



# Richmond College

Advanced Education



## **Qualification Specification for :**

Level 4 Diploma in Computing

610/3263/3

Level 4 Extended Diploma in Computing

610/3264/5

Pathways:

Level 4 Extended Diploma in Computing (Data Analyst)

Level 4 Extended Diploma in Computing (Software Developer)

Level 4 Extended Diploma in Computing (Cyber Security Technologist)



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TRAINING AND  
HIGHER EDUCATION

## Unit specifications

Unit 1 IT Systems Development: Preparation, Analysis, Design and Problem-solving			
<b>Unit aims</b>	This unit draws together concepts from Systems Analysis and Project Management to help learners develop the skills and techniques needed to confidently respond to a client brief, to identify a problem or opportunity, analyse an existing system, identify possible solutions to the problem before choosing the most appropriate solution and producing a suitable design. Learners will present their final solution design to their client and respond to feedback.		
<b>Unit level</b>	4		
<b>Unit code</b>	Y/650/8502		
<b>GLH</b>	60		
<b>Credit value</b>	15		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Understand the stages and purpose of the lifecycle and lifecycle models in development activities.	1.1 Explain the purpose of the lifecycle in development activities. 1.2 Describe the stages of the development lifecycle. 1.3 Explain the role of systems analysis in development and redevelopment.	1M1 Select and justify your choice of methodology for a development.	1D1 Evaluate different development lifecycles and models that can be used in systems development.
2. Understand the key behaviours needed to develop achievable requirements.	2.1 Explain the roles and responsibilities associated with the stages of development lifecycle. 2.2 Describe the importance of demonstrating the key behaviours of problem-solving.	2M1 Assess how the use of project management tools contributes to the successful control of development projects.	

3. Can use analysis techniques to investigate and document an existing system.	<p>3.1 Carry out an analysis using information gathering techniques to review an existing system.</p> <p>3.2 Document an existing system using appropriate tools.</p> <p>3.3 Produce a feasibility report.</p>		<p><b>LO3 and LO4</b></p> <p>3D1 Evaluate the effectiveness of using a range of documentation tools to communicate the results of analysis and design.</p>
4. Can identify, design, and document a possible solution.	<p>4.1 Use the analysis to identify possible solutions to a problem and choose a preferred solution.</p> <p>4.2 Design the solution using appropriate tools to document the proposal (including functionality and interfaces).</p> <p>4.3 Describe a further improvement.</p>	4M1 Justify your choice of preferred solution.	
5. Can present a solution proposal to a client.	5.1 Present your solution to the client using a suitable format.		5D1 Evaluate client's feedback on the proposed solution, explaining how appropriate amendments will be made to the design.

## Indicative Content

### 1. Understand the stages and purpose of the lifecycle and lifecycle models in development activities

- Purpose – to provide a framework for development, improve planning and control, reduce risk
- Development lifecycle stages – Initiate, Investigate, Design, Implement, Test, Deploy/Use, Maintain, Review, Sunset (end of life)
- Identification of inputs and outputs in each stage of the lifecycle
- Development lifecycles – Waterfall, V-shape, Spiral, Iterative
- Development models – SSADM, DSDM, Agile (including Scrum, Kanban), Prototyping, DevOps
- Role of systems analysis – Understand existing systems, identify issues or opportunities (such as reducing errors, improving processing, improving the user experience, to take advantage of emerging opportunities), examine the feasibility of a project or development.

### 2. Understand the key behaviours needed to develop achievable requirements

- Roles and responsibilities:
  - Roles and responsibilities within the development lifecycle (who is responsible for what)
  - Use of project management tools to manage the development lifecycle (e.g. Jira, 6 Sigma, Prince 2, Microsoft Project)
- Key behaviours of problem-solving:
  - Demonstrating objectivity
  - Undertaking exploration
  - Avoiding assumption
  - Managing stakeholder communication as an ongoing process particularly where stakeholders are involved in iterative developments (e.g. Minimum Viable Product (MVP))
  - Managing stakeholder expectations to avoid scope creep
  - Identifying development risks.

### 3. Can use analysis techniques to investigate and document an existing system

- Information gathering techniques:
  - Questionnaires (including online surveys)
  - Interviews
  - Observation
  - Documentation investigation
  - Surveys/Focus groups
- Documentation tools:
  - Data Flow Diagrams (DFD)
  - Entity Relationship Diagrams (ERD)
  - Flowcharts
  - Unified Modelling Language (UML)
  - Wireframing (for screen designs and navigation)
- Feasibility report:
  - Define the problem and its scope
  - Provide an overview of a potential new system and its rationale

- Identify and record any constraints
- Identify and record any risks.

#### 4. Can identify, design and document a possible solution

- Solutions can use any appropriate technologies (e.g. Off-the-shelf (OTS) solutions such as accounting programs or proprietary databases, tailored solutions using applications software such as MS Access or Excel, bespoke programs designed and built for a specific client and context)
- Use appropriate tools to document your proposed solution
- Justification of solution:
  - How the solution meets the brief
  - How the solution meets the needs of users
- Further improvements:
  - Additional features
  - Additional functionality.

#### 5. Can present a solution proposal to the client

- Presentation formats could include presentation slides, supporting documentation and a viva-voce
- Respond to feedback.

#### Suggested Resources

Cottrell S., 2023, Critical Thinking Skills: Effective Analysis, Argument and Reflection, Bloomsbury Academic

Brennan K.J., et al., 2022, Digital Product Management, BCS (The Chartered Institute for IT)

Bigrocks Thinking, 2022, Critical thinking, Logic & Problem Solving: The Ultimate Guide to Better Thinking, Systematic Problem Solving and Making Impeccable Decisions with Secret Tips to Detect Logical Fallacies, Independently published

Roche M., 2022, Business Communication in Plain English: How to Use Grammar, Punctuation & Style to Communicate Effectively in Business and Professional Settings: Business English Originals, IDM Business English

Kaczmarek S., Locker K., 2013, Business Communication: Building Critical Skills, McGraw-Hill

Sternad D., 2021, Solve It!: The Mindset and Tools of Smart Problem Solvers, Independently published

#### Websites

[www.skillsyouneed.com](http://www.skillsyouneed.com)

[www.coursera.org](http://www.coursera.org)

[How to develop an effective digital solution](#)

[Designing digital solutions to drive positive change in society](#)

<b>Unit 2 Programming and Scripting</b>	
<b>Unit aims</b>	<p>This unit focuses on the principles of programming and scripting using Python. Python is a general-purpose language that is used for a wide range of contexts. For example, it can be used to create applications such as utilities, web apps and bespoke applications. It can also be used for scripting. For example, for one-off, quick scripts to solve a problem. It could be used to automate common tasks or to create data pipelines (e.g. ETL). It is commonly used for AI and machine learning, for data analytics, and for the creation of simple APIs and for DevOps automation.</p> <p>Note: learners will have opportunities to explore other languages in the Advanced Programming unit for the Software Development pathway.</p>
<b>Unit level</b>	4
<b>Unit code</b>	A/650/8503
<b>GLH</b>	40
<b>Credit value</b>	10
<b>Unit grading structure</b>	Pass, Merit and Distinction
<b>Assessment guidance</b>	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.</p> <p>To study and achieve this unit students will need to have access to a Python interpreter. In addition, there are many IDEs that could be downloaded and installed, and which one learners choose to use will depend on their operating system and platform. Here are some common examples:</p> <p><a href="#">Python Releases for macOS   Python.org</a>  <a href="#">Python Releases for Windows   Python.org</a>  <a href="#">Visual Studio Python IDE - Python Development Tools for Windows (microsoft.com)</a></p> <p>You may find it easier to instruct learners to download whichever version you will be using during any formal classes as the interfaces can look quite different.</p>

