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Introduction

The second stage within the BCS three-stage Higher Education Qualification programme, the Level 5 Diploma enables candidates who have already achieved the Level 4 Certificate in IT to progress to higher levels of knowledge and competency.

This internationally-recognised qualification introduces you to the business-related aspects of the IT industry, developing your technological expertise while also considering the potential challenges of the day-to-day running of an organisation, such as legal obligations and intellectual property.

Our modules have been created in-line with the latest developments in the industry, giving you a competitive edge in the IT job market. You will have the opportunity to learn about object-oriented programming, user experience, systems analysis and design, as well as to build upon knowledge and skills developed during the Level 4 Certificate.

To successfully achieve the qualification, candidates need to complete:

- One core module
- Three optional modules
- One Professional Project in IT

Candidates who wish to progress onto the next stage will need to complete the Project at end of the Level 6 Professional Graduate Diploma in IT.

Web Application Development Optional Module

The Web Application Development module is an optional module that forms part of the Level 5 Diploma in IT – the second stage within the BCS three-stage Higher Education Qualification programme.

Candidates will explore mark-up languages, various web technologies, development methods, as well as front- and back-end technologies. Candidates will also consider the social, legal, ethical and professional issues relating to web applications.
Qualification Suitability and Overview

Candidates must have achieved the Certificate in IT or have an appropriate exemption to be entered for the Diploma in IT. Candidates can study for this diploma by attending a training course provided by a BCS accredited Training Provider or through self-study, although it is strongly recommended that all candidates register with an approved centre. Studying with an approved centre will deliver significant benefits.

Candidates are required to become a member of BCS, The Chartered Institute for IT, to sit and be awarded the qualifications. Candidates may apply for a four-year student membership that will support them throughout their studies.

The Level 5 Diploma is suitable for professionals wishing to gain a formal IT qualification, and this module may be particularly relevant for candidates interested in career opportunities such as game development, multimedia programming, or web design.

<table>
<thead>
<tr>
<th>Total Qualification Time (Certificate)</th>
<th>Guided Learning Hours (Module)</th>
<th>Assessment Time (Exam)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1086 hours</td>
<td>225 hours</td>
<td>Two hours</td>
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</table>

SFIA Levels

This award provides candidates with the level of knowledge highlighted within the table, enabling candidates to develop the skills to operate successfully at the levels of responsibility indicated.

<table>
<thead>
<tr>
<th>Level</th>
<th>Levels of Knowledge</th>
<th>Levels of Skill and Responsibility (SFIA)</th>
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</thead>
<tbody>
<tr>
<td>K7</td>
<td></td>
<td>Set strategy, inspire and mobilise</td>
</tr>
<tr>
<td>K6</td>
<td>Evaluate</td>
<td>Initiate and influence</td>
</tr>
<tr>
<td>K5</td>
<td>Synthesise</td>
<td>Ensure and advise</td>
</tr>
<tr>
<td>K4</td>
<td>Analyse</td>
<td>Enable</td>
</tr>
<tr>
<td>K3</td>
<td>Apply</td>
<td>Apply</td>
</tr>
<tr>
<td>K2</td>
<td>Understand</td>
<td>Assist</td>
</tr>
<tr>
<td>K1</td>
<td>Remember</td>
<td>Follow</td>
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</tbody>
</table>
Learning Outcomes

Upon completion of this module, candidates will be able to:

- Evaluate the contribution of underpinning web technologies to the process of web application development.
- Apply the procedures and processes necessary for the construction of high-quality web applications.
- Compare and contrast a variety of front end and back end web application frameworks.
- Apply a range of testing strategies and techniques to quality assure and continuously monitor web applications.
- Appreciate the importance of legal, social, ethical and professional issues associated with web applications.
1. Assess the technologies that are appropriate to build a web application

Learners will be able to:

1.1 Describe, compare and contrast mark-up languages.

**Indicative content**

a. XML and HTML
b. Document Object Model (DOM)
c. CSS Object Model (CSSOM)
d. Interchange languages:
   i. XML
   ii. JSON
   iii. YAML
e. Web protocols:
   i. HTTP
   ii. HTTPS
f. Interface description languages:
   i. WSDL
   ii. Thrift
g. Style sheet languages:
   i. XSL
   ii. CSS

**Guidance**

Candidates will be expected to be able to discuss different mark-up languages and interchange models, as well as be able to use them. Candidates are expected to be able to assess the appropriateness of each language for a given application.

