	Test monitoring provides visibility and progress about test activities. Test reporting is concerned with summarizing information about the nature of the software object under test and the whether test criteria are being met. a. monitoring test results and test progression b. present software test results c. communicate software test results to different stakeholders
Operates the organisation's software testing tools effectively and follows procedures and techniques correctl	Software testing tools can increase efficiency and reliability of software testing and speed up the process in order to more reliably meet deadlines. There are a wide range of open source and vendor software testing tools in the market. The tools are divided into different categories as follows: • Test management tools • Functional testing tools • Load testing tools • Bug tracking tools There are also a range of Automation Testing Tools a. the classification of the major types of software test tools b. an overview of the major functional testing tools and their application c. overview of test management and bug tracking tools d. how to perform automated testing e. benefits and risks of automated testing f. factors for choosing a particular tool
Complies with relevant legislation and internal/external standards related to software testing and software security	Apprentices should be aware of the standards and procedures to follow during software testing, as well as sector specific legislation and standards. Also they should be aware of code of ethics for accessing private and sensitive data. Software testing is defined in BS 7925-1 as the "process of exercising software to verify that it satisfies specified requirements and to detect errors". a. organisational standards for software testing b. sectoral standards and legislation legislation (e.g. insurance, food, health, automotive etc)) c. National and international standards for software testing: • the International Software Testing Standard - ISO/IEC/IEEE 29119 Software Testing

	• IEEE 829-2008, also known as the 829 Standard for Software and System Test Documentation • BS 7925-1 d. code of ethics for accessing private data
Advises and supports others on testing processes and procedures.	Apprentices should be able to inform and advise a wide range of stakeholders on software testing processes, procedures and outcomes a. Inform, advise and guide others on all aspects of software testing activities, including best practice

The What – what the apprentice has shown they can do

Criteria for a Merit or Distinction

The following table shows what the apprentices would need to demonstrate to be assessed as significantly above the expected level for what they have done

Dimensions	Description of what significantly above the expected level of quality looks like
Breadth – the range of tools and methods understand and applied	Understands and applies a wide range of tools and methods Accurately and appropriately applies and effectively implements the right tools and methods in a variety of different situations
Depth – the level to which these tools and methods are understood and applied	A sophisticated user - fully exploits the functionality/capability of the tools and methods Extensive and deep understanding of different tools and methods and how and why they can be applied in different contexts
Complexity – the extent and prevalence of inter-related and inter-dependant factors in the work and how well the apprentice has dealt with these	Deals confidently and capably with a high level of interrelated and interdependent factors in their work

The how: the way in which the work has been done

The following table shows what the minimum, expected requirements are for a pass on this criteria

Competency Standard	Minimum expected requirements for a pass
Apprentices can demonstrate the full range of skills, knowledge and behaviours required to fulfil their job role	Knows what skills, knowledge and behaviours are needed to do the job well Are aware of their own strengths in the job role, and any areas for improvement Appreciate who else is important, for them to do their job and fulfil the role effectively (e.g. colleagues, managers, other stakeholders) Are aware of potential risks in the job role (e.g. security, privacy, regulatory) Use personal attributes effectively in the role, e.g. entrepreneurship Understand how the job fits into the organisation as a whole
Apprentices can demonstrate how they contribute to the wider business objectives and show an understanding of the wider business environments	Understands the goals, vision and values of the organisation Aware of the commercial objectives of the tasks/ projects they are working on Understands the importance of meeting or exceeding customers' requirements and expectations Is in tune with the organisation's culture Aware of the position and contribution of the organisation in the economy Understands the key external factors that shape the way the organisation function, e.g. regulation Knows how the organisation can gain advantage in the industry, e.g. through innovation, technology, customer service etc.
Apprentices can demonstrate the ability to use both logical and creative thinking skills when undertaking work tasks, recognising and applying techniques from both.	Logical thinking: • Understands initial premise(s) and preconditions • Recognises the conclusion to be reached • Proceeds by rational steps • Evaluates information, judging its relevance and value • Supports conclusions, using reasoned arguments and evidence Creative thinking: • Explores ideas and possibilities • Makes connections between different aspects • Adapts ideas and approaches as conditions or circumstances change

Apprentices can show that they recognise problems inherent in, or emerging during, work tasks, and can tackle them effectively	Problem-solving:
	• Analyses situations
	• Defines goals
	• Develops solutions
	• Prioritises actions
	• Deals with unexpected occurrences

The How: the way in which the work has been done

Criteria for a Merit or Distinction

The following table shows what the apprentices would need to demonstrate to be assessed as significantly above the expected level for the way in which the work has been done

