Next Generation Higher National Educator Guide

Higher National Diploma in Computer Science

Qualification code GV20 48

Valid from session 2024 to 2025

Prototype educator guide for use in pilot delivery only (version 0.1) August 2024

This guide provides detailed information about the qualification to ensure consistent and transparent assessment year on year.

This guide is for assessors and lecturers and contains all the mandatory information you need to deliver and assess the qualification.

This edition: August 2024 (version 0.1)

Contents

Qualification overview

Introduction

This guide:

- assists centres to implement, deliver, and manage the qualification
- provides a guide for new staff involved in offering the qualification
- informs course managers, teaching staff, assessors, learners, employers, and higher education institutions of the aims and purpose of the qualification
- provides details about the range of learners that the qualification is suitable for and the progression opportunities

Purpose of the qualification

Higher National Diploma (HND) Computer Science provides learners with the high-quality technical and vocational skills they need to meet the rapidly changing demands of modern computing and IT technologies. There is an increasing demand for computer science professionals to sustain and develop the applications of computing technologies in modern society, business and industry. While there are many specialisms in the field of computing, there are fundamental concepts and technologies that underpin them all.

Computing and its applications are an ever-evolving field, with aspects such as artificial intelligence, cyber security and cloud technologies increasing in importance. Learners will gain knowledge and understanding of current technologies and applications of computer science. They work collaboratively in their learning.

The qualification prepares learners for a career path in this field. It develops foundational skills and knowledge in important aspects of computer science, including programming, data structures, algorithms, and computer systems. Learners can specialise in a particular area of computer science such as artificial intelligence (AI), cyber security or data science.

The qualification offers opportunities for learners to develop the meta-skills and professional attitudes required in this vital industry sector, along with awareness of legal and ethical obligations, including those relating to diversity, inclusion and sustainability. It also prepares learners for further study in this specialism, or in other aspects of computing, including study at degree level.

The structure and aims of the HND are described in the following sections.

Structure

Higher National Diplomas (HNDs) are designed at SCQF level 8 and consist of 120 SCQF credit points. HNDs must incorporate at least 80 credit points (10 credits) at SCQF level 8.

HNDs contain 15 credits that can be used flexibly to increase opportunities for learners returning to education. Refer to the 'Meta-skills' section of this guide for more information.

HND Computer Science meets the Next Generation Higher National (NextGen: HN) design principles, by incorporating a mandatory project unit (Professional Practice in Computer Science at SCQF level 8) with an SQA credit value of 4.

Framework

HND Computer Science is composed of the following two mandatory units (7 SQA credits) with the remaining 8 SQA credits selected from the table of optional units (15 SQA credits in total).

Mandatory units

Unit code	Unit title	SQA credit	SCQF credit points	SCQF level
J68M 48	Computer Science	3	24	8
J7DX 48	Professional Practice in Computer Science	4	32	8

Optional units

Unit code	Unit title	SQA credit	SCQF credit points	SCQF level
J7DH 48	Algorithms and Data Structures	3	24	8
J7DT 48	Applied Mathematics in Computing	2	16	8
J7DJ 48	Applied Artificial Intelligence	3	24	8
J7DV 48	Database Design and Development	3	24	8
J691 47	Emerging Technologies and Experiences	1	8	7
J7DW 48	Object Oriented Programming	2	16	8
J7DY 48	Programming Paradigms	2	16	8
J7E0 48	Virtualisation Technologies	2	16	8

Restricted optional units (maximum of 3 credits)

Unit code	Unit title	SQA credit	SCQF credit points	SCQF level
J68T 48	Networking and Infrastructure	3	24	8
J7E1 48	Application Development for Web	3	24	8

Learners must pass the two mandatory units (7 SQA credits) and achieve at least 8 SQA credits from the optional units specified in the framework. No more than 3 SQA credits can be obtained from the units in the restricted optional group.

We have provided information relating to the grade of the award later in this Educator Guide.

Aims of the qualification

HND Computer Science develops learners' knowledge and understanding of the fundamental concepts and principles of computer science, such as algorithms, data structures and programming languages. It enables them to write efficient and maintainable code and solve real-world problems that require computer solutions.

The HND includes an extensive collaborative project for learners to design and develop a solution to a computing problem using project management and other formal development processes, including version control, testing, and technical documentation.

General aims

The general aims of the qualification are to:

1 develop a range of academic competencies at SCQF level 8, including study and research skills
2 develop vocational skills to prepare learners for employment in current and future roles
3 develop capacity to apply knowledge and skills to solve real-world problems
4 develop professionalism and meta-skills to support lifelong professional learning and development
5 enable progression through the Scottish Credit and Qualification Framework (SCQF), including progression to degree-level study

Specific aims

The specific aims of the qualification are to:

1 develop understanding of the key concepts and principles of computer science
2 develop understanding of current and emerging technologies in computer science, including artificial intelligence and cyber security
3 develop mathematical and statistical understanding as it relates to computer science
4 prepare learners for employment in the design, development, testing and implementation of computing solutions
5 select and apply the correct approaches to resolving problems through computing solutions
6 develop learners' computational thinking, pattern recognition, deconstruction, logical thinking, synthesis and analysis skills
7 help learners to gain understanding of the ethical, social and legal issues associated with the use of computer systems, including those relating to diversity, inclusion and sustainability
8 prepare learners for progression to further studies in computer science, or related disciplines, at SCQF level 9

Qualification structure

The tables that follow show how the mandatory and optional units contribute to the general and specific aims of the HND.

There are two mandatory units in the structure that contribute 7 SQA credits at SCQF level 8. The first of these (Computer Science) deals with the concepts and principles that are fundamental to the practice of computer science. The other mandatory unit is a project unit that requires group working. Project work for this unit can include research into a topic in computer science, such as programming languages or developing a computing solution to a problem from contexts such as science, engineering, health, business or cybersecurity.

The options and restricted options groups enable learners to develop an area of specialism, such as programming paradigms or AI. Learners accumulate the remaining 8 SQA credits from a selection of optional units from the framework.

