**BTEC HND Computing Level 5 Module Specifications**

# Unit 13: Computing Research Project

**Unit code T/615/1639**

**Unit type Core**

**Unit level 5**

**Credit value 30**

**Introduction**

This unit is assessed by a Pearson-set assignment. Students will choose their own project based on a theme provided by Pearson (this will change annually). The project must be related to their specialist pathway of study (unless the student is studying the general computing pathway). This will enable students to explore and examine a relevant and current topical aspect of computing in the context of a business environment and their chosen specialist pathway.

The aim of this unit is to offer students the opportunity to engage in sustained research in a specific field of study. The unit enables students to demonstrate the capacity and ability to identify a research theme, to develop research aims, objectives and outcomes, and to present the outcomes of such research in both written and verbal formats. The unit also encourages students to reflect on their engagement in the research process during which recommendations for future, personal development are key learning points.

On successful completion of this unit students will have the confidence to engage in problem-solving and research activities which are part of the function of a manager. Students will have the fundamental knowledge and skills to enable them to investigate workplace issues and problems, determine appropriate solutions and present evidence to various stakeholders in an acceptable and understandable format.

As a result they will develop skills such as communication literacy, critical thinking, analysis, synthesis, reasoning and interpretation which are crucial for gaining employment and developing academic competence.

**Learning Outcomes**

By the end of this unit students will be able to:

LO1 Examine appropriate research methodologies and approaches as part of the research process.

LO2 Conduct and analyse research relevant to a computing research project. LO3 Communicate the outcomes of a research project to identified stakeholders. LO4 Reflect on the application of research methodologies and concepts.

**Essential Content**

### LO1 Examine appropriate research methodologies and approaches as part of the research process

*Developing a research proposition:*

The importance of developing methodical and valid propositions as the foundation for a research project.

Rationale: the purpose and significance for research question or hypothesis.

The value of the philosophical position of the researcher and the chosen methods.

Use of Saunders's research onion as a guide to establishing a methodological approach.

*Literature review:*

Conceptualisation of the research problem or hypothesis.

The importance of positioning a research project in context of existing knowledge.

Significance and means of providing benchmarks by which data can be judged.

*Qualitative, quantitative and mixed method research:*

Key theoretical frameworks for research.

Advantages and limitations of qualitative and quantitative research approaches and methods.

### LO2 Conduct and analyse research relevant for a business research project

*Research as a process:*

Research has distinct phases which support a coherent and logical argument. This includes using secondary research to inform a primary, empirical, study.

*Selecting a sample:*

The importance of gathering data and information (qualitative or quantitative) to support research analysis.

Selecting sample types and sizes that are relevant to the research.

Considering sampling approaches and techniques, including probability and non- probability sampling.

*Ethics, reliability and validity:*

Research should be conducted ethically. How is this achieved and reported?

Research should also be reliable (similar results would be achieved from a similar sample) and valid (the research measures what it aimed to measure).

*Analysing data:*

Using data collection tools such as interviews and questionnaires. Using analytical techniques such as trend analysis, coding or typologies.

### LO3 Communicate the outcomes of a research project to identified stakeholders

*Stakeholders:*

Who are they?

Why would they be interested in the research outcomes? What communication method do they expect?

*Communicating research outcomes:*

Consideration of different methods of communicating outcomes (e.g. written word, spoken word) and the medium (e.g. report, online, presentation). The method and medium will be influenced by the research and its intended audience.

*Convincing arguments:*

No matter what the method/medium, all research should be convincing and presented logically where the assumption is that the audience has little or no knowledge of the research process.

The importance of developing evaluative conclusions.

### LO4 Reflect on the application of research methodologies and concepts

*Reflection for learning and practice:*

Difference between reflecting on performance and evaluating a research project. The former considers the research process; the latter considers the quality of the research argument and use of evidence.

Reflection on the merits, limitations and potential pitfalls of the chosen methods.

*The cycle of reflection:*

To include reflection in action and reflection on action.

Considering how to use reflection to inform future behaviour and future considerations.

*Reflective writing:*

Avoiding generalisation and focusing on personal development and the research journey in a critical and objective way.

**Learning Outcomes and Assessment Criteria**

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| **Pass** | **Merit** | **Distinction** |
| **LO1** Examine appropriate research methodologies and approaches as part of the research process |  |
| **P1** Produce a research proposal that clearly defines a research question or hypothesis supported by a literature review.**P2** Examine appropriate research methods and approaches to primary and secondary research. | **M1** Evaluate different research approaches and methodology and make justifications for the choice of methods selected based on philosophical/theoretical frameworks. | **LO1 & LO2****D1** Critically evaluate research methodologies and processes in application to a computing research project to justify chosen research methods and analysis. |
| **LO2** Conduct and analyse research relevant for a business research project |  |
| **P3** Conduct primary and secondary research using appropriate methods for a computing research project that consider costs, access and ethical issues. | **M2** Discuss merits, limitations and pitfalls of approaches to data collection and analysis. |  |
| **P4** Apply appropriate analytical tools, analyse research findings and data. |  |  |

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| **Pass** | **Merit** | **Distinction** |
| **LO3** Communicate the outcomes of a research project to identified stakeholders | **D2** Communicate critical analysis of the outcomes and make valid, justified recommendations. |
| **P5** Communicate research outcomes in an appropriate manner for the intended audience. | **M3** Communicate outcomes to the intended audience demonstrating how outcomes meet set research objectives. |
| **LO4** Reflect on the application of research methodologies and concepts | **D3** Demonstrate reflection and engagement in the resource process leading to recommended actions for future improvement. |
| **P6** Reflect on the effectiveness of research methods applied for meeting objectives of the computing research project.**P7** Consider alternative research methodologies and lessons learnt in view of the outcomes. | **M4** Analyse results in recommended actions for improvements and future research considerations. |

**Recommended Resources**

### Textbooks

Cornford, T. (2005) *Project Research in Information Systems*: *A Student's Guide*. Paperback. Macmillan.