Dimensions	Description of what significantly above the expected level of quality looks like
Responsibility – the scope of responsibility and level of accountability demonstrated in the apprentices work	Undertakes work that is more complex, more critical or more difficult
	Works independently and takes high level of responsibility
Initiative	Independently demonstrates an ability to extend or enhance their approach to work and the quality of outcomes
	Doesn't just solve the problem but explores creative or innovative options to do it better, more efficiently, more elegantly or to better meet customer needs
Delivery focus – the extent to which the apprentice has shown they can grasp the problems, identify solutions and make them happen to meet client needs	Shows strong project management skills, in defining problem, identifying solutions and making them happen
	Demonstrates a disciplined approach to execution, harnessing resources effectively

Drives solutions – with a strong goal focused and
appropriate level of urgency

The with whom: the personal and interpersonal qualities the apprentice has brought to internal and external relationships

Minimum Requirements

The following table shows what the minimum, expected requirements are for a pass on this criteria

	Minimum expected requirements for a pass
Apprentices can manage relationships with work colleagues, including those in more senior roles, customers/clients and other stakeholders, internal or external and as appropriate to their roles, so as to gain their confidence, keep them involved and maintain their support for the task/project in hand Apprentices can establish and maintain productive working relationships, and can use a range of different techniques for doing so.	Managing relationships: - Understands the value and importance of good relationships - Influences others by listening to and incorporating their ideas and views - Acknowledges other people's accomplishments and strengths - Manages conflict constructively - Promotes teamwork by encouraging others to participate Customer/client relationships: - Understands their requirements, including constraints and limiting factors - Sets reasonable expectations - Involves them in decisions and actions - Interacts positively with them - Provides a complete answer in response to queries ('transparency', 'full disclosure') Stakeholders: - Understands who they are and what their 'stake' is - Prioritises stakeholders in terms of their importance, power to affect the task and interest in it - Uses stakeholders' views to shape projects early on - Gains support from stakeholders, e.g. to win resources - Agrees objectives
Apprentices can communicate effectively with a range of people at work, one-to-one and in groups, in different situations and using a variety of methods.	Intention/purpose: - Understands the purpose of communicating in a particular situation or circumstance (e.g. inform, instruct, suggest, discuss, negotiate etc.) - Checks that the person/people with whom one is communicating also understand the purpose

Apprentices can demonstrate various methods of communication, with an understanding of the strengths, weaknesses and limitations of these, the factors that may disrupt it, and the importance of checking other people's understanding.	• Is sensitive to the dynamics of the situation
	• Is aware of anything that might disrupt the effectiveness of the communication (e.g. status, past history)
	a. Method:
	  • Chooses a good, appropriate method for the situation
	  • Aware of the limitations of the chosen method, and the possible risks of miscommunication (e.g. ambiguity)
	  • Takes account of the affective dimensions of the method (e.g. body language, tone of voice, eye contact, facial expression etc.)
	b. Execution:
	  • Expresses self clearly and succinctly, but not over-simplifying
	  • Checks that the other person/people understand what is being expressed
	  • Takes account of the potential barriers to understanding (e.g. filtering, selective perception, information overload)
	  • Modifies the purpose and methods of communication during a situation in response to cues from the other person/people

The With Whom: the personal and interpersonal qualities the apprentice has brought to internal and external relationships

Criteria for Merit or Distinction

The following table shows what the apprentices would need to demonstrate to be assessed as significantly above the expected level for the personal and interpersonal qualities the apprentice has brought to internal and external relationships

Dimensions	Description of what significantly above the expected level of quality looks like
Scope and appropriateness – the range of internal and external people and situations that the apprentice has engaged appropriately and effectively with	Internally – works alone, 1:1, in a team and across the company with colleagues at all levels Externally – works with customers, suppliers and partners in a variety of situations Reads situations, adapts behaviours, and communicates appropriately for the situation and the audience

Reliability – the extent to which they perform and behave professionally	Can be trusted to deliver, perform and behave professionally, manages and delivers against expectations, proactively updates colleagues and behaves in line with the highest values and business ethics
A role model and exemplar to others	Actively inspires and leads others, takes others with them, leads by example

Annex: Software Developer: Knowledge and Understanding

Knowledge and Understanding is assessed on programme through Knowledge Modules and Vendor or Professional Qualifications

Knowledge Module 1: Testing Tools (for Level 4 Software Tester Apprenticeships)