Who is this qualification for?

This HND is suitable for learners who wish to develop their knowledge and understanding of fundamental concepts in computer science. It provides them with a sound foundation for further study of aspects of computer science that are central to the development of modern solutions to computing problems. To benefit from this qualification, learners should understand the basics of how computers work and be familiar with computer program design, coding and testing.

Recommended entry	Progression
Entry to this qualification is at the discretion of your centre. Learners would benefit from having attained the skills, knowledge, and understanding required by one or more of the following or equivalent qualifications and/or experience: ♦ HNC Computing (NextGen) GT6G 47 ♦ HNC Computing GF3E 15	Learners can progress to: ♦ other qualifications in computing-related areas ♦ degree-level study in computer science ♦ further study, employment and/or training in computing-related areas

Recognising prior learning

SQA recognises that learners gain knowledge and skills through formal, non-formal, and informal learning contexts.

It is unlikely that a learner would have the appropriate prior learning and experience to meet all the requirements of a full qualification.

You can find more information and guidance about the recognition of prior learning on SQA's website.

Articulation and/or progression

HND Computer Science is not designed to articulate to any particular degree programme. However, the design process has taken account of the common themes that occur in sub-degree courses in Computer Science at Scottish universities to facilitate progression to degree level in such courses. Centres can offer the selection of optional units that best fits progression to a chosen university degree course.

Professional recognition

There is no professional recognition associated with this HND.

Credit transfer arrangements

Centres can make decisions about transferring credits. They can transfer credits if the subject-related content of the units is broadly equivalent. Centres should consider the currency of a learner's achievement before transferring credit.

Core Skills entry profile

The Core Skills entry profile provides a summary of the assessment activities that demonstrate the SCQF level of this qualification. This information can help identify learners who need additional support or those who should take an alternative level or learning programme.

Core Skill	Recommended SCQF entry profile	Associated assessment activities
Communication	Level 6	Learners can evidence this skill by: ♦ making a formal presentation which collates, analyses, and presents conclusions on findings ♦ summarising and evaluating research reports ♦ producing a well-structured report of a complex, practical investigation
Numeracy	Level 6	Learners can evidence this skill by: ♦ performing calculations involving complex data (such as financial data) ♦ using formulae to calculate values ♦ researching and comparing systems performance, such as network throughput,
Information and communication technology (ICT)	Level 6	Learners can evidence this skill by: ♦ searching multiple external and internal databases ♦ creating and running program code ♦ recording a video on a mobile device and uploading to video streaming services

Core Skill	Recommended SCQF entry profile	Associated assessment activities
Problem solving	Level 6	Learners can evidence this skill by: ♦ summarising, explaining or drawing conclusions ♦ identifying and ensuring they have sufficient resources ♦ deciding how a task will be managed and carrying it out ♦ analysing the effectiveness of all aspects of a problem-solving strategy ♦ identifying and gathering appropriate evidence to support an evaluation
Working with Others	Level 6	Learners can evidence this skill by: ♦ analysing requirements of roles and relationships between them ♦ negotiating working methods with team members ♦ developing evaluation criteria for cooperative work ♦ using reflection and feedback received to identify learning objectives

Meta-skills

Meta-skills are higher-order skills that support the development of other skills and promote success in any context. They enable learners to respond to professional challenges and opportunities by reflecting on, developing, applying and adapting industry skills and sector knowledge.

Our new Higher National Qualifications are developed with meta-skills at their core. Meta-skills complement the industry and sector-specific content of the qualifications. They provide a framework for learners to complete personal development aligned to professional practices.

Throughout the qualifications, learners develop meta-skills while studying industry and sector-specific content. You can integrate meta-skills into contextualised teaching activities and include them in integrated and holistic assessment approaches.

The 21st century skills and meta-skills learning, teaching and assessment model focuses on how we can use skills to respond to societal, economic and industry drivers and change. Meta-skills frameworks vary, but they share an approach that emphasises individualistic, context-based skills development with reflective practice and localised definitions.

Skills Development Scotland developed a model of meta-skills in response to the concept of Industry 4.0 (or the 'fourth industrial revolution'). In this model, they identify 12 meta-skills that help learners adapt to changes to industry, job roles and society, which are expected because of technological advances and global trends. Developing these meta-skills supports learners as they prepare for a constantly evolving future.

The 12 meta-skills are grouped into three categories: self-management, social intelligence, and innovation.

Self-management	Social intelligence	Innovation
Focusing	Communicating	Curiosity
Integrity	Feeling	Creativity
Adapting	Collaborating	Sense-making
Initiative	Leading	Critical thinking

Adapted from: Skills 4.0: a skills model to drive Scotland's future, Centre for Work-based Learning in Scotland, (2018).

You should:

- make learners aware that meta-skills are generic and transferable across many different contexts
- support learners to focus on the meta-skills that they find most relevant by encouraging an individualised, active learning approach that relates to the industry and sector contexts of the qualification
- help learners to understand key meta-skills for their industry or sector and any other personally important meta-skills, and set development goals for these
- encourage learners to focus on reflective practice

None of the meta-skills are mandatory.

Learning and teaching

You can introduce meta-skills to learners as tools they can use in response to real-world challenges and opportunities. At SCQF level 8, you should use terminology from the Skills 4.0 model, but it is important that you develop a shared understanding with learners about meta-skills and what they mean to them, both individually and in the context of coursework, projects and sectors.

You should embed meta-skills in learning and project tasks as a context for planning, practice, and reflection. You should encourage learners to be self-aware, set active goals and monitor their progress.

The process of developing meta-skills is not linear and you should ensure learners are active participants in their learning. At the start of the process, you should introduce meta-skills to learners and explore the concept of self-assessment with them. You should set goals and make development and evaluation plans together. The process should become cyclical, with reflective practice informing new self-awareness, goal-setting and review.