Learning outcomes	Assessment criteria		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Understand principles of computer programming.	1.1 Explain key programming paradigms. 1.2 Explain the language constructs to be used within a program, with an emphasis on Python. 1.3 Explain the key differences between programming and scripting with examples.		
2. Can design a computer program to a client brief with a consideration of the user interface.	2.1 Design and document the functionality for a computer program to meet a client brief. 2.2 Design and document the user interface to meet a client brief.	2M1 Justify your design decisions for both the functionality and the user interface.	
3. Can develop a computer program to a client brief.	3.1 Implement the solution in line with the design to meet the needs of the client brief, demonstrating an understanding of appropriate coding standards in Python. 3.2 Apply validation to improve integrity of inputs.	3M1 Demonstrate Git repository commands and their purpose.	3D1 Evaluate the value of version control in the development of coded solutions.

4. Can test and evaluate a computer program.	4.1 Create a test plan to test a computer program that has been developed. 4.2 Analyse test results against expected results to identify discrepancies and corrective actions. 4.3 Carry out user testing.	4M1 Make recommendations in relation to solution handover.	4D1 Evaluate the solution against the original client brief.
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## Indicative Content

### 1. Understand principles of computer programming

- Programming paradigms: Procedural programming, Modular programming, Functional programming, Object-oriented programming
- Programming language constructs: Variables, Constants, Operators, Sequence, Selection and Iteration, Python Libraries, Built-in functions and User Defined functions
- Difference between programming and scripting
- Typical uses of scripting: extracting data from datasets, data pipelines, back-end web development and task automation.

### 2. Can design a computer program to a client brief with a consideration of the user interface

- Solution design tools: Flow charts, Entity Relationship Diagrams (ERDs), Data Flow Diagrams (DFDs), Unified Modelling Language (UML), data models, pseudocode, user stories
- Interface design tools: Storyboards, Navigation, Screen content, Wireframe (e.g. using suitable UI/UX tools, such as Sketch, Proto.io, LucidChart, Adobe XD, FlowMapp).

### 3. Can develop a computer program to a client brief

- Code the solution using programming constructs
- Validation (e.g. user input)
- Style guide - PEP 8 Style Guide for Python Code:
  - Naming conventions
  - Code layout
  - Indentation
  - Comments
  - Whitespace in Expressions and Statements
- Version control:
  - Role of version control software in development activities
  - Common Git repository commands: git add, git commit, git push, git pull, git checkout.

#### 4. Can test and evaluate a computer program

- Testing a program:
  - Identification of program elements that require testing.
  - Creation of a test plan
  - Applying testing programming practices (black box and white box)
  - Testing data structures and logical pathways
  - Testing validation
  - User testing
- Analysing test results:
  - Production of testing documentation and reports
  - Annotation to demonstrate corrective action
- Solution handover:
  - The role and importance of software documentation
  - Recommendations for integration, installation, deployment, maintenance
- Implementation strategies:
  - Direct
  - Parallel
  - Phased
- Check solution meets client expectations:
  - User acceptance
  - Evaluation of solution against original brief.

#### Suggested Resources

Fishpool Bernie and Fishpool Mark, 2022 Software Development in Practice, BCS (The Chartered Institute for IT)

Ellison Brady, 2022 Python: 3 books in 1- Your complete guide to python programming with Python for Beginners, Python Data Analysis and Python Machine Learning Paperback, Self-published

Ledger Leonard J., 2022 Python Programming For Beginners: The Ultimate Crash Course to Learn Python Coding Quickly and Easily | Step-by-Step Guide With Hands-on Exercises & Beginners Projects, Self-published

Sanders, Willard D., 2020 Learn python programming for beginners: A beginner's guide comprehending python. Develop your programming skills and learn all the tricks with this crash course, Self-published

Ramalho, Luciano, 2022 Fluent Python: Clear, Concise and Effective Programming, O'Reilly Media

#### Websites

[www.skillsyouneed.com](http://www.skillsyouneed.com)

[www.coursera.org](http://www.coursera.org)

[www.geeksforgeeks.org/introduction-to-programming-languages/](http://www.geeksforgeeks.org/introduction-to-programming-languages/)

[www.python.org](http://www.python.org)

[www.codingground.com/learn-python/](http://www.codingground.com/learn-python/)

<b>Unit 3 Data and Database Systems</b>			
<b>Unit aims</b>	<p>All IT professional roles will bring practitioners into contact with data and databases. For example: Analysts will gather, organise and manipulate data for use in a variety of ways; Cyber Security Technicians will manage the privacy and security of data and data systems; Software Developers and DevOps Engineers will create and maintain systems containing complex data.</p> <p>This unit introduces learners to data and database systems by exploring the concept of data, data modelling and creating systems to hold and manage data. It takes a real-world view of database and database design, without focusing on data manipulation, which will be introduced in a later unit.</p>		
<b>Unit level</b>	4		
<b>Unit code</b>	D/650/8504		
<b>GLH</b>	60		
<b>Credit value</b>	15		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.</p> <p>Although this unit focuses on databases and database systems, learners will not be required to build the database that they design. In terms of tools they could use to support this unit, they have the option of using specific diagramming software for example:</p> <p><a href="https://www.lucidchart.com/">https://www.lucidchart.com/</a>  <a href="https://miro.com/">https://miro.com/</a>  <a href="https://draw.io/">https://draw.io/</a></p> <p>Equally, learners could draw the diagrams by hand, as long as they are neat and legible.</p>		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Understand what is meant by data.	1.1 Describe different categories of data. 1.2 Explain the differences between structured and unstructured data. 1.3 Explain the concept of data types and structures, and the	1M1 Assess the importance of data classification.	1D1 Evaluate the importance of data to an organisation.

	importance of selecting the most appropriate data type of an identified data item.		
2. Understand database design.	<p>2.1 Explain different types of database.</p> <p>2.2 Describe the different relationship types, join types and types of key.</p> <p>2.3 Explain normalisation and functional dependency within a database.</p> <p>2.4 Describe database administration including integrity and security control.</p>	2M1 Assess the integrity constraints within relational models.	
3. Design a database system.	<p>3.1 Design a relational database to meet a specified design brief.</p> <p>3.2 Apply normalisation to a series of documents to 3NF.</p> <p>3.3 Use database documentation tools to document a design to meet a design brief.</p> <p>3.4 Present your design to the client using a suitable format.</p>	3M1 Identify the opportunities to implement validation and verification to enhance the integrity of the database.	3D1 Evaluate database design and how it meets the technical requirements of the brief following feedback.

