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Unit Specification

Fundamentals of Computing (EduQual Level 3)

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Fundamentals of Computing

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Fundamentals of Computing

## Unit Summary

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| **Equivalent RQF Level** | **3** |
| **Credit Value** | **15** |
| **Learning Time (hours)** | **150** |
| **Organisation name** | **EduQual Ltd.** (Company Number 8913632) |
| **As part of (Award Title)** | **Diploma in International Foundation Studies (Business) *OR***  **Diploma in International Foundation Studies (Computing)** |
| **Unit purpose** | Learners study the fundamental principles of how computer systems work, including the role of hardware and software, the way components of a system work together and how data in a system is used.  Knowing how and why computer components, and the data they use, perform in certain ways has a significant impact on the work of all computing professionals. In technical support roles, understanding how different parts of a system integrate facilitates accurate identification of problems and efficient solutions. Professional programmers use their understanding of the way the computer operates to develop more efficient software solutions.  In this unit, learners explore the relationship between hardware and software as part of a computer system. Learners examine the way computer components work both individually and together to store and process data, and the way in which data is transmitted and used in computer systems. Learners also explore the impact that computing systems have on organisations and individuals.  Finally, learners will apply the fundamental principles of computers to all areas of computing. This is essential for progression to a computing-related higher education course or for entry to the workplace as a computing professional. |
| **Unit Entry Requirements (if applicable)** | See Programme Specification. |

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| **Learning Outcome 1 (Assignment 1, Task 1)** | |
| **Hardware and Software** | |
| **Performance Criteria**  *On completion of this unit, the learner can:* | **Content/Evidence**  *The learner must have shown ability to:* |
| **1.1**  Understand the concepts and implications of the use of, and relationships between, hardware and software that form computer systems | Demonstrate understanding of computer hardware, with due attention to the following key points:   * **Types of computer systems:** multi-functional devices; personal computers; mobile devices; servers * **Purpose, features, and uses of internal components used in the above computer systems** * **Factors affecting the choice, use and performance of internal components** * **Hardware used in computer systems:** Input devices; output devices; storage devices * **How the features of hardware can affect their performance, and the performance of a computer system** * **Factors affecting choice of hardware:** user experience (ease of use, performance, availability, accessibility); user needs; compatibility; cost; efficiency; implementation (timescales, testing, migration to new system); productivity; security * **Data storage and recovery systems:** Redundant array of independent disks (RAID); network attached storage (NAS) |
| **1.2**  Understand the role of computer software in a computer system | Demonstrate understanding of computer software, with due attention to the following key points:   * **Operating systems:** Types of operating system (real-time; single-user single task; single-user multi-tasking; multi-user) * **Role of the kernel in controlling and managing system components and tasks:** program execution; interrupts; modes; memory management; multi-tasking; disk access; file system; device drivers * **Role of the OS in managing:** Networking; security * **Factors affecting the choice and use of user interfaces:** graphical; command line; menu-based * **Factors affecting the choice of operating system** * **Factors affecting the use and performance of an operating systems** * **Utility software:** Purpose, features, and uses; factors affecting the choice, use and performance of utility software * **Application software:** Purpose, features and uses * **Factors affecting the choice, use, and performance of application software** * **Principles and implications of open source operating systems and software** |
| **1.3**  Understand the role of data processing in a computer system | Demonstrate understanding of the following key concepts:   * **Use, features, and implications of computer systems for data processing** * **The role of hardware in collecting data** * **The role of software in collecting data** * **Data processing functions:** aggregation; analysis; conversion; reporting; sorting; validation * **Impact on individuals and organisations of using and storing data across multiple computer systems:** access; cost; implementation; productivity; security * **Backup and data recovery procedures** |