Many traditional learning and teaching activities used to develop industry or sector-specific skills, knowledge and understanding also support the development of meta-skills. You can map these in course materials and resources and during learning.

Meta-skills are central to successfully engaging with and completing assignments and projects. You should encourage learners to plan how they will use and develop meta-skills in their coursework and to reflect on their success and future goals.

The role of the coach, mentor or facilitator is key to help learners understand, develop and reflect on their own meta-skills and those central to course activities, assessment projects and their target industry or sector. You and any employer partners or guest speakers could guide learners by taking on a coaching and mentoring role.

In this role, you should introduce learners to the fundamentals of reflective practice. You could use several models of reflective practice. You do not need to use a theoretical perspective. Any reference to these models should support learners' understanding of the nature and value of reflective practice in self-understanding and making change.

Introducing reflective practice can support your learners' personal development and goal setting. Frequent formative peer-to-peer, assessor, client (if appropriate) and group reflection activity can support learners through reflective practice.

Learners can focus on any meta-skills appropriate to them and their context. However, learning and teaching should also facilitate individual development. Learners have individual strengths and areas for development, and they do not have to reach a particular level in relation to meta-skills. Coursework and projects provide the context for development appropriate to the SCQF level. Within these contexts, the **process** of development is important. You should create a clear learning plan with each learner to provide evidence of their development.

You can create descriptions of abilities and skills that relate to meta-skills with your learners. These can come from self-profiling, exploring the industry and sector, and discussion with peers and employers. You should consider the meta-skills needed to complete coursework and meet personal goals to set a context for reflection.

Exploring learning and working styles, personality traits and preferences, personal profiling and self-assessment tools can help learners to develop an understanding of their strengths and areas for development.

You can use case studies and scenario-based activities to demonstrate the value of meta-skills and how they can be applied. You can provide opportunities for peer reflection. A group of learners could share experiences and reflections about how to apply meta-skills in the context of their coursework. You could adopt the role of facilitator to draw learners' attention to situations where meta-skills were or could have been applied.

Reflective discussions can focus on how and where meta-skills are being developed. Your discussions with learners could include positive recognition and guidance on future development based on previous performance. As learners progress, you could introduce industry content that requires skills like problem recognition and problem solving, both of which combine multiple meta-skills.

You can deliver the knowledge and skills for practical aspects of projects in sequence. However, learners benefit from learning and teaching that integrates meta-skills with project planning and development. This approach supports learners to engage in reflective practice throughout the project, and develops their self-awareness and an appreciation for continuous learning. It also maximises your opportunities to support, coach and mentor learners through their projects.

Learning for Sustainability

Context

The UN 2030 Agenda for Sustainable Development, adopted by the UK in 2015, has shaped the development of internal and national sustainability policy. It sets out the United Nations Sustainable Development Goals(SDGs), which are central to the Scottish Government's National Performance Framework. Learning for Sustainability (LfS) is a commitment to embedding the SDGs in Scottish education.

In line with this, SQA is committed to incorporating the skills, knowledge, understanding and values of LfS within all new and revised qualifications.

LfS combines:

- education for sustainable development (ESD)
- global citizenship
- outdoor learning

ESD is the internationally used term for sustainability education. LfS has a broader remit; however, the terms are largely interchangeable. ESD tends to be used by colleges and universities, while LfS is usually used in schools. Both focus on a broad range of social, economic and environmental themes and approaches across all levels of education. SQA uses LfS as an umbrella term.

LfS is designed to nurture a generation of learners who know the value of the natural world and are committed to the principles of social justice, human rights, global citizenship, democratic participation and living within the ecological limits of the planet. It aims to respond to global challenges by developing learners' skills, knowledge, understanding and values relating to sustainability so they can interact with the world in a socially responsible way.

LfS is more than the sum of its parts; it is about building learners' capacity to deal with the unpredictable challenges facing our rapidly changing world. It encourages transformational change through learning, by which learners can critically analyse, communicate and collaborate on complex social, environmental and economic challenges. This gives learners increased confidence, opportunities to develop a range of meta-skills, and enhanced motivation and readiness to learn.

Learning for Sustainability in Next Generation Higher National Qualifications

Next Generation Higher National (NextGen: HN) qualifications have been developed with sustainability as a core component.

All NextGen: HN learners should exit their qualification with:

- a general understanding of sustainability and the SDGs
- an understanding of subject-specific sustainability issues, how these relate to the SDGs, and potential improvements
- the confidence to apply their knowledge and skills in the next stage of their lives

Central to these aims is a need for familiarity with both the SDGs and the concept of sustainability (which is the need to ensure a balance between economic growth, environmental stewardship and social well-being). Knowledge and understanding of current industry practices and behaviours, and consideration of how these could be made more sustainable and contribute towards the SDGs, are integral in developing young people to be responsible and empowered citizens who are able to contribute to building a socially just, sustainable and equitable society.

With this in mind, sustainability is embedded as an outcome in the Professional Practice in Computer Science project unit.

By completing this outcome, learners develop skills, including the abilities to:

- assess their own knowledge and understanding of sustainability and the SDGs
- review unit content against the SDGs to identify a sustainability-related issue
- apply knowledge and understanding of sustainability and the SDGs to propose improvements

Any of the SDGs can be covered; there are none that are mandatory.

You should look for opportunities in the HND Computer Science to demonstrate to your learners the various ways in which they might encounter concepts relating to sustainability. They should understand that computer science can support the realisation of a range of UN SDGs, while in some operational aspects, it also has a negative impact.