1.2 Discuss standards and web technologies.

**Indicative content**

a. W3C
b. ISO
c. ECMA International
d. ISO
e. IETF
f. IANA
g. WHATWG
h. Evolution of web technologies:
   i. Web 1.0
   ii. Web 2.0
   iii. Web 3.0/Semantic Web

**Guidance**

There are many standards associated with web technologies. Candidates will be expected to be able to identify the appropriate international standards and be able to apply them to their own applications.
### 1.3 Explain browsers and internet technology.

<table>
<thead>
<tr>
<th><strong>Indicative content</strong></th>
<th><strong>Guidance</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Browsers</td>
<td>A web application is built from a number of components. Candidates will be expected to describe them and explain their role in a typical web application system.</td>
</tr>
<tr>
<td>b. Web servers</td>
<td></td>
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<tr>
<td>c. Application servers</td>
<td></td>
</tr>
<tr>
<td>d. Mobile web</td>
<td></td>
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</table>

### 1.4 Discuss framework architectures.

<table>
<thead>
<tr>
<th><strong>Indicative content</strong></th>
<th><strong>Guidance</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. MVC</td>
<td>Candidates will be expected to understand appropriate framework architectures and appreciate their use.</td>
</tr>
<tr>
<td>b. MVVM</td>
<td></td>
</tr>
<tr>
<td>c. Flux</td>
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<tr>
<td>d. MVA</td>
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<tr>
<td>e. MVP</td>
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<tr>
<td>f. Push vs pull</td>
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<tr>
<td>g. Multi-layer</td>
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</table>

### 2. Apply appropriate development methods to build web applications

#### Learners will be able to:

**2.1 Explain stake holder analysis.**

<table>
<thead>
<tr>
<th><strong>Indicative content</strong></th>
<th><strong>Guidance</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Requirements analysis</td>
<td>Candidates will be expected to demonstrate an understanding of why requirements analysis is required, and the tools available to assist the developer.</td>
</tr>
<tr>
<td>b. The double diamond model</td>
<td></td>
</tr>
<tr>
<td>c. INVEST</td>
<td></td>
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</tbody>
</table>
2.2 Discuss project management techniques and tools.

**Indicative content**

- Project stages:
  - Initiation
  - Planning
  - Execution
  - Monitoring
  - Closure
- Team collaboration tools
- Scheduling and planning
- Budget management

**Guidance**

Effective project management is essential for projects to be delivered on budget and on time. Candidates will be expected to explain the stages in a project and the tools available to help them plan, schedule and budget it effectively.

2.3 Compare agile software engineering methods.

**Indicative content**

- Scrum and Kanban
- Hypothesis driven development

**Guidance**

Agile software engineering methods are becoming much more popular, and are considered more appropriate than traditional methods. Candidates should be able to discuss and compare the popular methods and demonstrate how they are applied.

2.4 Compare the roles of members of web application development teams.

**Indicative content**

- Project manager
- Project architect
- UI/UX designers
- Front-end developers
- Back-end developers
- Database developers
- QA and testing specialists

**Guidance**

A project team requires many different skills if it is to successfully complete its task. Candidates will be expected to compare these roles and explain how they need to work together as an effective team to produce a successful outcome.
2.5 Discuss what is meant by version control.

**Indicative content**

- E.g. (but not limited to):
  - GitHub
  - GitLab
  - Beanstalk
  - PerForce
  - Apache Subversion

**Guidance**

Managing software development requires effective monitoring of progress and ensuring that team members are working on the most recent and appropriate versions available. If it is necessary to branch, then each branch should be tracked and the reintegration process managed. Candidates will be expected to be able to discuss the main issues associated with version control, and discuss the tools available to help them manage it.

2.6 Compare the roles of front-end and back-end technologies.

**Indicative content**

- The difference in roles of the front and back ends, including:
  - Client-server
  - Peer-to-peer
  - How developers decide to locate particular functionalities

**Guidance**

Candidates will be expected to discuss the roles of the front end and back end of web applications, architectures used for their implementation and determine how the functionality should be split between them.