Costley, C., Elliot, G. and Gibbs, P. (2010) *Doing Work Based Research: Approaches to Enquiry for Insider-researchers*. London: SAGE.

Fink, A. (2009) *Conducting Research Literature Reviews: From the Internet to Paper*. 3rd Ed. Sage Inc.

Flick, U. (2011) *Introducing Research Methodology: A Beginner’s Guide to Doing a Research Project*. London: SAGE.

Gray, D. (2009) *Doing Research in the Real World*. 2nd Ed. London: SAGE.

Saunders, M, Lewis, P and Thornhill, A. (2012) *Research methods for Business Students*. 6th Ed. Harlow: Pearson.

Wellington, J. (2000) *Educational Research: Contemporary Issues and Practical Approaches*. Continuum International Publishing Group Ltd.

### Journals

*International Journal of Quantitative and Qualitative Research Qualitative Research Journal*

### Links

This unit links to the following related units:

*Unit 3: Professional Practice*

*Unit 6: Managing a Successful Computing Project Unit 9: Software Development Lifecycles*

# Unit 14: Business Intelligence

**Unit code M/615/1641**

**Unit type Core**

**Unit level 5**

**Credit value 15**

**Introduction**

Data and information is core to any organisation and business process. The necessity of having meaningful information is the key driver for effective decision-making and problem-solving. Business intelligence has evolved from technologies such as decision support systems (DSS) to include tools and methods associated with data mining, data integration, data quality and data warehousing in conjunction with other information management systems and applications.

This unit introduces students to a range of tools, techniques and technologies for acquiring data and processing this into meaningful information that can be used to support business functions and processes.

Within this unit students will examine the concept of business processing in terms of data capture, conversion and information output. Students will also be required to define the tools and technologies associated with business intelligence functionality. The use of a business intelligence tool/s and techniques is also required to demonstrate an understanding of a given problem. Finally, students will be expected to evaluate the impact of business intelligence for effective decision-making.

On successful completion of this unit students will be able to appreciate the importance of business intelligence in terms of optimising decision-making and performance. By exploring the tools, techniques and systems that support business intelligence students will have an awareness of the role and contribution that these technologies and methodologies have and their importance to organisations.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

**Learning Outcomes**

By the end of this unit students will be able to:

LO1 Discuss business processes and the mechanisms used to support business decision-making.

LO2 Compare the tools and technologies associated with business intelligence functionality.

LO3 Demonstrate the use of business intelligence tools and technologies.

LO4 Discuss the impact of business intelligence tools and technologies for effective decision-making purposes and the legal/regulatory context in which they are used.

**Essential Content**

### LO1 Discuss business processes and the mechanisms used to support business decision-making

*Business process model:*

Data input and capture, data processing/conversion and information output, security considerations; unstructured and semi-structured data.

Tactical and operational decisions, the business process model, business intelligence functionality.

Analyse and compare the systems and technologies associated with business intelligence.

*Mechanisms:*

Application software, databases, which are used to collect and store intelligence.

Systems that are used to manage, analyse and display business intelligence to support the decision-making process; the importance of reliable data; impacts of reliable data in businesses.

*Business processes:*

Management e.g. supporting decision-making, problem-solving; operational e.g. sales, purchasing and marketing; support e.g. accounting, technical supporting processes; improving the efficiency of a business process e.g. forecasting, decision-making, predictive reasoning; automating processes e.g. print runs, salary slips etc.

### LO2 Compare the tools and technologies associated with business intelligence functionality

*Support for business decisions:*

Operational tactical and strategic. Operational examples could include product positioning or pricing. Tactical decisions could include financial outlays to gain competitive advantage. Strategic business decisions could include priorities, goals setting and forecasting for the future, global diversification etc.

*Business intelligence functionality:*

Analysing data, decision-making, problem-solving, designing more intuitive/innovative systems.

*Systems and technologies:*

Information systems at an operational, tactical and strategic level. Transaction processing, management information systems, decision support systems, expert systems.

### LO3 Demonstrate the use of business intelligence tools and technologies

*Tools and techniques:*

Descriptive and predictive analysis, predictive modelling e.g. forecasting, use of statistical models to predict and identify trends. Data mining techniques to find anomalies, cluster patterns and/or relationships between data sets. Converting data into visual information using charts, graphs, histograms and other visual mediums.

*Solutions:*

Supporting a business process e.g. end user requirements, systems requirement, application to automate procedures. Designing a tool, program or package that can perform a specific task to support problem-solving or decision-making at an advanced level.

*Uses:*

For example, designing an application to solve a specific user need or system requirement. Create an e-commerce function for a website to support a specific business process, design a program for a specific end user that will support another application or process.

*Design considerations:*

Addressing a user or system requirement; designing a user-friendly and functional interface; considering user engagement and interaction with the designed solution; customisation of the solution to satisfy the user and system requirements.

### LO4 Discuss the impact of business intelligence tools and technologies for effective decision-making purposes and the legal/regulatory context in which they are used

Recognise the legal, social, ethical and professional issues involved in the exploitation of computer technology.