Here are some positive contributions that computer science makes to sustainability:

- computer technology can address environmental challenges, such as developing algorithms for optimising energy consumption in buildings or creating smart grids
- sustainable software engineering practices include code optimisation techniques that reduce energy consumption and minimise the carbon footprint of software applications
- data analytics and machine learning contribute to sustainability efforts, such as analysing patterns in energy usage or developing predictive models for environmental conservation
- building applications that facilitate renewable energy integration or developing software solutions for waste management and recycling

- the intersection of computer science with other fields, like environmental science or urban planning, supports the design of innovative and sustainable solutions

The challenges that computer science poses for sustainability include:

- the rapid pace of technology advancement, which often leads to a shorter lifespan for electronic devices and contributes to electronic waste
- high-performance computing and resource-intensive algorithms, which can consume significant amounts of energy and have a negative environmental impact
- privacy and security concerns, which may clash with sustainability goals, as increased data collection and processing for environmental monitoring might raise ethical dilemmas regarding data protection
- the risk of bias and discrimination in algorithmic decision-making systems, where algorithms trained on biased data may perpetuate social and environmental injustices
- the manufacture and disposal of electronic components used in computer science that can generate harmful electronic waste and contribute to the depletion of natural resources

Grading

Please see the Grading Pack for this qualification for more information on grading.

Learners who pass NextGen: HN Qualifications receive one of the following grade outcomes for the qualification as a whole:

- Achieved with Distinction
- Achieved with Merit
- Achieved

You assess and judge each learner's performance across the key competences of the qualification to determine their whole-qualification grade. You must align judgements with the whole-qualification grade descriptors, which are:

Achieved with Distinction

This candidate consistently demonstrates outstanding knowledge, understanding and application of skills. Thinking and working independently to an exceptional standard, they apply excellent judgement and creative problem-solving skills. They achieve or exceed agreed aims by confidently applying an extensive range of meta-skills and working very effectively with colleagues and peers.

Achieved with Merit

This candidate demonstrates an excellent level of knowledge, understanding and application of skills. Thinking and working independently to a high standard, they demonstrate good judgement and effective problem-solving skills. They achieve agreed aims by applying a broad range of meta-skills and working effectively with colleagues and peers.

Achieved

This candidate demonstrates thorough knowledge, understanding and application of skills. They think and work independently and use their judgement to find solutions to problems. They achieve agreed aims by applying a range of meta-skills and working well with colleagues and peers.

Successful learners receive their grade, along with the grade descriptor text, on their commemorative certificate.

In addition, you assess individual units on a pass or fail basis. Each unit has evidence requirements that learners must achieve before you can consider them for whole-qualification grading.

You make judgements about learners' quality of assessment evidence using a grading matrix based on important criteria in the qualification.

Grading and meta-skills

Meta-skills are a key part of the NextGen: HN Qualifications and learners develop them throughout the qualification. Competence in individual meta-skills is not assessed or graded. For example, the qualification does not judge the quality of learners' feeling or creativity, or their specific progress in any given meta-skill. Rather, it is the process of development the learner goes through that contributes to the whole-qualification judgement. This means learners should provide evidence of planning, developing and reflecting on their meta-skills. The grading matrix includes criteria on meta-skills, which you should use to support this judgement. See the NextGen: HN Meta-skills, Outcome and Assessment Guidance document for support with assessing meta-skills development.

How the qualification meets employer needs

This qualification is designed in collaboration with employers to meet the sector need. The following tables show how the qualification can benefit employers by producing learners with the necessary skill set.

The first table shows how units map to the aims of the qualification. The second table shows how the units map to National Occupational Standards (NOS) and/or trade or professional body for IT Professionals. The third table shows the significant opportunities that the qualification provides for learners to develop more generic skills and meta-skills. The final table shows the assessment strategy for the qualification.

Mapping qualification aims to units

General aims

Key: Aim is relevant to unit (X) Aim is not relevant to unit (—)

Unit code	Unit title	General aim 1	General aim 2	General aim 3	General aim 4	General aim 5
J68M 48	Computer Science	X	X	X	X	X
J7DX 48	Professional Practice in Computer Science	X	X	X	X	X
J7DH 48	Algorithms and Data Structures	X	X	X	X	X
J7DT 48	Applied Mathematics in Computing	X	—	X	X	X
J7DJ 48	Applied Artificial Intelligence	X	X	X	X	X
J7DV 48	Database Design and Development	X	X	X	X	X
J691 47	Emerging Technologies and Experiences	X	—	—	X	X
J7DW 48	Object Oriented Programming	X	X	X	X	X
J7DY 48	Programming Paradigms	X	X	X	X	X
J7E0 48	Virtualisation Technologies	X	X	X	X	X
J68T 48	Networking and Infrastructure	X	X	X	X	X
J7E1 48	Application Development for Web	X	X	X	X	X

Specific aims

Key: Aim is relevant to unit (X) Aim is not relevant to unit (—)

Unit code	Unit title	Specific aim 1	Specific aim 2	Specific aim 3	Specific aim 4	Specific aim 5	Specific aim 6	Specific aim 7	Specific aim 8
J68M 48	Computer Science	X	X	—	X	X	X	X	X
J7DX 48	Professional Practice in Computer Science	X	X	—	X	X	X	X	X
J7DH 48	Algorithms and Data Structures	X	—	X	X	X	X	—	X
J7DT 48	Applied Mathematics in Computing	X	—	X	—	—	X	—	X
J7DJ 48	Applied Artificial Intelligence	X	X	—	X	X	X	X	X
J7DV 48	Database Design and Development	X	X	—	X	X	X	X	X
J691 47	Emerging Technologies and Experiences	X	X	—	—	—	—	X	X
J7DW 48	Object Oriented Programming	X	X	—	X	X	X	—	X
J7DY 48	Programming Paradigms	X	X	—	X	X	X	—	X
J7E0 48	Virtualisation Technologies	X	X	—	X	X	X	X	X
J68T 48	Network Infrastructure	X	X	—	X	X	X	X	X
J7E1 48	Application Development for Web	X	X	—	X	X	X	X	X

Mapping NOS to units

The NOS for Information Technology Professionals are organised into 11 disciplines, each with a set of sub-disciplines. The following information lists the sub-disciplines that cover the key areas in HND Computer Science:

1 Digital Leadership Personal Competencies
1.1 Business Competencies

2 Business Analysis and Change Management
2.6 Requirements Engineering

4 Architecture, Analysis and Design
4.1 Systems Architecture
4.2 Data Analysis
4.4 Systems Analysis
4.5 Data Design
4.8 IT Infrastructure Design and Planning

5 Solution Development Systems Development
5.1 Software Development
5.5 Software Process Improvement
5.6 DevOps
5.7 User Centred Development

6 Cyber Security (IT Professional)
6.1 Information Security Management

7 Service Management and Delivery
7.1 IT Service Operations and Event
7.8 Change and Release Management

8 Data Science
8.3 Data Science
8.4 Artificial Intelligence (AI)
8.5 Machine Learning

9 IT Networks Network Services Planning
9.1 Network Design

Mapping NOS and/or trade or professional body requirements to units

Unit code	Unit title	NOS for IT Professionals sub-disciplines
J68M 48	Computer Science	4.1, 4.2, 5.1, 6.1, 9.1
J7DX 48	Professional Practice in Computer Science	1.1, 2.6, 4.1, 7.1, 8.1, 9.1
J7DH 48	Algorithms and Data Structures	5.1, 5.2, 5,5, 5.6, 8.3, 8.4, 8.5
J7DV 48	Database Design and Development	4.1, 4.2, 4.5, 8.1
J7DW 48	Object Oriented Programming	5.1, 5.7
J7DY48	Programming Paradigms	5.1
J7E0 48	Virtualisation Technologies	4.1, 4.8, 7.1, 9.1
J7DJ 48	Applied Artificial Intelligence	4.2, 4.5, 6.1, 8.3, 8.4, 8.5
J691 47	Emerging Technologies and Experiences	4.1, 5.1, 6.1, 7.1, 8.1, 9.1
J68T 48	Network Infrastructure	2.6, 4.1, 4.8, 7.1, 9.1
J7E1 48	Application Development for Web	1.1, 5.1, 5.2, 5.7, 8.1

Mapping opportunities to develop meta-skills across the qualification

Self-management

Unit code	Unit title	Meta-skills
J68M 48	Computer Science	♦ Focusing ♦ Adapting ♦ Initiative
J7DX 48	Professional Practice in Computer Science	♦ Focusing ♦ Integrity ♦ Adapting ♦ Initiative
J7DH 48	Algorithms and Data Structures	♦ Focusing
J7DT 48	Applied Mathematics in Computing	♦ Focusing ♦ Initiative
J7DJ 48	Applied Artificial Intelligence	♦ Focusing ♦ Integrity ♦ Initiative
J7DV 48	Database Design and Development	♦ Focusing ♦ Integrity ♦ Adapting ♦ Initiative
J691 47	Emerging Technologies and Experiences	♦ Integrity
J7DW 48	Object Oriented Programming	♦ Focusing
J7DY 48	Programming Paradigms	♦ Focusing ♦ Adapting ♦ Initiative
J7E0 48	Virtualisation Technologies	♦ Focusing ♦ Adapting ♦ Initiative
J68T 48	Networking and Infrastructure	♦ Focusing ♦ Adapting
J7E1 48	Application Development for Web	♦ Focusing ♦ Integrity ♦ Adapting ♦ Initiative

Social intelligence

Unit code	Unit title	Meta-skills
J68M 48	Computer Science	♦ Communicating ♦ Collaborating
J7DX 48	Professional Practice in Computer Science	♦ Communicating ♦ Feeling ♦ Collaborating ♦ Leading
J7DJ 48	Applied Artificial Intelligence	♦ Communicating
J7DV 48	Database Design and Development	♦ Communicating ♦ Collaborating ♦ Leading
J7DW 48	Object Oriented Programming	♦ Communicating ♦ Collaborating
J68T 48	Networking and Infrastructure	♦ Communicating ♦ Collaborating ♦ Leading
J7E1 48	Application Development for Web	♦ Communicating ♦ Collaborating ♦ Leading

Innovation

Unit code	Unit title	Meta-skills
J68M 48	Computer Science	♦ Curiosity ♦ Sense-making ♦ Critical thinking
J7DX 48	Professional Practice in Computer Science	♦ Curiosity ♦ Creativity ♦ Sense-making ♦ Critical thinking
J7DH 48	Algorithms and Data Structures	♦ Creativity ♦ Curiosity ♦ Sense-making ♦ Critical Thinking
J7DT 48	Applied Mathematics in Computing	♦ Sense-making ♦ Critical Thinking
J7DJ 48	Applied Artificial Intelligence	♦ Sense-making ♦ Critical Thinking
J7DV 48	Database Design and Development	♦ Creativity ♦ Sense-making ♦ Critical thinking
J691 47	Emerging Technologies and Experiences	♦ Sense-making ♦ Critical thinking
J7DW 48	Object Oriented Programming	♦ Creativity ♦ Sense-making ♦ Critical Thinking
J7DY 48	Programming Paradigms	♦ Creativity ♦ Sense-making ♦ Critical Thinking
J7E0 48	Virtualisation Technologies	♦ Creativity ♦ Sense-making ♦ Critical thinking
J68T 48	Networking and Infrastructure	♦ Creativity ♦ Sense-making ♦ Critical thinking
J7E1 48	Application Development for Web	♦ Creativity ♦ Critical thinking ♦ Sense-making

Assessment strategy for the qualification

Unit code	Unit title	Assessment method
J68M 48	Computer Science	♦ Knowledge evidence: No sampling frame is provided for question paper. Otherwise, there should be at least one evaluation of a contemporary ethical issue in computer science. ♦ Product evidence: One or more assembly language programs. One or more relational (normalised) databases.
J7DX 48	Professional Practice in Computer Science	♦ Product evidence (team): This is an extended team project of sufficient size and complexity to require a team solution. The project team will produce a report of how they planned and managed the project, analysed requirements, designed and implemented a solution, and their conclusions and recommendations. The project may also be a research question to be addressed, in which case the report will relate to the design and conduct of the research and the conclusions and/or recommendations from it. ♦ Product evidence (individual): A reflective report on the individual learner's contribution to the project. ♦ Performance evidence: A team presentation of the conduct of the project, the outcomes and solution. ♦ Meta-skills: A reflective report showing that the individual has self-assessed their meta-skills, created a plan for development and carried out activities that improved and developed their meta-skills. ♦ Learning for Sustainability: A report on how a computer science process or product could be made more sustainable to meet the aims of at least two selected UN SDGs.
J7DH 48	Algorithms and Data Structures	♦ Product evidence: Learners design, code and test one or more computer programs that cover all skills components. The evidence requirement specifies a list of mandatory functions to be coded in lightly-controlled conditions.
J7DT 48	Applied Mathematics in Computing	♦ Knowledge evidence: A question paper with a sampling frame provided. ♦ Product evidence: Learners use software or write program code to carry out mathematical and statistical operations to satisfy a list of requirements.