3. Front-end technologies

Learners will be able to:

3.1 Explain and demonstrate key functions of JavaScript language.

**Indicative content**

- Javascript/ECMAScript:
  - Statements
  - Expressions
  - Identifiers
  - Primitive values
  - Objects
  - Properties
  - Operators
  - Conditionals
  - Loops
  - Functions
  - Exception handling
  - Arrays
  - Regular expressions
  - HTML events

**Guidance**

Many web applications use JavaScript to modify what is displayed in the browser without reloading the complete page. Candidates will be expected to explain its use and relationship with other front end languages and technologies and demonstrate how it is used with practical examples.
3.2 Explain and demonstrate jQuery methods.

**Indicative content**

- Content Delivery Networks
- Document ready event
- Selectors
- Event methods
- Effects
- Call-back functions
- Chaining
- Get content
- Set content

**Guidance**

Candidates will be expected to be able to discuss the role of Content Delivery Networks and the tools used to implement them in practice.

3.3 Demonstrate CSS pre-processing.

**Indicative content**

- Sass
- Less
- Stylus

**Guidance**

Candidates will be expected to discuss the role of CSS processing and how it helps developers build effective web sites, as well as demonstrate how it is used.

3.4 Demonstrate front-end frameworks.

**Indicative content**

- E.g. (but not limited to):
  - Backbone.js
  - AngularJS
  - Angular
  - EmberJS
  - ReactJS
  - Vue.js

**Guidance**

Frameworks are used to speed development and provide consistency to web applications. Candidates should be able to discuss their properties and demonstrate examples of their use.
Learners will be able to:

4.1 Discuss the different options for information storage in web applications.

**Indicative content**

- SQL vs NOSQL
- Key-value stores
- Document stores
- Graph databases
- Brewer's CAP theorem
- ACID and eventually consistent transactions

**Guidance**

As web applications become more complex, the interaction between the client and the server becomes more critical to the achievement of their goals. Candidates will be expected to discuss the various means by which clients and servers can interact, and assess which to use in particular circumstances.

4.2 Discuss types of architecture that can be used to build web applications.

**Indicative content**

- Service oriented architecture
- Microservices

**Guidance**

Candidates should be able to compare service orientated and microservices architecture discuss the advantages and disadvantages of each.
4.3 Discuss the tools that are used when developing back-ends.

**Indicative content**

a. APIS:
   i. REST methods
   ii. HATEOAS methods
   iii. HTTP methods
b. Event based APIs
c. WebSockets
d. Error handling
e. Caching

**Guidance**

Candidates should be able to discuss a range of tools used to develop back end technologies, including their advantages and disadvantages.

---

4.4 Discuss the key features of back end technologies.

**Indicative content**

a. Language
b. Architecture
c. Cost
d. Scalability

**Guidance**

Candidates should be able to discuss a range of back end technologies, including their advantages and disadvantages.

---

4.5 Discuss the role and use of back end frameworks.

**Indicative content**

a. E.g. (but not limited to):
   i. Django
   ii. Rails
   iii. Spring
   iv. Flask
   v. Laravel

**Guidance**

There are various frameworks that assist the developer in constructing the back end of web applications. Candidates should be able to discuss their role in the application building process, and the criteria for choosing which is appropriate for a particular development.
5. Testing and evaluation

Learners will be able to:

5.1 Discuss the roles of available testing methods.

**Indicative content**

a. Property-based testing
b. Unit testing
c. Integration testing
d. End-to-end testing
e. Manual testing
f. Visual testing
g. Cross-functional testing
h. Load testing

**Guidance**

Each testing method is designed to identify errors at various stages in the development process. Candidates should be able to identify the range of testing methods available, how each is performed and their role in the development process.

5.2 Explain test-orientated development methods.

**Indicative content**

a. E.g. (but not limited to):
   - Test-driven development
   - Behaviour-driven development

**Guidance**

Candidates should be able to explain what is meant by different types of test development methods, including the stages in the development process and their advantages and disadvantages.

5.3 Describe testing frameworks.

**Indicative content**

a. Frameworks and tools, e.g. (but not limited to):
   - Cucumber
   - Selenium
   - JIRA
   - Bugzilla
   - JMeter

**Guidance**

Tools are important in ensuring that tests are carried out thoroughly and properly recorded. Candidates should be able to discuss a range of available testing frameworks and describe how they are used.
5.4 Explain web analytics.