*Cybersecurity management:*

Understanding the personal, organisational and legal/regulatory context in which these tools could be used, the risks of such use and the constraints (such as time, finance and people) that may affect how cybersecurity is implemented.

*Evaluation criteria:*

Enhanced or improved operations e.g. more efficient, faster results, more user- friendly, higher productivity, extended target audience, more competitive, more profitable, improved customer service.

**Learning Outcomes and Assessment Criteria**

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| **Pass** | **Merit** | **Distinction** |
| **LO1** Discuss business processes and the mechanisms used to support business decision-making | **D1** Evaluate the benefits and drawbacks of using application software as a mechanism for business processing. |
| **P1** Examine, using examples, the terms ‘Business Process’ and ‘Supporting Processes’. | **M1** Differentiate between unstructured and semi- structured data within an organisation. |
| **LO2** Compare the tools and technologies associated with business intelligence functionality | **D2** Compare and contrast a range of information systems and technologies that can be used to support organisations at operational, tactical and strategic levels. |
| **P2** Compare the types of support available for business decision-making at varying levels within an organisation. | **M2** Justify, with specific examples, the key features of business intelligence functionality. |

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| **Pass** | **Merit** | **Distinction** |
| **LO3** Demonstrate the use of business intelligence tools and technologies |  |
| **P3** Determine, with examples, what business intelligence is and the tools and techniques associated with it.**P4** Design a business intelligence tool, application or interface that can perform a | **M3** Customise the design to ensure that it is user- friendly and has a functional interface. | **D3** Provide a critical review of the design in terms of how it meets a specific user or business requirement and identify what customisation has been integrated into the design. |
| specific task to support problem-solving or decision-making at an advanced level. |  |  |
| **LO4** Discuss the impact of business intelligence tools and technologies for effective decision-making purposes and the legal/regulatory context in which they are used |  |
| **P5** Discuss how business intelligence tools can contribute to effective decision-making.**P6** Explore the legal issues involved in the secure exploitation of business intelligence tools. | **M4** Conduct research to identify specific examples of organisations that have used business intelligence tools to enhance or improve operations. | **D4** Evaluate how organisations could use business intelligence to extend their target audience and make them more competitive within the market, taking security legislation into consideration. |

**Recommended Resources**

### Textbooks

Boyer, J. (2010) *Business Intelligence Strategy*. MC Press (US).

Jeston, J. and Nelis, J. (2014) *Business Process Management*. 3rd Ed. Routledge.

Kolb, J. (2013) *Business Intelligence in Plain Language: A practical guide to Data Mining and Business Analytics*. CreateSpace Independent Publishing Platform.

Marr, B. (2015) Big Data: *Using Smart Big Data, Analytics and Metrics to Make Better Decisions and Improve Performance*. 1st Ed. John Wiley & Sons, Ltd.

### Journals

*International Journal of Business Intelligence and Data Mining International Journal of Business Intelligence Research (IJBIR)*

### Websites

businessintelligence.com Business Intelligence (General Reference) business-intelligence.ac.uk Business Intelligence Project for HE

(General Reference)

### Links

This unit links to the following related units: *Unit 6: Managing a Successful Computing Project Unit 12: Data Analytics*

*Unit 22: Applied Analytical Models Unit 33: Analytical Methods*

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# Unit 20: Advanced Programming

**Unit code Y/615/1651**

**Unit level 5**

**Credit value 15**

**Introduction**

Features of programming languages that are considered advanced are used to develop software that is efficient; it can affect the performance of an application as well as the readability and extensibility of the code, improving productivity and therefore reducing cost. Many commercial applications available today, whether for productivity or entertainment, will have used one or more design pattern in their development. A design pattern is a description of how to solve a problem that can be used in many different situations and can help deepen the understanding of object- orientated programming and help improve software design and reusability.

The aim of this unit is to familiarise students with these features and their best practices to ensure that their code is in line with industry standards.

Among the topics included in this unit are: object-orientated programming; polymorphism, encapsulation, class aggregation/association, constructors/destructors, inheritance, abstract classes, interfaces, containers, generics, introduction to design patterns and Unified Modelling Language (UML).

On successful completion of this unit students will be able to write code in an object- orientated fashion using design patterns where necessary and be able to model their code structure in UML class diagrams. As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

### Learning Outcomes

By the end of this unit students will be able to:

LO1. Examine the key components related to the object-orientated programming paradigm, analysing design pattern types.

LO2. Design a series of UML class diagrams. LO3. Implement code applying design patterns.

LO4 Investigate scenarios with respect to design patterns.

**Essential Content**

### LO1 Examine the key components related to the object-orientated programming paradigm, analysing design pattern types

*Outline the object-orientated paradigm characteristics:*

Encapsulation, polymorphism, constructors/destructors, sub objects, abstract/concrete, interface, method redefinition, generics/templates, containers.

*Object-orientated class relationships:*

Generalisation/inheritance, realisation, dependency, aggregation, composition.

*Design patterns:*

Creational, structural and behavioural.

### LO2 Design a series of UML class diagrams

*UML class design:*

Analyse a code scenario and utilise a suitable UML tool to develop class diagrams.

### LO3 Implement code applying design patterns

*Implementation:*

Using an appropriate language & IDE to develop code that implements design patterns and utilises techniques to produce secure code.

