HIGHER NATIONAL | SQA

Next Generation Higher National Unit Specification

NoSQL Databases (SCQF level 8)

Unit code: J6CJ 48

SCQF level: 8 (16 SCQF credit points)

Valid from: session 2023–24

Prototype unit specification for use in pilot delivery only (version 1.0) June 2023

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year.

This unit specification is for teachers and lecturers and contains all the mandatory information required to deliver and assess the unit.

This edition: June 2023 (version 1.0)

Unit purpose

This specialist unit introduces learners to NoSQL database concepts and technologies.

It is for learners who want to develop their knowledge of data management, particularly those studying a Higher National qualification in data science or computing.

Learners should have a basic understanding of databases, relational database management systems (RDBMS), and basic knowledge of a programming language, such as Java, Python, JavaScript or C++ is desirable.

The unit covers the concepts and evolution of NoSQL databases and examines the differences between relational and non-relational data structures. Learners explore NoSQL databases in detail, and gain hands-on experience of different types of non-relational (NoSQL) data models such as key-value, document, column, and graph. They understand the advantages and disadvantages of the different approaches, selecting the best fit data structure and building a database solution for a business problem.

Learners gain knowledge of and skills in using a range of NoSQL databases to an intermediate level, and how to use that knowledge to implement and manage complex unstructured data storage systems.

On completing this unit, learners can progress to a wide range of more specialist Higher National units in their chosen vocational fields.

Unit outcomes

Learners who complete this unit can:

1   evaluate database systems
2   use different types of NoSQL databases
3   build a NoSQL database driven solution

Evidence requirements

Learners must provide both knowledge and product evidence.

All evidence must be produced without assistance.

The knowledge evidence must show that learners have met all the knowledge points listed in the 'Knowledge and skills' section. The product evidence must demonstrate that learners can carry out practical assignments independently (see below).

Evidence must collectively demonstrate that learners can:

♦   explain the differences between different types of databases

♦   explain the architecture of NoSQL databases

♦   explain the importance of performance and optimisation of NoSQL databases

♦   install, configure and create a NoSQL database

♦   perform create, read, update and delete (CRUD) operations in a NoSQL database

♦   query a NoSQL database without using SQL

♦   apply security to a NoSQL database to prevent unauthorised access

♦   analyse, select and justify the best fit database architecture for a business problem

♦   design a database schema

♦   build a NoSQL database driven application

Learners can produce this evidence over an extended period of time, under lightly-controlled conditions (including access to reference materials). In this case, the evidence must be authenticated.

The standard of evidence should be consistent with the SCQF level of this unit.

You should use appropriate level descriptors when making judgements about the evidence.

Knowledge and skills

The following table shows the knowledge and skills covered by the unit outcomes.

Knowledge	Skills
Learners should understand: ♦ the historical development of database technologies ♦ contemporary database technologies ♦ NoSQL database concepts ♦ the purpose of NoSQL databases ♦ the differences between NoSQL and RDBMS ♦ benefits of a NoSQL database over a traditional RDBMS database ♦ applications of non-relational database technologies ♦ data models with NoSQL databases ♦ differences between row, key-value, graph, column and document stores patterns ♦ NoSQL database technologies, development tools and programming languages ♦ reliable database transactions systems (ACID and BASE) ♦ CAP theorem ♦ legacy (RDBMS) data architecture patterns ♦ NoSQL data architecture patterns ♦ applications of NoSQL databases ♦ detailed architecture of different types of NoSQL databases ♦ how to create and replicate a NoSQL database ♦ the purpose of map and reduce functions ♦ scalability and flexibility ♦ measures of capacity and performance ♦ the security and integrity of a NoSQL database	Learners can: ♦ identify various types of NoSQL databases ♦ install, configure and create a NoSQL database ♦ store and retrieve data in a NoSQL database ♦ perform create, insert, update, delete operations in a NoSQL database ♦ query a NoSQL database without using SQL ♦ apply security to a NoSQL database to prevent unauthorised access ♦ select a database architecture for a business problem ♦ design a database schema ♦ justify a chosen database solution ♦ build an application

Meta-skills

Throughout the unit, learners develop meta-skills to enhance their employability in the data science sector.

Self-management

This meta-skill includes:

♦ focusing: filtering, attention, sorting
♦ integrity: ethics
♦ adapting: self-learning
♦ initiative: independent thinking, decision-making

Social intelligence

This meta-skill includes:

♦ communicating: receiving information, giving information

Innovation

This meta-skill includes:

♦ curiosity: information sourcing, problem recognition
♦ creativity: maker mentality
♦ sense-making: pattern recognition, holistic thinking, synthesis, analysis
♦ critical thinking: deconstruction, logical thinking, computational thinking

Literacies

Throughout this unit, learners have opportunities to develop their literacy skills.

Numeracy

This is developed through capacity and performance measures of database systems, and understanding and interpreting data.

Communication

This is developed through activities that require learners to present gathered information.

Digital

This is developed through working towards all knowledge and skills.