Unit code	Unit title	Assessment method
J7DJ 48	Applied Artificial Intelligence	♦ Knowledge evidence: Sampling frame provided for question paper. Otherwise, learners can develop a portfolio of research or investigations. ♦ Product evidence: From a given brief, learners select and use AI services or tools and interpret the results.
J7DV 48	Database Design and Development	♦ Product evidence: From a given brief, learners design and develop a normalised relational database and populate it. They create a set of queries to access, manage and analyse the data. From a given brief, learners design and develop a NoSQL database. They create a set of queries to manage and analyse NoSQL data.
J691 47	Emerging Technologies and Experiences	♦ Knowledge evidence: In any form of media, learners demonstrate knowledge relating to each outcome.
J7DW 48	Object Oriented Programming	♦ Product evidence: Learners investigate and apply OOP techniques. They implement a given object-oriented design, produce test documentation, and troubleshoot code errors.
J7DY 48	Programming Paradigms	♦ Knowledge evidence: Learners explain and give examples of each paradigm. They compare and contrast paradigms, taking account of key characteristics and use cases. Where a question paper is used, a sampling frame is suggested. ♦ Product evidence: Learners solve a given problem using at least two of the paradigms and produce an evaluation report on the outcomes.
J7E0 48	Virtualisation Technologies	♦ Knowledge evidence: Sampling frame (extensive) provided for question paper. ♦ Product evidence: Learners demonstrate their competence in building a virtual machine and deploying applications to a virtual machine in the cloud. They demonstrate virtualisation on desktop PC.
J68T 48	Networking and Infrastructure	♦ Knowledge evidence: A theoretical assessment. Can be a closed-book test. ♦ Product evidence: From a given scenario, learners design and build a network, including cabling and configuration of network services. Learners demonstrate their practical skills in network troubleshooting and testing.

Unit code	Unit title	Assessment method
J7E1 48	Application Development for Web	♦ Product evidence: From a given brief, learners design and build a secure, full-stack, interactive web app using current front-end and back-end technologies. They deploy to the internet, use version control and repositing, and document the app, including testing.

Approaches to delivery and assessment

While conventional teaching methods like lectures and discussions are beneficial for introducing foundational knowledge, you should also encourage active participation in discussions, to ensure learners understand the concepts and ideas of computer science. You should also give learners the opportunity to gain presentation skills by assigning research topics to be reported back to the class.

Computer science is a practical field, so it is crucial to engage your learners in labs and workshops where they can apply the theory they have learned. You should set up coding exercises, practical labs on databases, and networking exercises. You can set problems that require learners to apply their knowledge in a practical way, such as designing an algorithm to solve a particular problem.

For some units, you can encourage learners to work collaboratively. The Professional Practice unit is a large extended project in which learners experience more formal approaches to project planning and management. This can mimic a real-world working environment and enhance their teamwork and communication skills. You could also engage learners in collaborative activities, such as code reviews or hackathons.

You should encourage self-guided learning by signposting resources to be accessed outwith class time. Typical sources are industry blogs, podcasts, vendor training videos, and online courses. Inviting industry experts for guest lectures or webinars is another way to expose learners to real-world applications and emerging trends.

Sequencing or integrating units

You should prioritise the Computer Science mandatory unit for delivery as early as possible, as it provides underpinning concepts for many of the optional units. You should also commence the mandatory project unit (Professional Practice in Computer Science) whenever you are confident that the learners have sufficient breadth of knowledge in their optional topics to apply the concepts, principles and skills acquired in them.

You should consider where you can deliver units in tandem to enhance learning, or where sequential delivery might provide the best learning opportunity. In all the units in this HND, the approach you take should be to realise the computer science concepts through practical experiences with real-world problems demanding a computational solution. The more realistic these are, the more powerful the learning experience will be. The increasing availability of virtual cloud infrastructures from technology vendors increases scope to challenge learners to apply their knowledge and skills to unfamiliar contexts.

As indicated above, some units would benefit from co-delivery to enhance the learning experience. Typical examples of these could be:

- Programming Paradigms and Object Oriented Programming
- Algorithms and Data Structures and Applied Mathematics for Computing
- Virtualisation Technologies and Networking and Infrastructure

Many of the units are suited to assessment in the form of assignments and/or projects. In such cases the product evidence is clearly specified in each unit and centres should use this information to plan work that enables the evidence requirements to be met. The case studies and assignments used for the purpose of generating assessment evidence should be as real-world as possible, while considering the SCQF level of the unit. Where program code is required, centres should ensure that learners have sufficient access to programming resources such as an integrated development environment (IDE) or notebook-style coding environments.

Additional guidance on integrated or holistic assessment

Holistic or integrated assessment focuses on assessing several outcomes in a unit together, or in some cases the whole unit, rather than specific outcomes. When assessing a unit of competence holistically, the assessment activities integrate aspects of the competence. Holistic or integrated assessment can reduce the time spent on assessment and can promote greater equity in the assessment process.

When developing or revising a Higher National qualification, SQA works with a development team to devise an appropriate assessment strategy that accommodates holistic or integrated assessment. However, the practice of integrating units for the purposes of learning and teaching is a centre-led activity.

