

Unit 74: Designing Tests for Computer Games

NQF Level 3: BTEC National

Guided learning hours: 60

Unit abstract

The games industry is a multi-million pound industry and is a competitive business. The success of each title is not only dependent on how 'good' the game is in terms of playability, its look and feel etc but also how well it performs on the platforms that it has been designed for.

There are a variety of bugs that can cause problems within a game. Learners who complete this unit will gain a clear understanding of the types of defects that can occur in a game together with an understanding of where these bugs will be found.

If a game is shipped to the consumer still containing major bugs or defects that hinder the players' enjoyment of the product then the reputations of not only the game or brand can be affected but so can the companies who developed and tested it. Many games rely on loyal fan bases and gaming communities who are quick to share and spread opinions as well as games cheats and short cuts, all of which can affect how profitable a game ultimately is. Games testing, therefore, is a crucial part of the games production process.

It seems hard to believe that people are actually paid to sit down and play games but, although it is sometimes fun, effective games testing is hard work. During the development phase games need to be constantly and methodically checked to ensure that any problematic bugs or defects are identified and documented in a concise and explanatory fashion. Once documented bugs are fixed by the developer then they are re-tested or verified by the tester. By the time the game goes on sale all major bugs should have been eliminated.

This unit aims to provide learners with the knowledge and skills to effectively design test cases and test suites ready for computer games testing. Learners will be taught some of the technical theory and testing methodologies that lie behind effective computer testing. This underlying theory needs to be understood before learners apply it to design and create test suites of their own.

Learning outcomes

On completion of this unit a learner should:

- 1 Understand what types of defects can be present within a game build
- 2 Understand the different test phases and processes within a test programme
- 3 Be able to design a test suite for use with a game build or module
- 4 Be able to produce a bug report using a test suite.

Unit content

1 Understand what types of defects can be present within a game build

Defect types: function; assignment; checking; timing; build package merge; algorithm; documentation

Defect triggers: Orthogonal Defect Classification (ODC); hardware configurations; software configurations; configuration trigger; start-up trigger; exception handling; exception trigger; stress trigger; normal trigger; restart trigger

Operating regions: game operation; pre-game; game start; in-game; post-game

2 Understand the different test phases and processes within a test programme

Test phases: preparation; alpha testing; internal beta testing; external beta testing; gold testing; end of certification testing; entry criteria; placeholder assets; regression

Processes: smoke testing; white box testing; black box testing; clean room testing; play testing; adhoc testing; player types; minor patch; major patch

Life cycle: plan and design test; prepare test; perform test; report test; re-test

3 Be able to design a test suite for use with a game build or module

What to test: game events; game settings; gameplay options; hardware configurations; character attributes; customisation choices

Combinatorial testing: parameters; pairwise; values; ranges; boundaries; combinatorial tables; combinatorial templates; combinatorial tools

Test flow diagrams: test flow diagram (TFD) elements; game flows; actions; events; states; primitives; terminators; design; paths; data dictionary definitions; templates; software used

4 Be able to produce a bug report using a test suite

Writing bug reports: clear communication; structure of reports; who it is for; headlines; full descriptions; illustrations; concise writing; instructional; steps to reproduce; associated materials; reproducible or not; severity

Documentation and artefacts: eg tracking decisions, reproducible paths, taping play/playtest videocapture, screenshots, storyboards, server logs, sound files, operating system error codes, log files; test case specification/scripts; test plans

Identifying bugs: test pass; test fail; blocked; not available; priorities; versions

Grading grid

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all of the learning outcomes for the unit. The criteria for a pass grade describes the level of achievement required to pass this unit.

Grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 describe the types of defects that can be present within a game build expressing ideas with sufficient clarity to communicate them and with some appropriate use of subject terminology	M1 explain the types of defects that can be present within a game build with reference to well chosen examples expressing ideas with clarity and with generally appropriate use of subject terminology	D1 fully explain the types of defects that can be present within a game build with supporting arguments and elucidated examples expressing ideas fluently and using subject terminology correctly
P2 describe the different test phases and processes within a test programme expressing ideas with sufficient clarity to communicate them and with some appropriate use of subject terminology	M2 explain the different test phases and processes within a test programme with reference to well chosen examples expressing ideas with clarity and with generally appropriate use of subject terminology	D2 fully explain the different test phases and processes within a test programme with supporting arguments and elucidated examples expressing ideas fluently and using subject terminology correctly
P3 design a test suite for use with a game build or module with some assistance	M3 design a test suite for use with a game build or module carefully and competently, with only occasional assistance	D3 design a test suite for use with a game build or module to a technical quality that reflects near-professional standards, working independently to professional expectations

continued

Grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P4 produce a bug report using a test suite, expressing ideas with sufficient clarity to communicate them and with some appropriate use of subject terminology.	M4 produce a detailed and illustrated bug report to a good technical standard using a test suite, expressing ideas with clarity and with generally appropriate use of subject terminology.	D4 produce a fully detailed and thoroughly illustrated bug report to a technical quality that reflects near-professional standards using a test suite, expressing ideas fluently and using subject terminology correctly.

Essential guidance for tutors

Delivery

This unit has been designed to provide learners with both the theoretical knowledge and practical application of designing test cases and test suites (sometimes known as test sheets) for computer games. In order that the unit remains relevant to the learners it is suggested that it is taught within the context of a broader games development or games design course where the knowledge can be applied to games that they are studying or already testing. The knowledge learned can be applied to either existing games or to games that are being produced as part of a broader base of study.

It is recommended that learners initially be provided with the technical knowledge needed to understand why and how defects and bugs occur within computer games. It is suggested that a combination of teaching techniques are used that include formal lectures, practical activities and discussion. As part of gaining this knowledge learners could be given practical experience of exploring basic hardware components of a computer or games console and, if possible, take apart and re-build hardware components. To aid contextualisation learners could also have hands-on experience of installing and uninstalling software. Looking at how games are produced and the games development process can aid learners' understanding of how bugs and defects can be introduced, as can an overview of job roles and teams within games development and testing companies.

A combination of formal teaching and personal investigative study can be used to develop understanding of the different test phases and processes within a test programme. To add authenticity and industry relevance to this learning outcome, learners should be encouraged to gain some of this knowledge first hand from games companies and practitioners. This can be achieved through visits to games development companies, bringing in visiting speakers and project-based research.

In order that learners can fully appreciate what needs to be considered when writing tests for computer games, it is important for them to understand what elements need to be tested and are included for testing. This can be achieved through a combination of formal teaching techniques and exploratory computer game play. Again, this learning can be based upon already published titles or work that has been produced as part of a broader base of study. Learners can then apply their understanding to designing test cases and suites.

It is important that learners have some experience of designing computer tests using both combinatorial tables and test flow diagrams. Although specialist software can be used to help design tests for use with computer games it is important that learners understand the underlying methods that are used. It is recommended, therefore, that such techniques as producing combinatorial tables and test flow diagrams are taught as practically as possible without (at least to begin with) the use of the specialist software.

When designing tests learners also need to be aware of the kinds of parameters that can be covered within a test together with the possible values. Both combinatorial tables and test flow diagrams can become very complex and it is suggested that learners initially use a simple yet thorough approach so as to understand the concepts as well as the techniques.

Learners can also use the test sheets designed to produce a series of detailed bug reports to help evaluate how good the test design is. To replicate the environment of a test department, learners could be encouraged to swap test sheets and use each other's tests for the basis of their bug reports.

It is important that learners understand the importance of concise and grammatically correct writing when producing reports. This can be done through the key skills learning. Learners can also be taught how to illustrate their findings by using such techniques as capturing screenshots and incorporating them into storyboards with written explanations.

Assessment

Evidence for assessment

For assessment of achievement of learning outcome 1 the learner can present any new-found or researched information. This could be done via a presentation, report or blog that explains the types of defects that can be found in a game, where they can be found and what causes them to occur in a game build. Research may include extracts from books, trade magazines, internet articles or from practitioners working within the field. Found knowledge can be expanded upon and illustrated by using primary resources such as screen grabs and photographs. Learners understanding of technical knowledge and terminology should be included.