## Indicative Content

### 1. Understand what is meant by data

- Categories of data: open and public data, private data, internal data, research data, big data
- Importance of data classification:
  - Compliance with regulations and guidelines
  - Protect data integrity, confidentiality and security
  - Usage rights for levels of access depending on sensitivity
- Structured data: Data is highly organised, factual or based on fact, quantitative. It is usually numeric, textual and contains dates; can be displayed in rows and columns (tabular)

- Semi-structured data: (e.g. log files which can combine structured with unstructured data).
- Unstructured data: Data is varied (e.g. images, audio or video files, emails); cannot be displayed in rows and columns and would be considered qualitative (so could include subjective data).
- Data Types and Structures:
  - Text (character, string)
  - Numeric (byte, integer, long, floating point/decimal, complex)
  - Boolean
  - Date and time
  - Timestamp
  - Sequence (array, stack, queue, linked list, set, dict).
- Importance of understanding data types and structures:
  - In programming:
    - i. to ensure inputs are correctly captured and stored for use in the program (e.g. losing numbers after the point if data incorrectly identified as an integer rather than a float (decimal) in typed languages)
    - ii. to be able to format outputs
    - iii. to be able to access built-in libraries of functions to manipulate data
  - In databases:
    - i. To ensure that identified fields can accurately accept inputs
    - ii. to make use of input masking and validation
    - iii. to be able to calculate the amount of storage needed.

## 2. Understand database design

- Database types: Flat database (row or column based), relational database, NoSQL versus SQL approach.
- Database relationships: types of relationships (1:M, M:M and 1:1 and the implications of each), types of joins (inner, outer (left, right and full)), keys (primary, foreign, compound).
- Integrity constraints: referential integrity, domain integrity, entity integrity, foreign key integrity
- Functional dependencies: schema normalisation, normal forms (EF Codd) (UNF, 1NF, 2NF, 3NF)
- ACID principles (atomicity, consistency, isolation, durability)
- Database schema
- Database administration: the role of the DBA, DBA skills and responsibilities.

## 3. Design a database system

- Relational database design fundamentals, logical vs. physical design
- Database documentation tools: ERD, DFD, data dictionary
- Database evaluation: performance evaluation benchmarks, verification, validation.

<b>Unit 4 Computer Systems, Networks and Security</b>			
<b>Unit aims</b>	This unit has three primary focuses. Firstly, it explores the technologies that enable computing such as memory, programs and logic. It then examines both hardware and software, connectivity and networking principles before examining risks to computer systems and data. Learners will explore a range of risks, attack techniques, security tools and a range of incidents and vulnerabilities. This is appropriate underpinning knowledge for any IT practitioner/professional who should have a basic understanding of computer security.		
<b>Unit level</b>	4		
<b>Unit code</b>	F/650/8505		
<b>GLH</b>	50		
<b>Credit value</b>	10		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Understand enabling principles.	1.1 Describe common units and metrics. 1.2 Explain the role of different types of memory. 1.3 Explain data representation. 1.4 Explain stored programs and languages. 1.5 Explain basic logic.		
2. Understand hardware and software.	2.1 Describe the components of different computer systems. 2.2 Explain the use of different software applications to meet specific purposes. 2.3 Explain the principles of networks and network connectivity.	2M1 Assess the function of components within a chosen computer system.	2D1 Recommend and justify a hardware and software solution to meet specific purposes.

<p>3. Understand the risks to computer systems and data.</p>	<p>3.1 Explain a range of attack techniques.</p> <p>3.2 Examine the nature of security incidents.</p> <p>3.3 Describe security tools and techniques used to mitigate against a range of attacks.</p> <p>3.4 Explain a range of security processes and their importance.</p>	<p>3M1 Assess the suitability of a range of security processes and the use of encryption to meet specific purposes.</p>	
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## Indicative Content

### 1. Understand enabling principles

- Common units and metrics
  - Key number bases and their uses, e.g. binary, octal, hexadecimal, base64
  - Use of IEC binary prefixes (i.e. kibi versus kilo)
  - Capacity/sizes, e.g. Kb, Mb, Gb, Tb etc
  - Speeds, e.g. data transfer rates such as megabytes per second (MB/s), megabits per second (Mbit/s)
  - Frequency (e.g. Mhz, Ghz etc)
  - Time (e.g. micro seconds, nano seconds)
- Computer memory
  - Volatile vs. Non-volatile
  - ROM, RAM, EPROM/EEPROM, NAND flash memory
- Data representation
  - Data versus information
  - Data representation, e.g. Character sets (ASCII, Unicode, UTF8 etc.)
  - Use of parity, checksum (e.g. MD5)
- Stored programs and languages
  - CPU architecture
  - Fetch-execute cycle
  - Low level and High-level languages
    - Machine code
    - Assembly language
    - Programming Languages (e.g. Python, Java, Ruby, Rust, C, C++)
  - Translators, e.g. compilers, interpreters
  - Virtual machines and byte code
- Basic logic
  - Boolean algebra
  - Logic gates
    - AND, OR, Not, XOR

### 2. Understand hardware and software

- Hardware:

- Motherboard, RAM, CPU, BIOS/EFI chip, CMOS, GPU, Expansion slots, Trusted Platform Module (TPM)
- Input devices, e.g. keyboard, mouse, scanner, camera, microphone
- Output devices, e.g. monitor, printer (2D, 3D), speakers
- Communications, e.g. Network Interface Card (NIC)
- Backing storage:
  - Hard Disk Drive (HDD)
  - Solid State Drive (SDD)
  - Universal Serial Bus (USB) flash drive
  - Writeable optical drives
  - Network Attached Storage (NAS)
  - Cloud storage
- Software:
  - Operating Systems:
    - The concepts, main functions and features of at least three Operating Systems (OS) (e.g. command line interface (CLI), graphical user interface (GUI)), and their security functions and associated security features.
  - Utility Software
  - Applications/Apps
- Firmware:
  - BIOS, Flashing (updates)
- Connectivity:
  - Wired, e.g. Cat 6, Optical, Ethernet over Power line (EOP)
  - Wireless, e.g. Bluetooth, WiFi 2.4/5 Ghz, Cellular, i.e. 3G, 4G, 5G
- Principles of networks:
  - Simple topologies (star, ring, mesh etc)
  - Types of network, e.g. PAN, LAN, MAN, WAN
  - OSI and TCP/IP models, data, protocols and how they relate to each other; the main routing protocols; the main factors affecting network performance including typical failure modes in protocols and approaches to error control; virtual networking
  - Binding network services; sockets and ports

### 3. Understand the risks to computer systems and data

- Risks: Computer threats, Digital crime, Privacy, Security, Impact of e-everything (e.g. e-marketing, e-banking).
- Attack techniques: Main types of common attack techniques; also the role of human behaviour, including the significance of the 'insider threat'. Including: how attack techniques combine with motive and opportunity to become a threat. Techniques and strategies to defend against attack techniques and mitigate hazards.
- Security tools and techniques: A range of modern security tools and techniques - e.g. threat modelling, vulnerability scanning and dependency checking, with a general awareness of penetration testing - in order to deal with threats and attack vectors within code and across the cyber domain.
- Nature of security incidents:

- Application of overly restrictive controls without understanding business needs and processes that may be impacted by the controls
- Lack of suitably defined organisational processes
- Unexpected pressures of business
- Accidental exposure to threats via the internet
- Weakness not identified due to insufficient testing
- The human element
- Common vulnerabilities: function and features of significant digital system components; typical architectures; common vulnerabilities in digital systems; principles and common practice in digital system security
- Software: anti-virus, anti-spyware, anti-phishing, anti-ransomware, Intrusion Detection Systems (IDS).
- Reasons for regular software updates and security patches.
- Hardware: TPM modules, Drive encryption (BitLocker)
- Security processes:
  - Authentication vs. authorisation; secure logins
  - User permissions, e.g. admin versus normal user
  - File permissions, e.g. read only, write, modify etc.
  - Logging and regular monitoring
- Hashing (as one-way cryptographic function)
- Encryption and cipher suites, strengths
- Virtual Private Networks (VPN)
- HTTPS (TLS), SSL Certificates
- Legislation overview