### LO4 Investigate scenarios with respect to design patterns

*Review the usage of design patterns:*

Relating design patterns to a range of given scenarios

**Learning Outcomes and Assessment Criteria**

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| **Pass** | **Merit** | **Distinction** |
| **LO1** Examine the key components related to the object- orientated programming paradigm, analysing design pattern types | **D1** Analyse the relationship between the object-orientated paradigm and design patterns. |
| **P1** Examine the characteristics of the object-orientated paradigm as well as the various class relationships. | **M1** Determine a design pattern from each of the creational, structural and behavioural pattern types. |
| **LO2** Design a series of UML class diagrams | **D2** Analyse how class diagrams can be derived from a given code scenario using a UML tool. |
| **P2** Design and build class diagrams using a UML tool. | **M2** Define class diagrams for specific design patterns using a UML tool. |
| **LO3** Implement code applying design patterns | **D3** Evaluate the use of design patterns for the given purpose specified in M3. |
| **P3** Build an application derived from UML class diagrams. | **M3** Develop code that implements a design pattern for a given purpose. |
| **LO4** Investigate scenarios with respect to design patterns | **D4** Critically evaluate a range of design patterns against the range of given scenarios with justification of your choices. |
| **P4** Discuss a range of design patterns with relevant examples of creational, structural and behavioural pattern types. | **M4** Reconcile the most appropriate design pattern from a range with a series of given scenarios. |

**Recommended Resources**

### Textbooks

Freeman, E. et al. (2008) *Head First Design Patterns*. 4th Ed. United Stated of America: O’Reilly Media.

Gamma, E. et al. (1995) *Design Patterns: Elements of Reusable Object-Oriented Software.*

1st Ed. New Jersey: Addison-Wesley.

Mclaughlin, B.D. et al. (2007). *Head First Object-Oriented Analysis and Design*. 1st Ed. United States of America: O’Reilly Media.

### Links

This unit links to the following related units:

*Unit 1: Programming*

*Unit 19: Data Structures & Algorithms Unit 28: Prototyping*

*Unit 41: Analytic Architecture Design*

# Unit 29: Application Program Interfaces

**Unit code M/615/1669**

**Unit level 5**

**Credit value 15**

**Introduction**

Many applications in use today are a composite of other software. This is true of an application, be it web based, mobile or on a desktop where the functionality of another is used to build upon. Think of an application that locates nearby restaurants

– this may utilise an already existing map service as its basis. Or a game application that enables players to invite other players, chat and post high scores to social media all within the game environment. How an application interacts with another is through an Application Program Interface (API).

Typically, APIs consist of methods and tools which are developed by the software author and can provide services and functionality to other application developers without having to ‘reinvent the wheel’. Existing APIs provide a huge range of functionality which can be integrated into an application by following the rules of the relevant API. One of the benefits in using APIs is access to existing and proven services that can help speed up development and help standardisation.

The aim of this unit is to introduce students to the nature of APIs by developing proof- of-concept application that utilises existing APIs for common tasks that can include communication, displaying interactive visuals, audio playback and handling a range of user inputs.

Among the topics included in this unit are: identifying what an API is and the need for APIs; types of APIs; application design and development utilising relevant APIs in a suitable development environment; testing of the application; and a critical review of the APIs used.

On successful completion of this unit students will be able to identify and select relevant APIs to use within an application of their own choice or from a given scenario, in addition to testing and documenting the review process against the initial design requirement.

As a result students will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

### Learning Outcomes

By the end of this unit students will be able to:

LO1. Examine what an API is, the need for APIs and types of APIs.

LO2. Apply the knowledge of API research to design an application that incorporates relevant APIs for a given scenario or a substantial student chosen application.

LO3. Implement an application in a suitable development environment.

LO4. Document the testing of the application, review and reflect on the APIs used.

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**Essential Content**

### LO1 Examine what an API is, the need for APIs and types of APIs

Research existing APIs, their role and the need for an API.

Identify types of API uses e.g. visual, social media, device manipulation.

Critically evaluate suitable APIs for use in an application (web/mobile/desktop) for a given scenario or a substantial student chosen application.

### LO2 Apply the knowledge of API research to design an application that incorporates relevant APIs for a given scenario or a substantial student chosen application

Develop relevant wireframes diagrams, concept the design of the application. Consider the application design/its purpose.

Consider the target platform (web/mobile/desktop). Identify the scope of the application.

Justify the selection/relevancy/purpose of the chosen APIs for the application. Take the security of APIs into consideration.

### LO3 Implement an application in a suitable development environment

Introduce different types of implementation processes. to extend knowledge and understanding of the stages involved.

Discuss a range of suitable development environments. Develop the application based on LO2.

Consider the use of a suitable development environment. Utilise best practices for implementing the application.

### LO4 Document the testing of the application, review and reflect on the APIs used

Document the testing procedure carried out to satisfy the design requirements/purpose of application.

Review/reflect on the application development process; identifying the chosen APIs strengths weaknesses, ease of use, access to features within the APIs.

**Learning Outcomes and Assessment Criteria**

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| **Pass** | **Merit** | **Distinction** |
| **LO1** Examine what an API is, the need for APIs and types of APIs | **D1** Evaluate potential security issues surrounding APIs |
| **P1** Examine the relationship between an API and a software development kit (SDK). | **M1** Asses a range of APIs for a particular platform that covers a range of uses. |
| **LO2** Apply the knowledge of API research to design an application that incorporates relevant APIs for a given scenario or a substantial student chosen application | **D2** Create a design for a chosen substantial application that will utilise a range of APIs, justifying choices. |
| **P2** Analyse an existing application that could be extended with a suitable API. | **M2** Design an application that will utilise an API for a given purpose. |
| **LO3** Implement an application in a suitable development environment | **D3** Construct an application utilising multiple APIs, following the designs in LO2. |
| **P3** Build on an existing application framework to implement an API. | **M3** Develop an application that utilises an API. |
| **LO4** Document the testing of the application, review and reflect on the APIs used | **D4** Critically evaluate the APIs used within your application. Provide a data security report of your application. |
| **P4** Design and complete a ‘white box’ test of the application, recording the results. | **M4** Conduct ‘black box’ tests of your application, recording the results.**M5** Update the application accordingly with the results. |

**Recommended Resources**

### Textbooks

Spencer, T. et al. (2015) *Securing the API Stronghold: The Ultimate Guide to API Security.*

1st Ed. Kindle. Amazon.