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Delivery of unit

There are opportunities for this unit to be delivered alongside or integrated with units such as:

♦ Big Data at SCQF level 8
♦ Cloud Computing at SCQF level 8
♦ Data Science at SCQF level 8

While the exact time allocated to this unit is at your centre's discretion, the notional design length is 80 hours.

We suggest the following distribution of time:

Outcome 1 — Evaluate database systems
(10 hours)
Outcome 2 — Use different types of NoSQL databases
(35 hours)
Outcome 3 — Build a NoSQL database driven solution
(35 hours)

Additional guidance

The guidance in this section is not mandatory.

This unit is for learners who already have a basic knowledge of relational databases. Therefore, when you introduce NoSQL databases and address complex technological topics, you should cover them in high-level terms.

You can tailor the depth of content to specific learners to reflect their vocational and personal interests. For example, in a data science context, you should focus on using NoSQL to manage big data; therefore covering distributed databases and map-reduce functions in more depth. In a cyber-security context, you should place emphasis on cloud computing; therefore covering installing and configuring cloud-based data storages in more depth.

In all contexts, you should give attention to security areas where data could potentially be at risk or accessed by unauthorised individuals.

During delivery, you should take every opportunity to introduce real-world examples of NoSQL database solutions. Teach concepts and terminology with a hands-on and problem-solving approach throughout the unit. All learners must have hands-on experience with a minimum of two types of NoSQL databases. Suggestions include:

♦ column-oriented NoSQL databases using Apache Cassandra or HBase
♦ document-oriented NoSQL databases using Amazon DynamoDb
♦ key or value NoSQL databases using MongoDB, Riak, DynamoDb, CouchDB
♦ graph NoSQL databases using Neo4J

We recommend that you encourage learners to carry out further reading of NoSQL databases, and provide opportunities for individual or group research for the unit's theoretical content.

Resource suggestions

♦ Ploetz, A & All (2018) *Seven NoSQL Databases in a Week*, Packt Publishing, ISBN: 9781787288867
♦ Kelly, A.; McCreary, D. (2013) *Making Sense of NoSQL*, Manning Publications*, ISBN 9781617291074

Approaches to assessment

Evidence can be generated using different types of assessment. The following are suggestions only.

Knowledge evidence

This can take the form of a report or presentation. Learners should demonstrate that they have carried out significant research using reliable sources. They should evaluate the information gathered in their report or presentation. Their report should consist of around 1000 words and their presentation should be no less than 10 minutes in length.

Product evidence

Another approach is for learners to maintain a portfolio, based on a case study or real-life business scenario. They can produce this as the unit progresses and under lightly-controlled conditions, in which case authentication would be essential. The Guide to Assessment provides further advice on methods of authentication.

The portfolio could contain:

♦ a report relating to business case scenarios that include:
— an analysis of business case requirements
— justification of the database model proposed
— a design of the proposed database schema
♦ a logbook containing screen dumps proving:
— correct configuration of the database
— correct configuration of access and permissions
♦ an application

If something is not covered by the portfolio, you can gather evidence requirements from sampling activities.

Alternatively, learners could create a blog to record their learning journey through the unit. The blog would contain all the defined knowledge and skills, and collectively meet the evidence requirements.

Equality and inclusion

This unit is 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](#).

Information for learners

NoSQL Databases (SCQF level 8)

This information explains:

♦   what the unit is about

♦   what you should know or be able to do before you start

♦   what you need to do during the unit

♦   opportunities for further learning and employment

Unit information

This unit provides you with an introduction to NoSQL database concepts and technologies. It is particularly suitable if you are studying a Higher National qualification in data science or computing. When learning about NoSQL, it is helpful to be able to make comparisons with relational databases. Although you review them in the unit, it is beneficial to have prior experience with the relational model.

This unit gives you hands-on experience in using different types of NoSQL databases. You learn how to install and configure a NoSQL database, and create and replicate databases, load and query data, and other operations. As the security and integrity of a database are essential, you learn how to apply security to a NoSQL database to prevent unauthorised access. You also learn how to design a database schema and build an application to solve a real-world problem. Although the unit is mostly practical, it does contain a theoretical section, and you are introduced to concepts and terminologies using real-world examples of NoSQL database solutions.

Assessment is an opportunity to demonstrate all the knowledge and skills you have learned. You can be assessed on the underpinning theory of NoSQL databases through a report or presentation. However, the practical assessments allow you to design and build a NoSQL database driven application.

You can develop or enhance your meta-skills in self-management, social intelligence and innovation.

On completing this unit, you can progress to a wide range of more specialist Higher National units in your chosen vocational field, such as:

♦   Big Data at SCQF level 8

♦   Cloud Computing at SCQF level 8

♦   Data Science at SCQF level 8

Administrative information

Published: June 2023 (version 1.0)

Superclass: CB

History of changes

Version	Description of change	Date

Note: please check [SQA's website](https://www.sqa.org.uk) to ensure you are using the most up-to-date version of this document.

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