Evidence for learning outcome 2 can also take the form of a report or presentation. Again learners may include research that includes extracts from books, magazines and the internet but this learning outcome also provides the ideal opportunity for them to approach games testing companies directly to understand what is current industry practice.

Presentations must be recorded for the purposes of internal and external verification.

For learning outcome 3 learners must produce documentation that shows their effective planning and understanding of designing tests for computer games. Background documentation that demonstrates an understanding of underpinning knowledge should be produced together with final, well-produced word processed and professional test sheets. The documents can be presented in either hard or soft copy.

Evidence for achievement for learning outcome 4 should be in the form of professionally produced bug reports based on the tests that have been designed. These reports should be presented either electronically or as hard copy. Illustrations demonstrating bugs or defects that are found can be included by using such methods screen grabs, audio files, storyboards etc. Learners should be encouraged to make accompanying notes that describe what they were doing during game play at each stage of the test.

For some elements of these units, and for some learners, a formal *viva voce* assessment might be appropriate. When more than one learner in a cohort is assessed in this way care must be taken to ensure that all learners are asked equivalent questions, and that all are given equal opportunities to expand or clarify their answers. Interviewers must also ensure that questions are not phrased in such a way as to provide or suggest an answer. Formal *vivas* should be recorded for the purposes of internal and external verification and at least 50 per cent of such assessments must be internally verified.

Application of grading criteria

When applying the grading criteria, tutors should follow the advice given below. Please note that any examples of evidence given here are indicative only. This advice is not exhaustive and the examples need not specifically be included in a learner's work in order for that learner to achieve the exemplified grade.

Pass

P1: learners will be able to name the types of bugs and defects that can be found within a game build. They will be able to name the operating regions within a game and name some of the defect triggers that can span the game operating regions. Descriptions will be correct and although they may know the names of the bugs and defects that can be found they may not necessarily describe exactly what causes them and why they materialise. A pass level learner might write when discussing a defect, 'Defects are bad in games because they make the game go wrong when you are playing it. A type of defect that you can find when testing games is a Documentation type defect.'

P2: learners will be able to name the different stages of a test programme in the correct order. They will be able to describe what happens within each of the phases. To achieve a pass learners will be able to describe different testing processes that are used within the industry and describe the typical life cycle of a games test. A pass level learner might write when describing the stages of a test programme, 'There are different stages when testing games. Some of these stages are called smoke testing, alpha testing and beta testing'.

P3: learners will have produced designs for a games test using both combinatorial tables and test flow diagrams. The tests designed will be of a basic nature and will have considered at least one parameter or element of a game tested against two values. The learner achieving a pass may have needed guidance on what exactly should be tested when designing the tests.

P4: learners will be able to produce a bug report that describes any problems found in basic terms. The bug reports will be structured and include sections such as headings, descriptions of what defect or bug they have discovered and what they were doing in the game when the defect was noted. The bug report will be illustrated by using at least one technique such as a screen grab.

P1, P2 and P4: when expressing themselves orally, learners' language skills will be sound and they will be able to express themselves with sufficient clarity to be understood, though vocabulary – and in particular technical vocabulary – will be limited, and register will not always be appropriate to the situation or audience. When expressing themselves formally in writing, learners' skills will be basic, typically with frequent errors of spelling and punctuation and occasional lapses in grammar and syntax. Generally, language skills will be adequate for learners to communicate simple ideas or deal with straightforward material.

Merit

To achieve a merit grade, in addition to achieving all the criteria at pass level, learners must achieve all the criteria at merit level.

M1: learners will be able to correctly name the types of bugs and defects that can be found within a game build and be able to identify them and explain what they are and how they may have been introduced. They will be able to describe what the different operating regions within a game are, giving examples of what happens in each region. They will be able to describe the range of defect triggers and be able to illustrate them with examples from games they have seen. A merit level learner might write when discussing a defect, 'Defects are introduced into games often because of an error in the code that has been produced. There are various types of defects that can be found when testing games. One defect is known as a documentation type defect and this type of defect occurs in such content as text audio and graphics.'