### Websites

[www.khronos.org](http://www.khronos.org/) The Khronos Group

“Vulkan API” (Development Tool) developers.google.com Google Developers (Development Tools)

### Links

This unit links to the following related units:

*Unit 9: Software Development Lifecycles Unit 30: Application Development*

# Unit 30: Application Development

**Unit code H/615/1670**

**Unit level 5**

**Credit value 15**

**Introduction**

Software drives business and developers drive software – the world is reliant on software, and programming is at the heart of this. Professionalism and critical thinking, supported by an ability to work independently and as part of a team are core skills of a developer. If you can think logically and you enjoy exploring and dismantling problems, working with others to consider requirements and creating ideas and possible solutions you can gain the experience and learn the skills needed to excel as an Application Developer.

This unit introduces students to Application Development and is designed to simulate the roles and responsibilities of a commercial developer working in a suitable business environment with access to a small team of colleagues. Initially, students are introduced to a business-related problem and will need to adopt and use appropriate methods and practices to analyse, break down and discuss the issues – then, decide, design, create and test a possible solution. Students should be free to debate, evaluate and select different design and development methodologies depending on their own judgement and consideration. On completion, students will be expected to formally evaluate their final application against their design plans and initial requirements.

Among the topics included in this unit are: design and developer documentation; problem analysis; research, system and user requirements; design methodologies and principles; security considerations; development methodologies; Unified Modelling Language (UML), software development lifecycles; teamwork, peer-reviews, development tools and techniques; integrated development environments; debugging, testing, software versions and quality assurance.

On successful completion of this unit students will be able to produce a Software Design Document by analysing a business-related problem and deduce an appropriate solution, including a set of initial requirements, select and use design and development methodologies with tools and techniques associated with the creation of a business application, work individually and as part of a team to plan, prepare and produce a functional business application with support documentation and assess and plan improvements to a business application by evaluating its performance against its Software Design Document and initial requirements.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

### Learning Outcomes

By the end of this unit students will be able to:

LO1. Produce a Software Design Document by analysing a business-related problem and deduce an appropriate solution including a set of initial requirements.

LO2. Use design and development methodologies with tools and techniques associated with the creation of a business application.

LO3. Work individually and as part of a team to plan and produce a functional business application with support documentation.

LO4. Evaluate the performance of a business application against its Software Design Document and initial requirements.

**Essential Content**

### LO1 Produce a Software Design Document by analysing a business-related problem and deduce an appropriate solution including a set of initial requirements

*Analyse a business-related problem and assess possible solutions:*

Discuss and produce a problem definition statement to highlight and describe the issues that need to be addressed.

Research and consider possible solutions and predict the overall success of the application.

*Produce a Software Design Document:*

Review and discuss the value of Software Design Documents with regards to application development.

Evaluate your possible solutions and synthesise the ideas into a single document that identifies and attempts to solve the business-related problem.

Research and use information relating to software testing to create a suitable test plan for your business application.

### LO2 Use design and development methodologies with tools and techniques associated with the creation of a business application

*Discuss different design and development methodologies:*

Present overviews on current design and development methodologies.

Debate various strengths and weaknesses commonly associated with each methodology.

Select or synthesise a design and development methodology for use with the creation of your application.

Consider the security implications of design and development methodologies.

*Use appropriate tools and techniques:*

Evaluate different tools and techniques available to create a business application.

Debate the advantages and disadvantages of your preferred or selected tools and techniques.

### LO3 Work individually and as part of a team to plan and produce a functional business application with support documentation

*Work as a small team to plan and prepare your business application:*

Peer-review and debate your development plan by effectively communicating and defending the ideas in your Software Design Document.

Discuss differences with regards to the possible strengths and weakness of each Software Design Document.

Modify your Software Design Document to reflect any new insights or considerations.

*Prepare and produce a functional business application:*

Use your Software Design Document with your preferred design and development methodology and your selected tools and techniques to develop a functional business application.

Create and quality check appropriate support documents for your application.

### LO4 Evaluate the performance of a business application against its Software Design Document and initial requirements

Assess the performance of a business application:

Analyse factors that influence the performance of a business application with regard to its system requirements.

Undertake a critical review of the performance and development of your application against all identified factors and any adopted design and development methodologies.

Measure the overall success of the application against your original prediction and identify any new areas of personal insight.

*Plan improvements to a business application:*

Evaluate the overall strengths and weaknesses of your business application against its Software Design Document and initial requirements.

Discuss and plan in detail possible revisions (including implementation) with regard to improving your application’s performance.