## Suggested Resources

Thornton G., Jones C., 2023, Computer and Network Technology, BCS Level 4 Certificate in IT study guide, BCS (The Chartered Institute for IT)

Hodson C.J., 2019, Cyber Risk Management: Prioritize Threats, Identify Vulnerabilities and Apply Controls, Kogan Page

Englander I., Wong W., 2021, The Architecture of Computer Hardware, Systems Software, and Networking: An Information Technology Approach, 6<sup>th</sup> Edition, Wiley

Mind Tools, 2023, Logic in Computer Science for Everyone: A Practical Guide with Real-World Scenarios, Independently Published

## Websites

[www.skillsyouneed.com](http://www.skillsyouneed.com)

[www.coursera.org](http://www.coursera.org)

[Info Security Magazine](#)

[8 hot networking technologies for 2023](#)

[What is network security?](#)

<b>Unit 5 Legislation, Regulation, Ethics and Codes of Practice</b>			
<b>Unit aims</b>	IT practitioners in the modern world should understand how legislation and regulation applies in the IT sector. They should also understand why organisations create policies and procedures to help them to operate on a day-to-day basis. They should have an appreciation of a range of ethical issues and should be aware of the role of professional bodies in setting standards to maintain the industry in the industry. Learners should also be familiar with the concept of professional certification. For example, there are some organisations that require specific professional certification as part of their pre-requisites for industry jobs.		
<b>Unit level</b>	4		
<b>Unit code</b>	H/650/8506		
<b>GLH</b>	60		
<b>Credit value</b>	10		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.</p> <p>NB. Although much of the legislation for this unit is UK and EU focused, there is evidence that many other countries are seeking to align their own legislation with the UK and EU. Tutors should be aware of how their own country's legislation compares with the UK and EU and should teach accordingly.</p>		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Understand current legal and regulatory issues in IT.	1.1 Describe key legislation in relation to data protection, digital systems and cyber security. 1.2 Explain the relationship between legislation/regulation and data/systems security. 1.3 Explain the importance of complying with legislation in relation to human computer interaction design.	1M1 Assess the importance of organisations meeting the requirements of current legislation and regulation.	1D1 Evaluate the impact of current legal and regulatory issues on a chosen organisation.

2. Understand current ethical issues in IT.	2.1 Describe the concept of ethical best practice. 2.2 Explain ethical issues in relation to IT roles. 2.3 Explain ethical issues in relation to emerging technologies.		
3. Understand the need to create organisational policies and procedures.	3.1 Examine the role of organisational policies and the need for standardised procedures in a range of contexts.	3M1 Assess the importance of standardised policies and procedures.	3D1 Evaluate the impact of standardised policies and procedures.
4. Understand the role of professional bodies and industry certification in maintaining professional standards in industry.	4.1 Describe the core competencies and skills required by an IT professional. 4.2 Identify professional bodies and industry certification that would be beneficial to those seeking work in a chosen professional IT pathway.	4M1 Assess the role of professional bodies and industry certification in the maintenance of professional standards in the industry.	

## Indicative Content

### 1. Understand current legal and regulatory issues in IT

- Data Protection: laws, regulations & standards relating to personal data and privacy (e.g. Data Protection Act 2018 implementing General Data Protection Regulation UK).
- Use of digital systems (e.g. Computer Misuse Act 1990).
- Regulatory standards for cyber security, intelligence collection and law enforcement (e.g. Intelligence Services Act 1994, Regulation of Investigatory Powers Act 2000), standards for good practice in cyber security (e.g. ISO 27001, CyberEssentials, NIST).
- IT contracts: confidentiality agreements, Intellectual Property.
- Impact of legislation in HCI design: functionality, usability, reliability, efficiency, maintainability, portability.
- End User License Agreement (EULA).
- Responsibilities: understanding that IT professionals need to observe legal and regulatory requirements when creating systems for users in other countries (e.g. US Data Privacy Laws in 2023, African Union's Convention on Cyber Security and Personal Data Protection).
- Importance of local issues: creating online games or app content for countries where gambling or other activities are banned, or where information or access to specific content is prohibited by governments.

- Relationship between legislation/regulation and data/systems security: promotes best practice, sets benchmarks for expected behaviours.
- Importance of observing the legal and regulatory requirements: safety of employees, consumer protection, protection of intellectual property (copyright and patents), avoid reputational damage, avoid penalties and/or sanctions.

## **2. Understand current ethical issues in IT**

- Ethical best practice: own responsibilities, responsibilities in relation to colleagues, responsibilities in relation to society (e.g. confidentiality, integrity, relationships), issues raised by users connecting their own kit to organisational systems.
- Ethics in IT roles: systems design and development, cyber security, digital marketing (e.g. data gathering, manipulation and use of personal data, marketing rules in relation to unsolicited sign-ups, channels of contact).
- Ethics in emerging technologies:
  - misuse of personal information
  - misinformation and the potential for using deep fakes in marketing
  - lack of oversight and acceptance of responsibility
  - autonomous technologies
  - dilemmas: potential for health tracking, genetic engineering, weaponisation of technology.

## **3. Understand the need to create organisational policies and procedures**

- Role of organisational policies and the need for standardised procedures:
  - information security management (e.g. governance, organisational structure, roles, policies, in-house computer use rules, standards, guidelines and how these all work together to deliver the identified security outcomes)
  - data management (e.g. storage and treatment of GDPR sensitive data)
  - access control
  - concept of data security in three key states (at rest, in transit, in processing)
  - electronic messaging
  - monitoring
  - remote access
  - server security.
- Importance of standardised policies and procedures:
  - set expectations for employees and managers
  - promotes shared culture
  - promotes transparency and formalises an accountability structure
  - sets out a plan for daily operations
  - promotes efficiency.
- Impact of standardised policies and procedures:
  - can take time to set up
  - may require some financial investment
  - some staff may be resistant to change enforced by new policies and procedures.

## **4. Understand the role of professional bodies and industry certification in maintaining professional standards in industry**

- Professional bodies for the IT industry and industry certification, e.g.:
  - BCS (The Chartered Institute for IT), who offer BCS membership and the opportunity to be included on the RITTech register of technical professionals

- IEEE Computer Society for Electrical and Electronics Engineers
- National Cyber Security Centre (NCSC) in the UK
- National Cyber Security Alliance (NCSA) in the US
- CIS (Centre for Internet Security)
- IoA (The Institute of Analytics and Data Science)
- ITIL Foundation (Information Technology Infrastructure Library)
- PRINCE2 (Project Management certification)
- APM (Association for Project Management).

Although these professional bodies are recognised in many countries around the world, the teacher should add in any relevant local examples.

- Role of professional bodies:
  - set expectations and (sometimes) assess professional practice
  - provide opportunities for professional development
  - provide access to professional networks
  - contribute to codes of conduct that guide professional behaviour
  - publish journals and books that promote best practice.
- IT professional core competencies:
  - technology awareness
  - understanding business practice
  - being adaptable
  - designing technical solutions
  - managing projects
  - communication
  - influencing and persuading.
- Skills required for IT professionals:
  - analysis
  - design
  - development.