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| **Learning Outcome 2 (Assignment 1, Task 2)** | |
| **Computer architecture** | |
| **Performance Criteria**  *On completion of this unit, the learner can:* | **Content/Evidence**  *The learner must have shown ability to:* |
| **2.1**  Understand the implications of computer architecture models and the impact of the relationships between their component parts | Show analytical understanding of the following key issues:   * **Approaches to computer architecture:** the features and characteristics of different computer architecture models including   + **Stored program model:** Von Neumann architecture; Harvard architecture   + **Cluster computing**   + **Uniform memory access and non-uniform memory access** * **Use and application of emulation** * **Factors affecting the choice of different architecture models** * **The impact of using different architecture models** |
| **2.2**  Understand the concepts and uses of microarchitecture | Demonstrate analytical understanding of the following key issues:   * **Instruction cycles** * **Execution speeds:** factors affecting execution speeds; methods of increasing execution speed; implications of execution speeds * **The use and choice of instruction sets** * **Pipelining** * **Cache** * **Registers** * **Multi-processing and multi-threading** * **The features and implications of central processing unit (CPU) architecture in:** embedded devices; mobile devices; microcomputers; servers |
| **2.3**  Understand registers and register handling | Demonstrate analytical understanding of registers and register handling, to include the following key points:   * **Types of register:** general purpose; special registers (accumulator, instruction register, memory address register (MAR), memory data register (MDR), program counter * **The function and purpose of general and special registers and their impact on the way computer systems perform** * **The role of interrupts in a computer system** |

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| **Learning Outcome 3 (Assignment 1, Task 3)** | |
| **Data Representation** | |
| **Performance Criteria**  *On completion of this unit, the learner can:* | **Content/Evidence**  *The learner must have shown ability to:* |
| **3.1**  Understand how data is represented by computer systems, including the characteristics, concepts, and implications of computer data representation methods | Demonstrate an analytical understanding of the following key points:   * **Number systems:** The use and interpretation of number systems used in computer systems, including:   + Units of digital data (bit, byte, kilobyte, and multiples of these)   + Binary   + Binary coded decimal (BCD) * **The use of binary arithmetic (including BCD) to perform basic mathematical calculations:** addition, subtraction, multiplication, and division * **The use of binary to represent negative and floating point numbers** |
| **3.2**  Understand text representation in computer systems | Show analytical understanding of text representation, to include the following key points:   * **The purpose and implications of using codes to represent character sets in text representation** * **The features and uses of common character sets:** ASCII; Unicode |
| **3.3**  Understand image representation in computer systems | Show analytical understanding of image representation, to include the following key points:   * **How bitmap/raster image data is stored and represented in a computer system** * **The impact of image resolution on the way images are stored and represented** * **The impact of sample/bit depth on the way that image data is stored and images are displayed** * **The effects of compression on image data** |

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| **Learning Outcome 4 (Assignment 1, Task 4)** | |
| **Data Organisation** | |
| **Performance Criteria**  *On completion of this unit, the learner can:* | **Content/Evidence**  *The learner must have shown ability to:* |
| **4.1**  Assess and understand the characteristics and implications of methods of organising data in computer systems, and its impact on computer processes | Demonstrate critical understanding of data structure, to include the following key points:   * **The features, applications, and implications of data types used in computer systems:** stack; queue; array; list * **The use and application of data types in computer software** * **The use and implications of data types in computer hardware** |
| **4.2**  Assess and understand the concept of indices, matrices, and matrix representation in computer systems | Demonstrate analytical understanding of matrix representation, to include the following key points:   * **The relationship between matrices and arrays** * **Mathematical operations using matrices** * **Single, two-, and multi-dimensional arrays** * **Row-major and column-major order** |

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| **Learning Outcome 5 (Assignment 1, Task 5)** | |
| **Data Transmission** | |
| **Performance Criteria**  *On completion of this unit, the learner can:* | **Content/Evidence**  *The learner must have shown ability to:* |
| **5.1**  Understand the concepts, processes, and implications of data transmission in and between computer systems | Show analytical understanding of transmitting data, and the following key issues:   * **Types of communication channel:** simplex; half-duplex; full-duplex; point-to-point; multi-drop * **Methods of connecting devices and transmitting data across/between computer systems** * **The selection of connection methods to fulfil specified tasks and functions** * **Asynchronous and synchronous data transmission** * **Use of packet data in transmitting data:** Contents of a data packet; the role of components of a data packet; packet switching * **Protocols used to govern and control data transmission** * **Features, applications and implications of encryption**    + **Simple encryption ciphers:** Caesar; Vigenère   + **Encryption used in computer systems:** symmetric key encryption; public key encryption * **Types of compression:** Lossy; lossless * **Applications and implications of data compression** |
| **5.2**  Understand the methods used to detect errors in data transmission | Show analytical understanding of error detection methods and their implications, and awareness of the following key issues:   * **Parity schemes** * **Checksum** * **Repetition schemes** * **Cyclic redundancy check (CRC)** * **The concepts, implications, and applications of error detection** |
| **5.3**  Understand the concepts and implications of error correction in computer systems | Demonstrate an analytical understanding of error correction systems, to include the following key points:   * **Commonly used error correction systems:** Automatic repeat request (ARQ); forward error correction (FEC) * **The concepts, implications, and applications of error correction systems** |