Indicative content

a. Logfile analysis
b. Page tagging
c. Click analytics
d. Customer lifecycle analytics

Guidance

Analytics are used both to identify issues with the execution of web applications and to track and assess visitor activity (both individually and as a whole). Candidates should be able to describe the range of analytical data available and explain how it can be used to assist the web applications designer.

6. Social, legal, ethical and professional issues

Learners will be able to:

6.1 Discuss the different options for information storage in web applications.

Indicative content

a. E.g. (but not limited to):
   i. National and international data protection regulations

Guidance

Most countries have adopted the international standards ISO27001 for data security and ISO27701 for data privacy but most have modified them for their own needs, as for example the GDPR regulations in Europe. Candidates shall be expected to understand the need for such regulations and compare the requirements in the different jurisdictions in which they expect to work.

6.2 Discuss web application security.

Indicative content

a. Secrets and trust
b. Threats

Guidance

All web sites are subject to a range of security issues. Failure to properly protect the information held will lead to a lack of trust and potential visitors will be unwilling to visit. Candidates will be expected to identify and categorise these threats and discuss how they would attempt to protect a site against them by for example implementing an Information Security Management System (ISMS).

6.3 Explain privacy issues in web applications.

Indicative content

a. Validation and sanitisation
b. Threats
c. OWASP top ten vulnerabilities

Guidance

If website visitors are to have confidence in an application, they must be assured that the information that they provide will be held privately and only for the purpose which it was given. Candidates should be able to explain the privacy requirements specified by ISO 27701, GDPR and local legislation, where appropriate.
Examination Format

This module is assessed through completion of an invigilated written exam.

<table>
<thead>
<tr>
<th>Type</th>
<th>Four written questions from a choice of six, each with equal marks</th>
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<tbody>
<tr>
<td>Duration</td>
<td>Two hours</td>
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<tr>
<td>Supervised</td>
<td>Yes</td>
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<tr>
<td>Open Book</td>
<td>No (no materials can be taken into the examination room)</td>
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<tr>
<td>Passmark</td>
<td>10/25 (40%)</td>
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<tr>
<td>Delivery</td>
<td>Paper format only</td>
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Adjustments and/or additional time can be requested in line with the [BCS reasonable adjustments policy](https://www.bcs.org.uk/policies/reasonable-adjustments-policy) for candidates with a disability or other special considerations.

Question Weighting

Candidates will choose four questions from a choice of six. All questions are equally weighted and worth 25 marks.

6.4 Explain interface design and accessibility.

Indicative content

a. Web content accessibility guidelines
b. Screen reader testing

guidelines

Guidance

It is important that web applications are made fully accessible so that they can be used effectively by everybody. It is therefore essential that development teams fully understand the requirements of every type of user. The Web Content Accessibility Guidelines (WCAG) have been developed to assist developers in achieving this. Candidates should be able to discuss the design principles and their implementation. They should also be able to plan and execute the steps necessary to ensure that their application is fully available through a screen reader.

Examinations are in the form of a written component. It is conducted under invigilation conditions. Four questions are set from a choice of six. All questions are equally weighted and worth 25 marks.

Web content accessibility guidelines

a. Web content accessibility guidelines
b. Screen reader testing

guidelines

Explanations are given on the exam paper.

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guidelines

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Recommended Reading

Primary texts and resources

Title: Ry’s Git Tutorial  
Author: R. Hodson  
Publisher: RyPress  
Date: 2014  
Available at: https://www.amazon.co.uk/Rys-Git-Tutorial-Ryan-Hodson-ebook/dp/B00QFIA5OC  [Accessed 09 July 2021]

Title: The full stack developer: your essential guide to the everyday skills expected of a modern full stack Web developer  
Author: C. Northwood  
Publisher: Apress  
Date: 2019  
ISBN: 978-1484241516

Title: OWASP Top Ten  
Author: OWASP  
Creation Date: 2017  
Available at: https://owasp.org/www-project-top-ten/  [Accessed 09 July 2021]  
ISBN: 978-1118804674