## Websites

[www.skillsyouneed.com](http://www.skillsyouneed.com)

[www.coursera.org](http://www.coursera.org)

<https://www.jisc.ac.uk/guides/networking-computers-and-the-law/laws>

<https://www.legislation.gov.uk/ukpga/1990/18/contents>

<https://u.ae/en/information-and-services/justice-safety-and-the-law/cyber-safety-and-digital-security>

<https://www.cio.com/article/189326/how-uae-s-new-data-law-will-change-the-way-enterprises-use-personal-data.html>

<https://www.icdigital.com/post/uae-federal-data-protection-law-for-cybersecurity>

<https://www.lexology.com/library/detail.aspx?g=baef72ee-10bd-4eb9-a614-a990c236bb45>

<https://www.dataguidance.com/jurisdiction/africa>

<https://digital-strategy.ec.europa.eu/en/policies/cybersecurity-act>

<https://gdpr.eu/what-is-gdpr/>

<https://www.computing.co.uk/news/4076979/europes-online-rules-affect-uk-businesses>

<b>Unit 6 Organisational Data Architecture</b>			
<b>Unit aims</b>	This unit teaches the learners to appreciate the organisational context of data and its importance in modern organisations. It does so by making learners aware of how data is managed, how it is structured, and how data and its analysis impacts the operation of an organisation.		
<b>Unit level</b>	4		
<b>Unit code</b>	K/650/8535		
<b>GLH</b>	40		
<b>Credit value</b>	10		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Understand the principles of organisational data architecture.	1.1 Explain the importance of data as a business resource. 1.2 Describe the roles played by operational and analytical systems. 1.3 Describe the importance of database locations.	1M1 Compare the development effort and benefits achieved by activities undertaken through an ETL process.	1D1 Evaluate the technical design choices usually employed in operational and analytical systems.
2. Understand a common data analysis lifecycle of their choice.	2.1 Describe each stage and how they follow each other. 2.2 Outline the activities and outcomes of each step.	2M1 Compare the key features of a chosen model with other models.	
3. Understand a simple entity-relationship model.	3.1 Explain the difference between a 'type' and an 'instance'. 3.2 Identify types and their attributes.		3D1 Evaluate the importance of understanding the directions of relationships and how this impacts the

	3.3 Identify relationships between types and their cardinalities, if applicable.		navigability between types.
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## Indicative Content

### 1. Understand the principles of organisational data architecture

- The importance of data as a business resource in addition to traditional business resources such as:
  - Physical
  - financial
  - intellectual
  - human.
- Data generated by business departments:
  - Finance; structured, well defined, reconciled, confidential data.
  - Human resources; structured records, unstructured documents, sensitive data.
  - Customer services; structured sales and customer data, unstructured emails, and voice calls.
  - Senior management/company board; summarised, high level, interpreted data.
- How data is stored and exchanged between departments in an enterprise:
  - Unstructured documents and reports; structured spreadsheets, databases, and APIs.
  - Unprotected email attachments vs protected document sharing, such as SharePoint.
- Master data management; data stored in multiple systems (aka. fragmentation):
  - The golden source of a data item.
- The difference between operational systems and analytical systems:
  - Processing needs in transactional processing; needing to process one record at a time.
  - Bulk/batch processing in analytical systems; needing to process large number of records and write-once-read-many (WORM).
  - Data models; normalised vs flat/tabular.
- Distributed databases; on-premises solutions vs outsourced vs cloud solutions; the impact of non co-location of datasets when performing analysis.

### 2. Understand a common data analysis lifecycle of their choice

- A common data lifecycle model such as CRISP-DM (alternatives include SEMMA, KDD or a custom/industry specific model) – typical stages include:
  - Business Understanding; stakeholder motivations, analysis objectives, requirements description.
  - Data Understanding; listing data sources, considering possible data quality issues.
  - Data Preparation; common data analysis methods described below.
  - Modelling; evaluate, select, and apply modelling techniques, loopback to data preparation, statistical modelling and visualisation techniques are covered in subsequent units.
  - Evaluation; testing the accuracy of the models, collaboration with stakeholders.

- Deployment; presenting them to stakeholders, integrating models into systems/user interfaces.
- Typical characteristics and key features could include:
  - Cyclicity/iterative approach; benefits vs drawback of cyclical models.
  - Does not prescribe tools or methods.
  - Focus on business goals.
  - Industry standard model.
- The requirements of the inputs to each step and to the outputs of each step:
  - Business Understanding; build on prior data analysis, establishes framework/preliminary plan.
  - Data Understanding; build on knowledge of the business, establishes familiarity with the data.
  - Data Preparation; build on data familiarity, establishes well-structured data.
  - Modelling; build on robust data, establishes a set of models.
  - Evaluation; build on models, establishes the most appropriate model(s).
  - Deployment; build on suitable models, realises the business value of the analysis.
- The skills and people involved in each step.

### 3. Understand a simple entity-relationship model

- The popular UML Class Diagram notation:
  - Alternatives such as Barkers, IDEF1X or any other recognised notation, are acceptable.
- The notation and the modelling concepts typically represented by:
  - Entities: type.
  - Relationships: type, cardinality, role descriptions, direction/navigation.
  - Attributes: type, name, value.
- Operation signatures (parameters and return types), operation name.
- The business relationships described by an entity-relationship diagram.

### Suggested Resources

Rasmussen, R., Gulati, H., Joseph, C., Stanier, C. and Umegbolu, O. (2019) Data Analyst: Careers in data analysis, Rasmussen, R. (ed.), BCS Learning and Development.

Parkinson, J. (2022) Introduction to Data Architecture: A foundation covering the key essentials, Holifast Limited

Ben Zahra Anouar (2023) Azure Modern Data Architecture: A Guide to Design and Implement Modern Data Solutions, Self-published

Malaska T. and Seidman, J. (2018) Foundations for Architecting Data Solutions: Managing Successful Data Projects, O'Reilly

### Websites

[www.skillsyouneed.com](http://www.skillsyouneed.com)

[www.coursera.org](http://www.coursera.org)

<https://www.bmc.com/blogs/data-architecture/>

<https://www.cio.com/article/190941/what-is-data-architecture-a-framework-for-managing-data.html>

<https://www.simplilearn.com/what-is-data-architecture-article>

<https://www.snowflake.com/trending/data-architecture-principles>

<https://rivery.io/blog/what-is-data-architecture/>

<b>Unit 8 Data Preparation and Quality</b>			
<b>Unit aims</b>	This unit helps learners develop an understanding of basic data extraction, manipulation, combination and common data quality issues. It equips the learners with practical skills needed to perform basic data analysis tasks with SQL and in a spreadsheet.		
<b>Unit level</b>	4		
<b>Unit code</b>	M/650/8537		
<b>GLH</b>	40		
<b>Credit value</b>	10		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.</p> <p>To complete this unit learners must have access to a suitable DMBS that allows them to work with SQL commands. This could be MySQL, MariaDB, Oracle. Learners could also use MS Access, but if they do this, they must write the SQL commands rather than using query wizards. Learners will also need spreadsheet software such as MS Excel.</p>		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Can undertake basic data extraction and manipulation with SQL queries.	1.1 Carry out simple data extraction using SELECT, WHERE, and FROM clauses. 1.2 Manipulate the product of analysis using ORDER BY and GROUP BY clauses. 1.3 Use six of functions and operators in a data analysis.	1M1 Annotate the code with appropriate comments. 1M2 Explain the role and importance of commenting SQL code.	
2. Understand common approaches to combining data from different sources.	2.1 Explain the need for combining data. 2.2 Describe the difference between horizontal and vertical appending	2M1 Analyse the issues of inconsistency between different datasets and how	

	data and their required conditions.	inconsistencies can be overcome.	
3. Understand quality risks inherent in data and how to mitigate or resolve these.	3.1 Explain the importance of clean data and the potential for data quality issues to be costly. 3.2 Explain how different types of data quality errors can occur.	3M1 Analyse the actions to correct data quality issues and their associated costs.	3D1 Justify the cost of maintaining ongoing data quality monitoring and remediation in the enterprise.