M2: learners will be able to name the different stages of a test programme, explaining what happens within each test phase. They will be able to describe what types of activity happen at each phase and say why they are important. They will be able to describe the purpose of each phase and be able to identify the kinds of criteria that indicate when each phase is seen to be completed. Learners at a merit level should produce some evidence of primary research that could be gathered from industry. They will be able to describe the different testing processes and explain why different processes may be used. A merit level learner might write when describing the different stages of a test programme, 'In order that a game is tested effectively there are different stages within the test programme. The test programme can typically begin with a preparation phase for the testers where they can become familiar with both the game that they are about to test and the hardware. Testers can use different methods to test games. One method is called black box testing where testers can test games by playing the game using the normal input devices as a player.'

M3: learners will be able to create comprehensive games tests using both combinatorial and test flow diagrams. They will be able to identify what parameters and values can be tested with little guidance.

M4: learners will be able to produce a comprehensive bug report that is well structured and includes most of the necessary sections and criteria. Brief descriptions will clearly identify the defects found. Any bugs or defects that have been found will be, on the whole, concisely described. When and where bugs were identified will be clearly described with a variety of illustrations. Full descriptions will be written in such a way that any instructions to re-create a bug can be understood with little difficulty. At least two techniques for documenting or illustrating the bugs found will be incorporated.

M1, M2 and M4: when expressing themselves orally, learners' language skills will be good and they will be able to express intentions and ideas clearly using, for the most part, the right word in the right context, including technical vocabulary and the kind of language used in the industry. Register will be generally appropriate, with perhaps occasional lapses. When expressing themselves formally in writing, learners' skills will be sound with typically few lapses in grammar and syntax, though there might be some errors of spelling and punctuation. Generally, language skills will be good enough for learners to be able to express fairly complex ideas and to handle material of moderate difficulty.

Distinction

To achieve a distinction grade, in addition to achieving all the criteria at pass and merit level, learners must achieve all the criteria at distinction level.

D1: learners will be able to name and comprehensively describe the types of bugs or defects that can be found within a game build showing a confident understanding of what these bugs are and how they could have been introduced. They will show a comprehensive understanding of the different operating regions within a game giving a full description of what happens in each region. Learners will explain each defect trigger using technical terminology giving examples of how these may manifest themselves when playing a game. A distinction learner might say, 'As a result of badly written or missing code, computer games may not function properly for the player. There are different types of defects that may occur within a game build and these can be described in different ways. One defect is a documentation type defect and these can occur in text assets such as instructions or dialogue, audio assets such as sound effects and background music and graphics assets such as items of clothing or weapons'.

D2: learners will comprehensively describe each phase within a test programme explaining why each stage is important. They will describe what the purpose of each stage is. They will be able to describe comprehensively what types of activity happen at each phase and say why they are important, often using highly technical language. They will be able to identify the relationship that each phase has to the others and understand which criteria are used to understand how and when test phases are complete. A distinction level learner, when describing test processes, will be able to describe each process in detail and also suggest why certain processes may be used for different types of testing. A large part of their research will come from primary resources such as games testing companies and practitioners. A learner at this level might say, 'It is important that when testing games, companies have a thorough plan of what and when to test so that most of the bugs that may occur in the build are eliminated. Testing a computer game is made up of a testing cycle that occurs within different phases of a test programme. These phases can differ from company to company but they may typically start with test preparation phase and finish at a gold testing phase. Depending on what is being tested in a game build and why, games testers can use different methods to test games. Black box testing is used to test a game using the normal input devices such as keyboards and joysticks and is useful as it tests the game in the same way a user would play it.'

D3: learners will be able to design near industry-standard games tests using both combinatorial and test flow diagrams. Learners will be able to identify the parameters and values within a game without guidance.

D4: learners will produce professionally-presented bug reports which use language, including technical terminology, in a concise manner. All the elements that would be found in a bug report will be present and the bugs reported will be communicated very clearly and effectively. Brief descriptions will explain each defect very clearly and will be followed by full descriptions that will allow any user that reads the report to recreate the bug without any difficulty. Techniques that are used to illustrate bugs found will be relevant and informative.