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| **Learning Outcome 6 (Assignment 1, Task 6)** | |
| **Logic and Data Flow** | |
| **Performance Criteria**  *On completion of this unit, the learner can:* | **Content/Evidence**  *The learner must have shown ability to:* |
| **6.1**  Understand the use of logic and data flow in computer systems, including the application and interpretation of logical processes and diagrams to represent data flow and relationships in and between computer systems | Demonstrate analytical understanding of Boolean logic, including the following key issues:   * **The use, application, and interpretation of Boolean logic to identify data flow and solve problems** * **The use, application, and interpretation of Boolean logic to identify logical structures, represent data flow, and solve problems** |
| **6.2**  Understand flow charts and system diagrams in computer systems | Demonstrate analytical understanding of flow charts and systems diagrams, to include the following key issues:   * **The use, application and interpretation of flow charts and diagrams to represent data flow in and between computer systems** * **The use, application and interpretation of flow charts and diagrams to solve problems** |

## Delivery and Assessment

Tuition and guidance should feature flexible approaches to delivering the unit. Formal tuition sessions, whether face to face or online, will identify some of the required, theoretical subject matter. This will help students to work individually, or as part of a group, researching and gathering information about the subject. Personal and group research, case studies, simulations, exercises and discussion are typical and engaging ways of learning about the subject. Students will likely use tutor- and self-directed study and reflect on their experience and expertise. Up-to-date information and materials are available from many sources such as businesses, the World Wide Web, television and radio broadcasts, broadsheet newspapers and advisory services.

Full guidance on delivery and assessment is available from EduQual upon request.[[1]](#footnote-1) Where Recognition of Prior Learning (RPL) is a valid option for learners that meet some (or all) of the assessment criteria outlined for a given unit, readers are referred to [**EduQual’s Recognition of Prior Learning Policy**](http://eduqual.org.uk/wp-content/uploads/2015/10/RPL_Pol_v6_pblc.pdf). This policy is available online, or by request.[[2]](#footnote-2)

Finally, EduQual provides detailed Assessment Guidance to its Approved Centres. Centres that lack this document may:

* Request it from the email address shown in the footnotes on this page
* Access it from their own EduQual Dropbox folder.

**This unit is assessed through a written examination set and marked by EduQual.**

**The examination is one hour and 45 minutes in length. During the supervised assessment period, learners will be assessed on their knowledge and understanding of how computer systems work, including the role of hardware and software, the way components of a system work together and how data in a system is used.**

**The number of marks for the unit is 80.**

**The assessment availability is twice a year in January and May/June. The first assessment availability is May/June 2017.**

## Outline Learning Plan

This unit is assessed through a written examination set and marked by EduQual.

The examination is one hour and 45 minutes in length. During the supervised assessment period, learners will be assessed on their knowledge and understanding of how computer systems work, including the role of hardware and software, the way components of a system work together and how data in a system is used.

The number of marks for the unit is 80.

The assessment availability is twice a year in January and May/June. The first assessment availability is May/June 2017.

## List of Learner Sources

The recommended sources listed below should be familiar to each tutor and assessor who is delivering this unit as part of an EduQual qualification. Learners should be made aware of these sources before delivery of this unit, and be fully conversant with these sources upon completion of this unit.

1. Email: [**info@eduqual.org.uk**](mailto:info@eduqual.org.uk) [↑](#footnote-ref-1)
2. Email: [**info@eduqual.org.uk**](mailto:info@eduqual.org.uk) or [**click this link to view EduQual’s RPL Policy online**](http://eduqual.org.uk/wp-content/uploads/2015/10/RPL_Pol_v6_pblc.pdf) [↑](#footnote-ref-2)