Units are designed to facilitate holistic or integrated assessment approaches that prevent large, unwieldy instruments of assessment.

Sometimes more than one piece of evidence is needed for a unit. For example, if a unit is about building a wall, a learner would need to produce evidence of performance (following the correct procedures and processes when building the wall) and product (a completed wall).

Evidence requirements must do what they say: specify requirements for evidence of learner competence in the unit or units. The evidence must be of sufficient quality for an assessor or verifier to judge that the learner has achieved the unit or units.

Assessing project units

The Professional Practice in Computer Science unit comprises a project that is sufficiently large or complex to require analysis and solution by a project team. This could be research into one or more aspects of computer science, such as AI or machine learning. It could also be a problem that requires a computing solution, such as the design and implementation of an algorithm. You group your learners into teams of three to five learners, considering the preferences expressed by learners in relation to the available projects and your judgement of an appropriate composition for each team, which should vary in terms of age, gender, ability and other relevant characteristics.

You should have a range of computer science projects or research themes that would be suitable to enable learners to demonstrate the outcomes of the project unit. The requirements must be sufficiently complex to require formal project management and development approaches. You should select these to be as real-world as possible and aligned to the level of study required. The project should allow learners to draw on the range

of outcomes in their Higher National Qualification and make it possible for them to develop their meta-skills while engaging in the project. To standardise the learner experience and level of demand, you should use a template to describe the objectives and required outcomes for each project to be offered to the groups of learners.

You should:

- approve projects
- assign learners to teams
- ensure each team allocates roles at the beginning of the project
- receive briefings from each team on progress against milestones
- observe and record the contributions of individual learners to teamwork and the problem solution
- arrange for the presentation of the project outcomes and solution
- intervene to guide and support learners when circumstances require it

You should approach your role with a light touch, leaving each team to make their own decisions about a project methodology, as well as roles, timelines, resource allocations and meetings. We recommend that each learner leads a specific part of the project (such as lead designer or lead researcher).

The product evidence is the outcome of the research or the solution to a computer science problem. Each project team must collectively produce items 1 to 5 below. Each learner must individually produce item 6. Learners must provide the following product evidence:

1 the project plan based on requirements gathering and analysis
2 the solution to the problem or the conclusions from the research
3 a project report (including project evaluation)
4 documentation of the process and outcomes
5 presentation of the project outcomes and demonstration of solution
6 personal statement

The learner's personal statement must:

- describe their specific role or roles in the project team
- include a self-evaluation of their contribution to the progress and completion of the project

The performance evidence is in two parts:

- a record of the learner's professional behaviours and contributions to the project; this may be in the form of a checklist
- a recording of performance in delivering the presentation

Each learner must make an identifiable contribution to the final presentation of the project outcomes and the demonstration of the solution (where required). This contribution can be in any form that is appropriate and agreed with the tutor.

Opportunities for e-assessment

Assessment that is supported by information and communication technology (ICT), such as e-testing or the use of e-portfolios or social software, may be appropriate for some assessments in this unit.

If you want to use e-assessment, you must ensure that you apply the national standard to all evidence and that conditions of assessment (as specified in the evidence requirements) are met, regardless of the mode of gathering evidence.

Learners need to use software products for most of the assessments that require product evidence. This results in a high proportion of digital evidence, which can be gathered in an e-portfolio.

Where knowledge evidence is required, this can often be generated in digital form, such as text documents, slide decks, audio files and video recordings. Where testing is used, then you should adopt online approaches to tests where practicable.

Remediation and re-assessment in Next Generation Higher National Qualifications

Remediation

Remediation allows an assessor to clarify learners' responses, either by requiring a written amendment or by oral questioning, where there is a minor shortfall or omission in evidence requirements. In either case, the assessor must formally note such instances, in writing or as a recording, and make them available to the internal and external verifier.

Remediation is not permitted for closed-book assessments.

The size and structure of the larger NextGen: HN units should mean that the assessor or lecturer is close enough to ongoing assessment activity in project-based units to identify the requirement for remediation as it occurs.

Re-assessment

We must give learners who fail the unit a re-assessment opportunity or, in exceptional circumstances, two re-assessment opportunities. Where we have introduced larger units to the framework, we expect instances of re-assessment to be minimal, due to the approach to assessment and remediation. Where re-assessment is required in a project-based unit, a substantially different project must be used.

Resource requirements

To ensure that learners can develop their knowledge and skills across the mandatory and optional units in the framework, you should consider the following resources:

- access to computer workstations that have reliable and fast internet access. These must be sufficient to perform coding exercises, access video-based instruction and support collaboration. Server technology is required for virtualisation technologies and potentially some AI model training. These can be physical servers or cloud-based servers
- the computer workstations should have good quality graphic processing units (GPUs) for image rendering and for the Artificial Intelligence unit. Networking lab equipment, such as routers, switches and firewalls, are required for the Networking and Infrastructure unit
- software provision should include integrated development environments (IDEs) such as Eclipse, IntelliJ IDEA, or Visual Studio Code and text editors for coding. The programming paradigms unit requires access to a range of programming languages, including Java, Python, C++, Javascript and Haskell. Jupyter Notebooks or Google CoLab could be used for collaborative work in coding
- coding practice platforms such as HackerRank or LeetCode could be helpful to gain programming skills
- for AI and mathematical computations, you should make available libraries such as PyTorch, Keras, Scikit-learn, NumPy, or SciPy. You should provide frameworks such as Node.js, React, Angular or Flask for the Web Development unit
- for the Database unit, you should provide tools such as MySQL, MongoDB, PostgreSQL or SQLite. For the Virtualization Technology unit, potential tools that you might use include VMware, Oracle VirtualBox, Hypervisor, and Docker

- for the Networking unit, you require network simulators such as Cisco Packet Tracer or GNS3
- to deliver the Applied Mathematics in Computing unit, you might supplement your teaching with mathematical software such as MATLAB or Mathematica
- for group projects and communication, you could make use of collaboration tools like Google Workspace or Microsoft Teams
- you should provide links as appropriate to websites, such as blogs, tutorials or online courses to support independent learning

Information for centres

Equality and inclusion

The units in this qualification are designed to be as fair and as accessible as possible, with no unnecessary barriers to learning or assessment.