D1, D2 and D4: when expressing themselves orally, learners will speak with fluency, using a wide vocabulary and deploying both general and technical language with accuracy and confidence. Register will always be appropriate. When expressing themselves formally in writing, learners' skills will be good with typically quite complex sentence structures, very few grammatical errors and infrequent errors in spelling and punctuation. Generally, language skills will enable learners to express complex ideas and to handle difficult material.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit links with *Unit 68: Computer Game Engines*, *Unit 70: Computer Game Design*, *Unit 71: Sound for Computer Games* and *Unit 73: Human-Computer Interfaces*.

There are opportunities to relate the work done for this unit to Skillset National Occupational Standards in Interactive Media as follows:

- IM12 Devise user testing of interactive media products
- IM13 Conduct user testing of interactive media products
- IM14 Evaluate user testing of interactive media products.

Essential resources

Learners will need access to:

- a range of computer games including PC games, console games and multiplayer online games
- hardware such as PC's, consoles, keyboards, joysticks and joypads
- screen grab software (such as Snagit).

Indicative reading for learners

Books

Hind C – *Games Testing* (Wordware Publishing Inc, 2004)

Shultz C P, Bryant R and Langdell T – *Games Testing All In One* (Thomson Course Technology, 2005)

Websites

www.gamestester.com	resource about games testing
www.secondlife.com	free multiplayer online games resource
www.sloperama.com/advice.html	resource for advice on the games industry
www.there.com	free virtual community

Key skills

Achievement of key skills is not a requirement of this qualification but it is encouraged. Suggestions of opportunities for the generation of Level 3 key skill evidence are given here. Tutors should check that learners have produced all the evidence required by part B of the key skills specifications when assessing this evidence. Learners may need to develop additional evidence elsewhere to fully meet the requirements of the key skills specifications.

Communication Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> • contributing towards group presentations and discussions with regards to the nature of games industry • presenting research about such topics as the production process and the development of games • preparing their research on such subjects as the types of bugs found in games or the testing process • preparing a report on: <ol style="list-style-type: none"> a) the types of bugs that can be found in a game build b) the different test phases within a test programme together with the techniques. 	<p>C3.1a Take part in a group discussion.</p> <p>C3.1b Make a formal presentation of at least eight minutes using an image or other support material.</p> <p>C3.2 Read and synthesise information from at least two documents about the same subject. Each document must be a minimum of 1000 words long.</p> <p>C3.3 Write two different types of documents, each one giving different information about complex subjects. One document must be at least 1000 words long.</p>

Information and communication technology Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> • using the internet to research about the games industry or testing processes • illustrating bug reports by using a combination of text and images. 	<p>ICT3.1 Search for information, using different sources, and multiple search criteria in at least one case.</p> <p>ICT3.3 Present combined information such as text with image, text with number, image with number.</p>
Improving own learning and performance Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> • planning and writing the games tests for specific games • reviewing the effectiveness of the tests that have been written and identifying ways in which they could be improved. 	<p>LP3.1 Set targets using information from appropriate people and plan how these will be met.</p> <p>LP3.3 Review progress and establish evidence of their achievements.</p>
Problem solving Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> • identifying elements within a game that could be tested • planning and writing games tests • performing a games test and reviewing its effectiveness. 	<p>PS3.1 Explore a problem and identify different ways of tackling it.</p> <p>PS3.2 Plan and implement at least one way of solving the problem.</p> <p>PS3.3 Check if the problem has been solved and review their approach to problem solving.</p>

Working with others Level 3	
When learners are:	They should be able to develop the following key skills evidence:
<ul style="list-style-type: none"> • working in small groups to design and write games tests • producing planning documents and test schedules • producing group evaluations of how a specific test may have gone. 	<p>W03.1 Plan work with others.</p> <p>W03.2 Seek to develop co-operation and check progress towards their agreed objectives.</p> <p>W03.3 Review work with others and agree ways of improving collaborative work in future.</p>