## Indicative Content

### 1. Can undertake basic data extraction and manipulation with SQL queries

- SELECT statement syntax:
  - Star syntax, comma separated columns, DISTINCT.
  - FROM single table
  - Renaming/aliasing columns
- WHERE conditions:
  - Text literals, numeric literals
  - Comparison operators; equal, greater than, greater than or equal, less than, less than or equal, not equal, BETWEEN range, IN list
  - Boolean operators; AND, OR, NOT, use of brackets
- FROM clause; joining tables:
  - ON keyword, INNER join, LEFT join, RIGHT join, OUTER join, FULL join
  - Self joins, cross joins (aka. cartesian joins)
  - Joining multiple tables
- ORDER BY keyword:
  - Comma separated columns.
  - ASC vs DESC
- SQL aggregate functionality:
  - GROUP BY and HAVING clauses syntax.
  - Selected columns must be aggregated or appear in GROUP BY clause
  - Aggregate functions; MIN, MAX, SUM, AVG, COUNT
- Functions and operators (function names and syntax can vary by RDBMS provider):
  - General functions; NVL, NVL2, DECODE, COALESCE, NULLIF
  - Arithmetic operators; add, subtract, multiply, divide and modulo
  - Type conversion; implicit vs explicit, TO\_CHAR, TO\_DATE, TO\_NUMBER
  - String functions; LOWER, UPPER, INITCAP, CONCAT, LENGTH, SUBSTR
  - Date functions; NOW, CURDATE, CURTIME, DATE, EXTRACT, DATE\_ADD, DATE\_SUB, DATEDIFF, DATE\_FORMAT
  - Numeric functions; maths functions, SQRT, PI, SQUARE, ROUND, CEILING, FLOOR, INSTR, LPAD, RPAD, TRIM, REPLACE

- IF function and CASE statements using WHEN, THEN, ELSE, END
- Advanced functions (e.g. RDBMS specific functions); CURRENT\_USER; DATABASE, VERSION
- Comparison functions for NULL (IS NULL and IS NOT NULL)
- Comments in SQL code; double hyphen lines are not executed
- Set operators; UNION, UNION ALL, EXCEPT, INTERSECT
- Subqueries (aka. nested queries):
  - FROM clause, WHERE clause, HAVING clause
  - ANY, ALL, EXISTS conditions
  - Performance of sub-query vs joins

## 2. Understand common approaches to combining data from different sources

- Horizontally appending rows using SQL set operators
- Vertically appending columns using SQL join statement
- Three value logic; TRUE, FALSE and NULL
- Missing values (aka. NULL values) coming from horizontal or from vertical appending
- Inconsistency between different datasets:
  - Aggregation levels, e.g. one dataset cover people while another cover households
  - Groupings; one dataset group age by decade (e.g. 20ies, 30ies etc) while another group by generations (e.g. Boomers, GenX, Millennials etc.)
  - Encodings; one dataset using numerical groups (e.g. 1, 2, 3 etc) while another use alphabetical groups (e.g. A, B, C etc.)
- Non-SQL methods for merging data sources:
  - Combining text files or spreadsheets

## 3. Understand quality risks inherent in data and how to mitigate or resolve these

- Clean data is valuable – ‘dirty’ data is less valuable and/or costly to deal with:
  - Costs: analysis time spend correcting quality, lost opportunity/inability to produce data analysis, reduced accuracy of analysis
  - Monitoring and measuring the quality of the data
  - Comparing with Management Information from Finance or Human Resource etc.
- Data accuracy:
  - Causes of inaccurate data: manual/systematic data entry errors
  - Corrective actions: correction of errors or removal of erroneous records
- Data appropriateness:
  - Causes of inappropriate data: unavailability of correct measures or difficulty in measuring the right values
  - Corrective actions: evaluating suitability of using pseudo-measures
- Data completeness:
  - Causes of incomplete data: data only from some regions, limited customer groups
  - Corrective actions: obtain missing data, consider whether limited data is representative of whole
- Data reliability:
  - Causes of unreliable data: contradictions with authoritative sources or inconsistency with alternative sources
  - Corrective actions: choose alternative sources or correct for systematic discrepancies
- Data timeliness:
  - Issues with old and stale data sets

- Corrective actions: evaluating the appropriateness of the data or seeking newer versions

### **Suggested Resources**

Rasmussen, R., Gulati, H., Joseph, C., Stanier, C. and Umegbolu, O. (2019) Data Analyst: Careers in data analysis, Rasmussen, R. (ed.), BCS Learning and Development

Forta, B. (2022) SQL in 10 Minutes a Day, 5<sup>th</sup> Edition, Sams Publishing

Nield, T. (2016) Getting Started with SQL: A Hands-On Approach for Beginners, O'Reilly

King, T. and Schwarzenbach, J. (2020) Managing Data Quality: A practical guide, BCS Learning and Development

Moses, B., Gavish, L., Vorwerck, M. (2022) Data Quality Fundamentals: A Practitioner's Guide to Building Trustworthy Data Pipelines, O'Reilly

### **Websites**

<https://www.w3schools.com/sql/>

<https://www.codecademy.com/learn/learn-sql>

<https://www.gov.uk/government/news/what-is-data-quality>

<https://www.ibm.com/topics/data-quality>

<https://icedq.com/6-data-quality-dimensions>

<https://www.udemy.com/course/data-management-d/>

<b>Unit 13 Mobile Applications Development</b>			
<b>Unit aims</b>	This unit helps learners develop the skills needed to confidently design and build simple interactive apps which can be used on common mobile devices, e.g. smartphones, tablets etc.		
<b>Unit level</b>	4		
<b>Unit code</b>	T/650/8548		
<b>GLH</b>	40		
<b>Credit value</b>	10		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.</p> <p>As no particular mobile app platform is mandated for use, this aspect may be selected at the centre's discretion and reflect local industry practice, cost factors, and/or available tooling, although Android Studio is a popular example.</p>		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Understand the user experience.	1.1 Describe the commercial drivers for mobile apps. 1.2 Describe the three different forms of mobile app implementation. 1.3 Describe different commercial platforms and their common feature sets. 1.4 Explain the different accessibility adaptations that should be catered for.	1M1 Compare the strengths and weaknesses of different forms of mobile app implementation.	

2. Can design and develop mobile apps to meet a client brief.	2.1 Prototype a mobile application for a client brief using appropriate platform guidelines. 2.2 Create a mobile application using a recommended development environment and tools.	2M1 Demonstrate the accurate measurement of sensor information on a mobile device.	2D1 Evaluate user gestures on a mobile device programmatically to affect mobile app behaviour.
3. Can test and publish mobile apps.	3.1 Demonstrate the successful debugging and testing of a mobile app.	3M1 Deploy a mobile application using appropriate methods.	