You should take into account the needs of individual learners when planning learning experiences, selecting assessment methods, or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and/or those with additional support needs is available on the assessment arrangements web page.

Internal and external verification

All instruments of assessment used in this qualification should be internally verified according to your centre's policies and SQA's guidelines.

SQA carries out external verification to ensure that internal assessment meets the national guidelines for this qualification.

Further information on internal and external verification is available in SQA's Guide to Assessment.

Glossary

SQA credit value: the credit value allocated to a unit gives an indication of the contribution the unit makes to an SQA qualification. An SQA credit value of 1 represents approximately 40 hours of programmed learning, teaching, and assessment.

SCQF: the Scottish Credit and Qualifications Framework (SCQF) provides the national common framework for describing programmes of learning and qualifications in Scotland. SCQF terminology is used throughout this guide to refer to credits and levels. For further information on the SCQF, visit the SCQF website.

SCQF credit points: SCQF credit points provide a way of describing and comparing the amount of learning required to complete a qualification at a given level of the framework. 1 National Unit credit is equivalent to 6 SCQF credit points. 1 National Unit credit at Advanced Higher and 1 SQA Advanced unit credit (irrespective of level) is equivalent to 8 SCQF credit points.

SCQF levels: the level a qualification is assigned in the framework is an indication of how hard it is to achieve. The SCQF covers 12 levels of learning. SQA Advanced Certificates and SQA Advanced Diplomas are available at SCQF levels 7 and 8, respectively. SQA Advanced units are usually at levels 6 to 9 and graded units at level 7 and 8. National Qualification Group Awards are available at SCQF levels 2 to 6 and are usually made up of National Units, which are available from SCQF levels 2 to 7.

Information for learners

HND Computer Science

This information explains:

- what the qualification is about
- what you should know or be able to do before you start
- what you will need to do during the qualification
- opportunities for further learning and employment

Qualification information

The Higher National Diploma (HND) Computer Science provides you with the opportunity to gain the high-quality knowledge and skills you need to pursue a career in the ever-evolving field of modern computing and IT technologies. The demand for computer science professionals remains high as business and industry increase their requirement to sustain and develop applications of computing technologies. You understand that while there are many specialisms in the field of computing, there are fundamental concepts and technologies that underpin them. By completing this HND, you are well-equipped to pursue a computing specialism of your choice or undertake further study of computer science at degree level.

In HND Computer Science, you gain understanding of important aspects of computer science, including programming, data structures, algorithms, and computer systems. You can also specialise in a particular area of computer science, such as artificial intelligence (AI), cyber security or data science.

The specific aims of the qualification are that you can:

1 understand the key concepts and principles of computer science
2 appreciate current and emerging technologies in computer science, including AI and machine learning
3 develop mathematical and statistical understanding as it relates to computer science
4 apply knowledge of principles and concepts to real-world problems
5 prepare for employment in the design, development, testing and implementation of computing solutions
6 select and apply the correct approaches to resolving problems through computing solutions
7 develop computational thinking, pattern recognition, deconstruction, logical thinking, synthesis and analysis skills
8 develop professional practices and behaviours associated with computer science
9 gain understanding of the ethical, social and legal issues associated with the use of computer systems. including those relating to diversity, inclusion and sustainability
10 prepare for progression to further studies in computer science, or related disciplines, at SCQF level 9

During the course you carry out two mandatory units that add to 7 SQA credits. In the Computer Science unit, you learn the concepts and principles that are fundamental to the practice of computer science. In the Professional Practice unit, you work in a team to carry out an extended project, such as research into a topic in computer science or developing a computing solution to a problem from contexts such as science, engineering, health, business or cybersecurity.

Before you begin, you should have a good understanding of basic concepts of computer science, such as computer programming, computer hardware and software, along with good digital skills. You should also be familiar with software tools that aid the planning and reporting on your progress. You can evidence this by having an HNC qualification in computing, or equivalent at SCQF level 7.

To achieve the HND in Computer Science, you must pass the two mandatory units and achieve at least 8 SQA credits from a group of optional units. You can select optional units relating to a specialist area of computing.

You are assessed through a variety of approaches that reflect modern practice in assessment, including the use of projects, assignments, and investigations, as well as question papers. You are encouraged to use a range of media to present evidence, such as video, audio, web pages and social media platforms.

Your final award (provided all units are passed) is graded in a manner that reflects the quality of your work over the course. Project work that you have completed in the units of the course are graded according to a set of criteria that relate to the competences expected of a computer scientist.

Throughout the HND Computer Science you also develop your personal meta-skills while studying industry and sector-specific content. Meta-skills are higher-order skills that support the development of other skills and promote success in any context. They enable you to respond to professional challenges and opportunities by reflecting on, developing, applying and adapting industry skills and sector knowledge. These meta-skills are grouped into three categories: self-management, social intelligence, and innovation.

In line with government policy, you also develop your knowledge, skills and values related to the challenges of sustainability. You are encouraged to ask questions, analyse, think critically and work with others to make positive contributions to a sustainable future.

Successful completion of the HND Computer Science opens up career opportunities in a junior computing role. It also prepares you for progression to a degree-level qualification in computer science or further study in related computing topics.

Administrative information

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History of changes

Version	Description of change	Date

Note: please check SQA's website to ensure you are using the most up-to-date version of this guide, and check SQA's APS Navigator to ensure you are using the most up-to-date qualification structure.

If a unit is revised:

- no new centres can be approved to offer the previous version of the unit
- centres should only enter learners for the previous version of the unit if they can complete it before its finish date

For further information on SQA's Next Generation Higher National Qualifications please contact nextgen@sqa.org.uk.