Additional texts and resources

Title: Web Accessibility: Web Standards and Regulatory Compliance  
Author: M. R. Burks, et al  
Publisher: Apress  
Date: 2006  
ISBN: 978-1590596388
Title: Agile testing: a practical guide for testers and agile teams.  
Author: L. Crispin and J. Gregory  
Publisher: Addison Wesley  
Date: 2009  
ISBN: 978-0321534460

Title: Web Design with HTML, CSS, JavaScript and jQuery  
Author: J. Duckett  
Publisher: Wiley  
Date: 2014  
ISBN: 978-1118907443

Title: Continuous integration: improving software quality and reducing risk  
Author: P. M. Duvall, S. Matyas and A. Glover  
Publisher: Addison Wesley  
Date: 2007  
ISBN: 978-0321336385

Title: How the Double Diamond process can help you work in a more user-centred way  
Author: C. Eissa  
Date: 2019  
Available at: https://www.testingtime.com/en/blog/double-diamond-process/  
[Accessed 09 July 2021]

Title: Just jQuery: Events, Async & AJAX  
Author: I. Elliot  
Publisher: I/O Press  
Date: 2017  
ISBN: 978-1871962529
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<tr>
<th>Title</th>
<th>Author</th>
<th>Publisher</th>
<th>Date</th>
<th>ISBN</th>
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<tbody>
<tr>
<td>Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity</td>
<td>A. Kaushik</td>
<td>Sybex</td>
<td>2009</td>
<td>978-0470529393</td>
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<tr>
<td>Kanban and Scrum: making the most of both</td>
<td>H. Kniberg and M. Skarin</td>
<td>C4Media</td>
<td>2010</td>
<td>978-0557138326</td>
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<td>Title</td>
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<td>Publisher</td>
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<tr>
<td>Building microservices:</td>
<td>Author: S. Newman</td>
<td>Publisher: O'Reilly Media</td>
<td>Publication Date: 2015</td>
<td>ISBN: 978-1491950357</td>
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<tr>
<td>designing fine-grained</td>
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<td>systems</td>
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<td>Speaking JavaScript</td>
<td>A. Rauschmayer</td>
<td>O'Reilly Media</td>
<td>2014</td>
<td>978-1449365035</td>
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<td>RESTful Web APIs. RESTful</td>
<td>L. Richardson, M. Amundsen</td>
<td>O'Reilly Media</td>
<td>2013</td>
<td>978-1449358068</td>
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<td>Web application</td>
<td>S. Ruby</td>
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<td>programming interfaces</td>
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<td>Essential Scrum: a</td>
<td>K. S. Rubin</td>
<td>Publisher: Addison Wesley</td>
<td>Publication Date: 2012</td>
<td>978-0137043293</td>
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<td>practical guide to the</td>
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<td>NoSQL Distilled: A Brief</td>
<td>P. J. Sadalage</td>
<td>Addison Wesley</td>
<td>2013</td>
<td>978-0321826626</td>
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<td>Guide to the Emerging</td>
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<td>World of Polyglot</td>
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<tr>
<td>Constructing accessible web sites</td>
<td>J. Thatcher</td>
<td>Apress</td>
<td>2002</td>
<td>978-1590591482</td>
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<tr>
<td>INVEST in Good Stories, and SMART Tasks</td>
<td>W. Wake</td>
<td>Apress</td>
<td>2003</td>
<td></td>
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<tr>
<td>REST in practice: Hypermedia and Systems Architecture</td>
<td>J. Webber, S. Parastatidis and I. Robinson</td>
<td>O'Reilly Media</td>
<td>2010</td>
<td>978-0596805821</td>
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Using BCS Books

Accredited Training Organisations may include excerpts from BCS books in the course materials. If you wish to use excerpts from the books you will need a license from BCS. To request a license, please contact the Head of Publishing at BCS outlining the material you wish to copy and its intended use.

Document Change History

Any changes made to the syllabus shall be clearly documented with a change history log. This shall include the latest version number, date of the amendment and changes made. The purpose is to identify quickly what changes have been made.

<table>
<thead>
<tr>
<th>Version Number</th>
<th>Changes Made</th>
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<tbody>
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<td>Version 1.0</td>
<td>Document Creation</td>
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<td>July 2021</td>
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CONTACT

For further information please contact:

BCS
The Chartered Institute for IT
3 Newbridge Square
Swindon
SN1 1BY

T +44 (0)1793 417 445

www.bcs.org

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