**Learning Outcomes and Assessment Criteria**

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| **Pass** | **Merit** | **Distinction** |
| **LO1** Produce a Software Design Document by analysing a business-related problem and deduce an appropriate solution including a set of initial requirements | **LO1 & LO2****D1** Justify your solution to a business-related problem and your preferred software development methodology, by comparing between the various software development tools and techniques researched. |
| **P1** Explore a business- related problem and produce a well-defined Problem Definition Statement supported by a set of user and system requirements.**P2** Determine any areas of risk related to the successful completion of your application. | **M1** Analyse a business- related problem using appropriate methods and produce a well-structured Software Design Document that defines a proposed solution and includes relevant details on requirements, system analysis, system design, coding, testing and implementation. |
| **LO2** Use design and development methodologies with tools and techniques associated with the creation of a business application |
| **P3** Research the use of software development tools and techniques and identify any that have been selected for the development of this application. | **M2** Compare the differences between the various software development tools and techniques researched and justify your preferred selection as well as your preferred software development methodology. |

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| **Pass** | **Merit** | **Distinction** |
| **LO3** Work individually and as part of a team to plan and produce a functional business application with support documentation | **D2** Evaluate any new insights, ideas or potential improvements to your system and justify the reasons why you have chosen to include (or not to include) them as part of this business application. |
| **P4** Create a formal presentation that effectively reviews your business application, problem definition statement, proposed solution and development strategy. Use this presentation as part of a peer-review and document any feedback given.**P5** Develop a functional business application with support documentation based on a specified business problem. | **M3** Interpret your peer- review feedback and identify opportunities not previously considered.**M4** Develop a functional business application based on a specific Software Design Document with supportive evidence of using the preferred tools, techniques and methodologies. |

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| **Pass** | **Merit** | **Distinction** |
| **LO4** Evaluate the performance of a business application against its Software Design Document and initial requirements | **D3** Critically evaluate the strengths and weaknesses of your business application and fully justify opportunities for improvement and further development. |
| **P6** Review the performance of your business application against the Problem Definition Statement and initial requirements. | **M5** Analyse the factors that influence the performance of a business application and use them to undertake a critical review of the design, development and testing stages of your application. Conclude your review by reflectively discussing your previously identified risks. |

**Recommended Resources**

### Textbooks

Carmen, T. et al. (2009) *Introduction to Algorithms*. USA: MIT Press.

Martin, R.C. (2011) *The Clean Coder: A Code of Conduct for Professional Programmers*. USA: Prentice Hall.

McConnell, S. (2004) *Code Complete: A Practical Handbook of Software Construction*. USA: Microsoft Press.

### Links

This unit links to the following related units: *Unit 6: Managing a Successful Computing Project Unit 9: Software Development Lifecycles*

# Unit 38: Database Management Systems

**Unit code Y/615/1682**

**Unit level 5**

**Credit value 15**

**Introduction**

As globalisation and the 24-hour economy develop and increase, organisations must ensure that their database management systems (DBMS) are reliable, secure, efficient and able to cope with rapid change. Database management systems will continue to service the many operations of our modern world; they are becoming increasingly complex, to develop and manage, due to technological advancements and changes in the way organisations do their business in a global market.

In this unit, students will examine the structure of data, and how an efficient data design follows through into an effectively developed database management system. Students will examine the merits of different DBMS platforms, and investigate system administration and management tools of the platform.

Amongst the topics included in this unit are: examination of different database management systems, database design tools and techniques of relational database management systems, using an open source platform to develop, test and manage a client’s system.

On successful completion of this unit students will be able to demonstrate their knowledge of the fundamentals of database management systems, be able to make informed choices between vendor and open source platforms for database management systems, design and develop a relational DBMS for a client using an open source platform, and carry out system administration tasks.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

### Learning Outcomes

By the end of this unit students will be able to:

LO1. Analyse different types of database management systems.

LO2. Design a database management system using a relational model to meet client requirements.

LO3. Develop a database management system using a suitable platform.

LO4. Demonstrate the system administration and management tools available on the chosen platform

**Essential Content**

### LO1 Analyse different types of database management systems

Types of database management systems (DBMS) and their operating system support, e.g. MySQL, Oracle.

Data models: Entity-Relationship, relational, hierarchical, network, object- oriented, object-relational.

Examine details of DBMS based on a relational model.

Relational data structures, including: relations, attributes, domain, tuple, cardinality.

Constraints: key, domain, referential integrity. Normalisation in developing efficient data structures.

Modelling languages: query language, data definition language (DDL), data, manipulative language (DML), relational languages.

Transaction and concurrency in DBMS.

Investigation of open source and vendor-specific systems. Multiple platform approaches to database management.

### LO2 Design a database management system using a relational model to meet client requirements

Determine user and system requirements.

Examine design tools and techniques for a relational database management system.

Physical system design.

Logical design: design for relational databases, tables, data elements, data types, keys and indexes, entity relationship modelling, data flow diagrams, flowcharts.

Mathematical relations e.g. relational algebra, relational calculus. DBMS selection, e.g. MySQL.

Application design, including: data entry/input (verification, validation, calculated fields, masks, directed input), reports (queries, presentation of data, layouts), task automation (imports, updates, deletions), queries using multiple criteria, form values and wild cards, action queries, calculated queries, queries across multiple tables.

Hardware, software and other resource requirements.

Test plans to check correctness of data, security, functionality, accessibility and usability.

Quality, effectiveness and appropriateness of the solution: correctness of data, relationships between data, data integrity, normalisation.

Working with clients and others to improve the quality, effectiveness, security and appropriateness of solution design

### LO3 Develop a database management system using a suitable platform

Use of an appropriate database management system and Structured Query Language (SQL) to produce a secure solution to meet client’s requirements.

Creating, setting up and maintaining data tables. Applying data validation rules.

Generating outputs e.g. user-generated queries, automated queries, reports.

Application and user interface e.g. navigation, data entry forms and sub-forms, automated functions.