The Knowledge Standards	Definition of the Minimum Requirements

Understands and can apply the basic concepts of software testing including testing types; test procedures; testing techniques; testing tools and testing terms	a) Understand the purpose and outputs of software testing activities
	b) Understand the principles of software testing
	c) Understand how to design software tests
	d) Understand the importance of using realistic data for testing
	e) Understand the range of software testing tools available and how to apply them
	f) Understand the importance of test planning to manage the various stages of test activities
	g) Understand the standards, policies and procedures for designing tests for software products/applications/modules etc.
	h) Understand the range of issues that may occur with testing software vs. requirements and how to address these
	i) how to access, create and modify different types of;
	   a. high level test scenarios
	   b. test cases
	   c. test scripts
	   d. test data
	   e. test plans
	j) Understand the different test methodologies and procedures used
	k) Understand the concepts of code coverage

Understands how to use and apply automated test tools	a) Understand how to check whether test cases are suitable to be automated b) Understand how to carry out automated test scripts and the importance of doing this correctly c) Understand the different types of test automation tools and their applicability to different test types d) Understand the different types of testing and associated test management tools and how to use these

	e) Understand the range of problems that may occur with automated testing and how to mitigate these
	f) Understand how to analyse and interpret automated test results
Understands the importance of accuracy and clear documentation of software tests	a) Understand how communicate the outcomes of testing activities in an effective manner
	b) Understand the range of data/information that may need to be provided including the sources
	c) Understand the need to operate accurately when conducting testing activities
Understands how to use bug tracking tools	d) Understand the difference between software testing and debugging
	e) Understand the role of bug tracking tools to keep track of reported bugs in software development projects
	f) Understand that bugs don't only exist in code, but that bugs can exist in requirements, design, or specifications.
	g) Understand the range of bug tracking tools and how to apply them

The following Vendor or Professional Certifications exempt apprentices from this knowledge module

ISTQB certified Tester Foundation Level

Knowledge Module 2: Testing Concepts (for Level 4 Software Tester Apprenticeships)

The Knowledge Standards	Definition of the Minimum Requirements
Understands and can communicate the differences between software testing and verification	a) Understand that verification is ensuring that software has been designed to meet the software specification and that testing is making sure that the software operates correctly at all times.
Understands industry standard software development paradigms and methods (including Object Oriented, procedural and agile) to conduct testing	a) Understand the different industry standard software development paradigms and languages in order to be able to test software developed using these
Understands that software should be `secure by design' and how to test for security requirements	a) Understand the importance of developing software to be 'secure by design'
	b) Understand that to produce software with increased security resilience adds to the complexity and that software testing has increased responsibilities
	c) Understand the practices used for secure software design and how to test for security during software testing
	d) Understand that the six basic security concepts that need to be covered by security testing are: confidentiality, integrity, authentication, availability, authorization and non-repudiation.

Understands the range and features of software test commonly used (Unit Testing, Integration Testing, Functional and Non-functional Testing, System Testing, Stress Testing, Performance Testing, Usability Testing, Acceptance Testing, Regression Testing, and Exploratory Testing)	a) Understand the different types of testing available and when and how to apply these (e.g. unit testing, integration testing, system testing, load testing, stress testing, performance testing, regression testing, security testing and user acceptance testing)different types of testing and associated test management tools and how to use these
Understands how to set up and configure testing packages	a) Understand how to set up a test environment and testing packages, including: • the components of the system as close as possible to the deployed state • setting aside separate regions on mainframe computers and/or servers, networks and PCs that can be dedicated to the test effort and that can be reset to restart testing as often as needed • ensure that the correct equipment and test data are available for performance or usability testing b) Understand the importance of having a clearly defined test strategy, which then needs to be reality checked as part of the test planning process c) Understand that the steps to set up the test environment are part of the testing plan and need to be completed before testing begins

Understands the role of software testing within the wider systems development life cycle	a) Understand that the process of software testing in a well-planned and systematic way is known as software testing lifecycle (STLC) and is a component part of the software development life cycle (SDLC).
	b) Understand that although different organisations may have different phases, that generic Software Test Life Cycle (STLC) consists of the following phases.
	   1. Requirements Analysis
	   2. Test Planning
	   3. Test Analysis
	   4. Test Design
	   5. Test Construction and Verification
	   6. Test Execution and Bug Reporting
	   7. Final Testing and Implementation
	   8. Post Implementation

Understands the need for conformance to specific standards where appropriate (including data protection, health informatics, safety critical, etc) related to software testing	a) Understand the importance of ensuring conformance to standards such as data protection especially in relation to testing any new IT systems using live customer data.

	b) Understand that there are an internationally agreed set of standards for software testing (such as those from ISO and IEEEE) that can be used within any software development life cycle or organisation, where to find these and how to apply them.

There are no Vendor or Professional certifications against this knowledge module

ISTQB Certified Tester Foundation Level

BCS Intermediate Certifficate