## Indicative Content

### 1. Understand the user experience

- Commercial Drivers: How the user experience sits at the heart of modern development practices in terms of strategies to understand diverse user needs, accessibility and how to drive adoption
- Implementation of mobile applications
  - Three types:
    - Native application
    - Mobile web-based applications
    - Hybrid mobile application
- Different commercial platforms: Apple iOS, Google Android
  - User perspectives:
    - Hardware platform; different models (“device fragmentation”) and specifications (screen sizes etc)
    - Hardware features, e.g. camera, sensors (accelerometer, gyroscope, digital compass, proximity sensor etc.)
    - Memory and storage, e.g. iOS and Android versions/revisions
    - Compatibility issues
- User accessibility
  - Published platform guidelines (iOS “Human Interface Guidelines”, Android etc.)
  - Considering adaptations, and accommodating users with:
    - Cognitive impairments, e.g. make data entry easier
    - Visual impairments, e.g. screen/font size, colour contrast
    - Auditory impairments, e.g. don’t rely on audio-only cues/feedback
    - Mobility impairments, e.g. simple gestures, increase tap target zones
  - Accessibility goals:
    - Perceivable information

- Operable interface
- Understandable information and functionality
- Robust, including interaction by user agents, e.g. assistive screen readers etc.

## 2. Can design and develop mobile apps to meet a client brief

- Prototyping; on paper (templates etc), online and offline prototyping and wireframe tools
- Different commercial platforms: Apple iOS, Google Android
  - Development perspectives:
    - Development tools, e.g. Xcode, Android Studio, Eclipse, IntelliJ Idea etc.
    - Programming language(s), e.g. Swift for iOS, Java or Kotlin for Android
    - Security limitations; Apple iOS is a “closed” ecosystem
    - Development and testing environments
    - Deployment options
    - User demographics
- Codeless App Development platforms
- Mobile App essential concerns
  - Design features
  - Functionality
  - UI (User interface)
  - UX (User eXperience)
- Mobile app core language
  - basics (variables, data types, operators, constructs – if statements, loops etc, lists and arrays etc)
  - functions, classes, methods, properties, and objects
  - layouts; responsive vs. exact-size
  - UI components/widgets
  - responding to events; event handlers
  - navigation
  - static images
  - sounds
  - capturing gestures
  - interacting with onboard sensors

## 3. Can test and publish mobile apps

- Testing
  - Via Physical devices
  - Via Emulators and virtual devices, e.g. AVD (Android Virtual Device)
  - Physical devices vs. emulated devices
  - Typical test types: unit test, integration, functional
  - Simulating a range of devices for compatibility:
    - Via Automated testing tools
    - Check various form factors, connectivity types e.g. wi-fi vs 4G, OS versions etc.
- Publishing
  - Apple App store for iOS mobile apps
  - Google Play store for Android apps
  - Sideloading, e.g. for Android apps without using Google Play

## Suggested Resources

Forrester Alex, et al., 2023 How to Build Android Apps with Kotlin: A practical guide to developing, testing and publishing your first Android apps, 2<sup>nd</sup> Edition, Packt

Callaghan Michael, 2020 Developing a Mobile Application UI with Ionic and React: How to Build Your First Mobile Application with Common Web Technologies: 2 (Ionic and React: Idea to App Store)

Thornton Edward, 2021 Coding Projects in Flutter: A Hands-On, Project-Based Introduction to Mobile App Development

Whitaker Rob, 2020 Developing Inclusive Mobile Apps: Building Accessible Apps for iOS and Android, Apress

## Websites

[www.accessibilitychecker.org/guides/mobile-apps-accessibility/](http://www.accessibilitychecker.org/guides/mobile-apps-accessibility/)

[www.gov.uk/guidance/make-your-website-or-app-accessible-and-publish-an-accessibility-statement](http://www.gov.uk/guidance/make-your-website-or-app-accessible-and-publish-an-accessibility-statement)

[www.gov.uk/guidance/guidance-and-tools-for-digital-accessibility](http://www.gov.uk/guidance/guidance-and-tools-for-digital-accessibility)

<https://developer.apple.com/design/human-interface-guidelines/>

<https://m2.material.io/design/introduction>

<b>Unit 18 Cyber Security Concepts</b>			
<b>Unit aims</b>	This unit helps learners understand cyber security concepts. They will understand the cyber security risks to systems, data, and assets. They will develop skills to act when detecting a cyber security event and carry out appropriate activities to contain and recover due to a cyber security incident. The learner will understand the methods used to implement appropriate security of critical services.		
<b>Unit level</b>	4		
<b>Unit code</b>	L/650/8554		
<b>GLH</b>	40		
<b>Credit value</b>	10		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Understand cyber security concepts.	1.1 Explain how cyber security assurance concepts are applied and why it matters. 1.2 Outline the tools used by cyber security teams. 1.3 Differentiate between threat intelligence and threat hunting concepts.	1M1 Analyse malicious activity using the appropriate tools and techniques.	
2. Understand risks and how to respond to cyber incidents.	2.1 Explain how attack methodology frameworks are applied. 2.2 Describe the incident management lifecycle. 2.3 Describe how vulnerability assessments are measured.		

<p>3. Understand client security requirements to derive security objectives.</p>	<p>3.1 Examine security requirements. 3.2 Outline standards and regulations that apply to cyber space. 3.3 Recommend security objectives.</p>	<p>3M1 Create a playbook based on a known vulnerability.</p>	<p>3D1 Develop a case study on a recent data breach that is relevant to a given scenario.</p>
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## Indicative Content

### 1. Understand cyber security concepts

- Cyber security concepts and why cyber security matters to business and society:
  - Loss of data required to undertake business processes
  - Diminished reputation (lack of client engagement, no longer recommended by current clients)
  - Financial penalties for non-compliance with legislation (data protection, misuse of computers)
  - Reduced profits (loss of financial details, paying to gain access to data being held by third party, fraud)
  - Increased overheads (hardware, specialist support)
  - Denial of services (access to websites, ability to place orders, access to data stored on networks)
- Security assurance concepts and how assurance may be achieved in practice including penetration testing and extrinsic assurance methods:
  - Tools used in Cyber Security e.g., Kali, Parrot OS, Backbox. Horizon scanning including use of recognised sources of threat intelligence and vulnerabilities
- The difference between threat intelligence and threat hunting; threat intelligence is the data that has been collected and analysed by automatic security systems; this is then used in threat hunting to start looking for the 'potential bad actor' on the network; this hunt can in itself identify new threats or a false positive
- The significance of identified trends in cyber security threats and how to deal with attack techniques:
  - Zero-day hazards
  - Ransomware
  - Phishing
  - Supply chain attacks
  - Social engineering

### 2. Understand risks and how to respond to cyber incidents

- Risk assessment and audit methodologies and approaches to risk treatment:
  - fault tree analysis
  - failure mode effect critical analysis (FMECA)
  - Central Computer and Telecommunications Agency (CCTA) risk analysis and management methodologies

- Approaches to identifying the vulnerabilities in organisations and security management systems:
  - Network monitoring
  - Penetration testing
  - Permission management - Access control (mandatory access control (MAC)), discretionary access control (DAC), attribute-based access control (ABAC), role-based access control (RBAC))
- The role of the risk owner in contrast with other stakeholders
- Cyber incident response and management processes/the incident management lifecycle:
  - Threat identification
  - Security of information
  - Detection of intrusions and attacks
  - Response to intrusion and attacks
  - Rebuild and recover
- Evidence collection/preservation requirements to support incident investigation