Populating the database.

SQL statements to extract, manipulate and modify data.

Applying security measures to control access to data, e.g. user access levels.

Testing the database solution using different types of testing: referential integrity, functionality, security, stability.

Selection and use of appropriate test data.

Selecting suitable test users and gathering feedback from users. Making use of testing outcomes to improve and/or refine the solution.

Reviewing the solution, criteria for use when reviewing the solution against: quality of the database, fitness for purpose, suitability against the original requirements, technology constraints, strengths and improvements, platforms and compatibility.

Optimising the solution: data types, data sizes e.g. size on disk, many tables e.g. overheads for many tables, query optimising.

### LO4 Demonstrate the system administration and management tools available on the chosen platform

Describe core database administration tasks and tools.

*Practical demonstrations of server management to include:* Setting up and managing data storage for servers and users. Backup and recovery routines for data and applications.

Managing authorisations. Managing security and encryption. Importing and exporting data.

Trace database activity.

Monitoring performance and optimising performance. Audit trails.

Managing alerts and notifications.

Database maintenance including setting up automatic routines.

**Learning Outcomes and Assessment Criteria**

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| **Pass** | **Merit** | **Distinction** |
| **LO1** Analyse different types of database management systems | **D1** Critically evaluate different database management systems available in relation to open source and vendor- specific platforms, justifying the criteria used in the evaluation. |
| **P1** Compare and contrast the different types of database models. | **M1** Assess how relational database models and the process of normalisation can provide reliable and efficient data structures. |
| **LO2** Design a database management system using a relational model to meet client requirements | **LO2 & LO3****D2** Critically evaluate the effectiveness of the system design and development against client and system requirements. |
| **P2** Produce a design for a relational database management system to meet client requirements. | **M2** Analyse how the design will optimise system performance. |
| **LO3** Develop a database management system using a suitable platform |
| **P3** Develop a fully functional system which meets client and system requirements, using an open source language (with an application software e.g. MySQL with front end Microsoft Access).**P4** Test the system for functionality and performance. | **M3** Implement effective features in the solution to handle concurrency, security, user authorisations and data recovery. |

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| **Pass** | **Merit** | **Distinction** |
| **LO4** Demonstrate the system administration and management tools available on the chosen platform | **D3** Analyse any future improvements that may be required to ensure the continued effectiveness of the database system. |
| **P5** Demonstrate the tools available in the system to monitor and optimise system performance, and examine the audit logs.**P6** Demonstrate the tools available in the system to manage security and authorisations. | **M4** Assess the effectiveness of the system administration and management tools available on the platform identifying any shortcomings of the tools. |

**Recommended Resources**

### Textbooks

Connolly, T. and Begg, C. (2014) *Database systems: A practical guide to design, implementation and management*. 3rd Ed. Addison-Wesley.

Elmasri, R. and Navathe, S. (2011) *Fundamentals of Database Systems*. 6th Ed. Addison-Wesley.

Hoffer, J. (2008) *Modern Database Management*. Pearson Education.

Jeffrey A., Ramesh, V. and Topi Heikki, T. (2012) *Modern Database Management*. Pearson Education.

Silberschatz, A., Korth, H.F. and Sudarshan, S. (2011) *Database System Concepts*. 6th Ed. McGraw-Hill Edition.

Plus others linked specifically to the version of the software used for a given platform.

### Journals

*International Journal of Database Management Systems Journal of Database Management*

*The Computer Journal*

*Journal of Emerging Trends in Computing and Information Sciences*

### Links

This unit links to the following related units:

*Unit 4: Database Design & Development Unit 7: Strategic Information Systems*

# Unit 47: Games Development

**Unit code D/615/1697**

**Unit level 5**

**Credit value 15**

**Introduction**

In the field of computing, games development is a multidisciplinary art form that creates worlds that blend player psychology, problem-solving and artificial intelligence with knowledge about dedicated hardware and software platforms. This level of ability can often require significant effort on the part of the student with regards to time and practice. However, as more experience is gained, the skills and abilities quickly improve. In addition, once completed it is important to know that the capabilities and flexibility of a good games developer can easily be transferred to other roles in the business sector.

This unit introduces students to games development and is designed to simulate the roles and responsibilities of a games developer working in a suitable games development studio with access to a small team of colleagues. Students are expected to discuss and review a number of original game ideas before synthesising them into a single game concept. Once defined they will need to adopt and use appropriate methods and practices to analyse, breakdown and discuss the issues – then, decide, design, create and test a functional game. Students should be free to debate, evaluate and select different design and development methodologies depending on their own judgement and consideration. On completion, and in addition to the student reviewing and reflecting on the experience, they will be expected to formally evaluate their completed game against their Games Design Document and original concept.

Among the topics included in this unit are: game design and developer documentation, problem analysis, research, system and user requirements, design methodologies and principles, development methodologies, unified modelling language (UML), software development lifecycles, games engines, hardware platforms, graphic manipulation, physics, maths for games, sound, networking, collision detection, teamwork, peer-reviews, development tools and techniques, integrated development environments, debugging, testing, software versions and quality assurance.

On successful completion of this unit students will be able to develop a Game Design Document by evaluating and synthesising game ideas into an original video game concept, select and use different design and development methodologies with tools and techniques associated with the creation of a video game, work individually and as part of a team to plan, prepare and produce a functional video game including support documentation, assess and plan improvements to a video game by evaluating its performance against its Game Design Document and original concept.

As a result they will develop skills such as communication literacy, critical thinking, analysis, reasoning and interpretation, which are crucial for gaining employment and developing academic competence.

### Learning Outcomes

By the end of this unit students will be able to:

LO1. Develop a Game Design Document by evaluating and synthesising game ideas into an original video game concept.

LO2. Use different design and development methodologies with tools and techniques associated with the creation of a video game.

LO3. Work individually and as part of a team to plan and produce a functional video game, including support documentation.

LO4. Evaluate the performance of a video game against its Game Design Document and original concept.

### Essential Content

LO1 **Develop a Game Design Document by evaluating and synthesising game ideas into an original video game concept**

*Research and compare different game genres and ideas:*

Discuss and compare common game elements such as: type, story, characters, environment, levels, gameplay, loops, art, sound, user interface and controls.

Determine possible game ideas and predict the overall success of fully developing your game.

*Develop a Game Design Document:*

Review and discuss the value of Game Design Documents with regards to games development.

Evaluate and synthesise your game ideas into a single document that describes (in detail) your game concept.

Research and use information relating to games testing to create a suitable test plan for your game.

### LO2 Use different design and development methodologies with tools and techniques associated with the creation of a video game

*Discuss different design and development methodologies:*

Present overviews on current design and development methodologies.

Debate various strengths and weaknesses commonly associated with each methodology.

Select or synthesise a design and development methodology for use with the creation of your video game.

*Use appropriate tools and techniques:*

Evaluate different tools and techniques available to create a video game.

Establish your development plan by debating the advantages and disadvantages of your preferred or selected tools and techniques.

### LO3 Work individually and as part of a team to plan and produce a functional video game, including support documentation

*Work as a small team to plan and prepare your functional video game:*

Peer-review and debate your development plan and Games Design Document by effectively communicating and defending your ideas and reasoning.

Discuss differences with regards to the possible strengths and weakness of each Game Design Document and development plan.

Modify your design document or plans to reflect any new insights or considerations.

*Prepare and produce a functional video game:*

Use your Game Design Document with your development plan to produce a functional video game.

Create and quality check appropriate support documents for your video game.

### LO4 Evaluate the performance of a video game against its Game Design Document and original concept

*Assess the performance of a video game:*

Analyse factors that influence the performance of a video game with regard to its system requirements.

Undertake a critical review of the performance and development of your video game against all identified factors and any adopted design and development methodologies.

Measure the overall success of the video game against your original prediction and identify any new areas of personal insight.

*Plan improvements to a video game:*

Evaluate the overall strengths and weaknesses of your video game against its Game Design Document and original concept.

Discuss and plan in detail possible revisions (including implementation) with regard to improving your video game’s performance.

**Learning Outcomes and Assessment Criteria**

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| **Pass** | **Merit** | **Distinction** |
| **LO1** Develop a Game Design Document by evaluating and synthesising game ideas into an original video game concept | **D1** Evaluate common game design elements and justify their use when designing a suitable Game Design Document. |
| **P1** Explore different game- based ideas, blending them into an original video game concept.**P2** Examine any areas of risk related to the successful completion of your video game. | **M1** Analyse and combine common game design elements (such as type, story, characters, environment, levels, gameplay, loops, art, sound, user interface and controls) with your original video game concept to create a suitable Game Design Document. |

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| **Pass** | **Merit** | **Distinction** |
| **LO2** Use different design and development methodologies with tools and techniques associated with the creation of a video game | **LO2 & LO3****D2** Evaluate any new insights, ideas or potential improvements to your concept, methodology or use of tools and justify the reasons why you have chosen to include (or not to include) them as part of this development. |
| **P3** Research the use of different design and development methodologies, tools and techniques and determine which have been selected for the development of this video game. | **M2** Compare the differences between the various design and development methodologies, tools and techniques researched and justify your preferred selection. |
| **LO3** Work individually and as part of a team to plan and produce a functional video game, including support documentation |
| **P4** Create a formal presentation that effectively reviews your video game concept together with your preferred design and development methodologies and selected tools and techniques. Use this presentation as part of a peer-review and document any feedback given.**P5** Develop a functional video game based on a specified game concept. | **M3** Interpret your peer- review feedback and identify opportunities not previously considered.**M4** Develop a functional video game based on a specific Game Design Document with supportive evidence of using the preferred design and development methodologies and selected tools and techniques. |
| **LO4** Evaluate the performance of a video game against its Game Design Document and original concept | **D3** Critically evaluate the strengths and weaknesses of your video game and fully justify opportunities for improvement and further development. |
| **P6** Evaluate the performance of your video game against your original concept. | **M5** Critically analyse the factors that influence the performance of a video game and use them to undertake a critical review of the design, development, game elements and testing stages of your video game. Conclude your review by reflectively discussing your previously identified risks. |

**Recommended Resources**

### Textbooks

Gibson, J. (2014) *Introduction to Game Design, Prototyping, and Development.*

New Jersey: Pearson Education.

Gregory, J. (2014) *Game Engine Architecture*. United States: Taylor.

Madhav, S. (2013) *Game Programming Algorithms and Techniques*. USA: Addison-Wesley.

Nystrom, R. (2014) *Game Programming Patterns*. USA: Genever Benning.

Rogers, S. (2014) *Level Up! The Guide to Great Video Game Design*. UK: John Wiley and Sons Ltd.

Schell, J. (2014) *The Art of Game Design: A Book of Lenses*. USA: A K Peters/CRC Press.

### Links

This unit links to the following related units:

*Unit 9: Software Development Lifecycles Unit 31: Games Engine & Scripting*

*Unit 32: Game Design Theory*