### 3. Understand client security requirements to derive security objectives

- Analyse employer or customer requirements to derive security objectives
- Proposed security objectives/measures in the context with reasoned justification
- Applying lifecycle and service management practices to an established standard e.g., Information Technology Infrastructure Library (ITIL), National Institute of Standards and Technology (NIST), the Cybersecurity Framework's five functions.
- Cyber Security response playbook: this is a plan that sets out the steps that will need to be taken in the event of a security incident

### Suggested Resources

Patu V. and Yamamoto, 2013, How to develop Security Case by combining real life security experiences (evidence) with D-Case, Procedia Computer Science Vol 22 pages 954-959

Charles J. Brooks, Christopher Grow, Philip A. Craig, Donald Short, Cybersecurity Essentials, Wiley 2018

Raef Meeuwisse, Cybersecurity for Beginners, Kogan Page Publishers, 2018

P.W. Singer and Allan Friedman, Cybersecurity and Cyberwar: What Everyone Needs to Know, Oxford University Press, 2014

### Websites

[www.nist.gov/cyberframework](http://www.nist.gov/cyberframework)

<http://csrc.nist.gov/>

<https://www.bcs.org/articles-opinion-and-research/the-biggest-cyber-attacks-of-2022/https://www.ncsc.gov.uk/section/keep-up-to-date/threat-reports?q=&defaultTypes=report&sort=date%2Bdesc>

<https://www.nist.gov/itl/smallbusinesscyber/cybersecurity-basics/case-study-series>

<b>Unit 21 Synoptic Computing Project</b>			
<b>Unit aims</b>	This unit is designed to enable learners from any pathway to resolve a business problem or show how a business opportunity could be pursued using appropriate tools and technologies. The project should be a suitable match to their study pathway and should make use of the knowledge and skills gained when studying the Diploma and Extended Diploma programmes.		
<b>Unit level</b>	4		
<b>Unit code</b>	H/650/8560		
<b>GLH</b>	40		
<b>Credit value</b>	10		
<b>Unit grading structure</b>	Pass, Merit and Distinction		
<b>Assessment guidance</b>	<p>In order to achieve this unit, learners must produce work which demonstrates achievement of the learning outcomes at the standards provided by the assessment criteria. To achieve a merit or distinction grade, the learners must demonstrate that they have achieved all the criteria set for these grades.</p> <p>Learners may implement and test the solution if they choose to as they may feel it will help with the evaluation. However, this unit's purpose is to allow learners to demonstrate that they can draw together the technical knowledge and learned skills needed to design a solution for their pathway, not deliver one.</p> <p>This is the synoptic unit for the qualification and should be delivered as the final unit for learners in their qualification.</p>		
<b>Learning outcomes</b>	<b>Assessment criteria</b>		
The learner will demonstrate that they:	The learner can:		
	<b>Pass</b>	<b>Merit</b>	<b>Distinction</b>
1. Can identify and investigate a business problem or opportunity that could benefit from a computing solution.	1.1 Identify and define a problem or opportunity that would benefit from a computing solution, defining its scope and its key stakeholders. 1.2 Explain why solutions should meet the needs of project stakeholders. 1.3 Define a series of metrics that will be used to measure the	1M1 Justify your choice of metrics that will be used to measure success.	

	success of the project.		3D1 Evaluate your approach to the project and explain how you demonstrated best practice.
2. Can use appropriate tools to design a solution and plan its implementation and testing.	2.1 Use a range of tools to design a potential solution to the problem or opportunity. 2.2 Document a plan to implement the solution. 2.3 Explain the testing strategies that will be used to test the solution.	2M1 Justify your choice of design tools in the context of this project.	
3. Can demonstrate an understanding of professional best practice.	3.1 Explain the skills and behaviours that would be needed in a team context to ensure effective working. 3.2 Communicate your project proposal, design, implementation and testing plan to an audience. 3.3 Explain any ethical or legislative considerations in relation to your solution.	3M1 Justify your choice of communications methods, demonstrating an understanding of the target audience.	

## Indicative Content

### 1. Can identify and investigate a business problem or opportunity that could benefit from a computing solution

- Type of problem or opportunity: e.g.
  - data analysis, data visualisation, big data
  - software development, web development, mobile app development
  - network implementation or configuration, cyber security consultation, business security risk assessment
- Project stakeholders: e.g.

- internal: users, teams, departments, business owners, directors, employees, shareholders
- external: external client or customer and their users, suppliers, the public, government, local community
- Metrics to measure the success of the project: e.g.
  - business outcomes (gross profit margin)
  - Key Performance Indicators (KPIs)
  - customer satisfaction
  - efficiency (improvement in processing times, resource utilisation)
  - return on investment (ROI)
  - stakeholder satisfaction

## **2. Can use appropriate tools to design a solution and plan its implementation and testing**

- Design tools: e.g.
  - text (e.g. reports, presentation slides)
  - tables of information
  - diagrams (e.g. DFDs, ERDs, flowcharts, wireframes, network diagrams, technical schematics, cyber security network diagrams, cyber attack diagrams, data analysis flowcharts, business data flow diagrams)
- Identify suitable timelines and use planning tools: e.g.
  - Gantt charts
  - Pert charts
  - Critical path diagrams
  - proposed work breakdowns
  - timelines
  - schedules
  - tables of information
- Testing strategies: e.g.
  - functional testing
  - non-functional testing
  - user testing
  - compliance testing

## **3. Can demonstrate an understanding of professional best practice**

- Skills and behaviours for working effectively as a part of a team
  - understanding your role
  - making appropriate contributions
  - supporting peers
  - being flexible
  - having a positive attitude
  - having personal accountability
  - showing commitment to the team activity
- Communication methods for different audiences:
  - technical audience
  - non-technical audience
  - written
  - oral
- Professional practice best behaviours:

- spell checking documents using available software
- proof reading outputs to eradicate context errors
- writing clearly and with purpose
- creation of reports with page numbers and a contents page
- demonstrating interest in the project when communicating with an audience
- taking personal responsibility for the completion of tasks
- speaking with confidence
- making good use of communications technologies
- Wider considerations:
  - ethical practice
  - acknowledgement of relevant legislation e.g. DPA 2018 (or local alternatives)

## Suggested Resources

Hughes Bob, 2019 Project Management for IT-Related Projects: 3rd Edition, BCS (The Chartered Institute for IT)

Phillips Joseph, 2010 IT Project Management: On Track from Start to Finish 3rd Edition, McGraw-Hill Education

Rosell M, 2023 Data Analyst's Step-by-Step Project Planner: A comprehensive Guide for Success, Self-published

Fishpool B and Fishpool M, 2020 Software Development in Practice, BCS (The Chartered Institute for IT)

Hodson Christopher J, 2019 Cyber Risk Management: Prioritize Threats, Identify Vulnerabilities and Apply Controls, Kogan Page

Szymanski Thomas, 2021 Migration of Network Infrastructure: Project Management Experience, Lulu.com

## Websites

[www.skillsyouneed.com](http://www.skillsyouneed.com)

[www.coursera.org](http://www.coursera.org)

[www.projectmanager.com/guides/it-project-management](http://www.projectmanager.com/guides/it-project-management)

[asana.com/resources/it-project-management](http://asana.com/resources/it-project-management)

[www.fool.com/the-ascent/small-business/project-management/articles/it-project-management/](http://www.fool.com/the-ascent/small-business/project-management/articles/it-project-management/)