

BQA NCQF QUALIFICATION TEMPLATE

SECTION A: QUALIFICATION DETAILS														
QUALIFICATION DEVELOPER (S)			University of Botswana											
TITLE		Doctor of Philosophy in Computer Science								NCQF LEVEL		10		
STRANDS (where applicable)		N/A												
FIELD		Information and Communications Technology								CREDIT VALUE		360		
SUB FIELD		Information Technology												
New Qualification			Legacy Qualification			Renewal Qualification			✓					
						Registration Code			Q0325					
SUB-FRAMEWORK			General Education			TVET			Higher Education			✓		
QUALIFICATION TYPE		Certificate	I	II	III	IV	V	Diploma	Bachelor					
		Bachelor Honours			Post Graduate Certificate			Post Graduate Diploma						
		Masters					Doctorate/ PhD			✓				
RATIONALE AND PURPOSE OF THE QUALIFICATION														
RATIONALE: Digital transformation across Botswana, Southern Africa and the global economy has made advanced computing research capacity a strategic national asset. Secure and scalable software, cloud and edge platforms, cybersecurity, data-intensive systems, artificial intelligence and advanced analytics are reshaping government services, finance, health, mining, energy, agriculture, logistics and education. The qualification is necessary because these sectors require doctoral-level specialists who can generate new knowledge, design advanced algorithms and systems, supervise high-level research, and translate research into innovation, standards, policy and sector solutions. The need and relevance of the qualification are substantiated by national policy and skills priorities. Vision 2036: Achieving Prosperity for All positions innovation, ICT and research as key enablers of a knowledge-based economy. National Development Plan 12, covering 2025/26 to 2029/30, prioritises economic diversification, improved service delivery, job creation, productivity, competitiveness and ICT-enabled transformation across sectors. Botswana's National ICT Policy, Maitlamo, and the UNCTAD National ICT Policy Review and National E-commerce Strategy for Botswana emphasise														

connectivity, digital government, cybersecurity, digital trade, digital inclusion and human capital development.

The Human Resource Development Council, HRDC Priority Skills 2023/2024: Consolidated List of Priority Occupations and Skills, is used as the relevant priority skills reference for this renewal. It identifies ICT-related occupations and digital and analytical skills as priority areas. The Doctor of Philosophy in Computer Science directly addresses these sector needs by producing NCQF Level 10 graduates with advanced research capability in artificial intelligence and machine learning, cybersecurity, software engineering, data-intensive systems, distributed, cloud and edge computing, networks and communications, and human-centred computing. These capabilities support e-government, digital trade, secure infrastructure, agriculture and food systems, financial technology, data-driven decision making and technology-enabled productivity.

Programme performance and tracer evidence further strengthen the rationale. Available programme evidence indicates a low-volume but sustained doctoral pipeline, with one graduate to date and six candidates currently at different stages of doctoral study. The six candidates include staff employed by the University of Botswana, Botho University and the University of Malawi, demonstrating that the qualification contributes to academic staff development and advanced research capacity in Botswana and the region.

Available employability evidence records the one graduate as employed by the Botswana University of Agriculture and Natural Resources, BUAN, in the Department of Biometry and Mathematics, within the higher education, agriculture and natural resources sector. No graduate progression to further study is recorded in the available tracer evidence to date. This is consistent with the qualification being a terminal academic award, where post-PhD progression normally takes the form of postdoctoral research, research fellowships, academic career development, research leadership and senior specialist employment.

Stakeholder and industry feedback from BUAN confirms the effectiveness and relevance of the qualification. BUAN reports that the graduate's doctoral training has made a substantial contribution in three areas: programme development, teaching and research. The graduate has supported development of a new computing-related programme from bachelor's through to PhD level, strengthened delivery of MTH405: Introduction to Artificial Intelligence, and contributed to research addressing agricultural challenges in Botswana and the broader SADC region using blockchain, Internet of Things, data trust modelling and artificial intelligence. BUAN indicates that the graduate's skills align directly with its institutional and research mandate and affirm the value of the University of Botswana doctoral programme in producing graduates capable of meaningful impact.

The University of Botswana has a mandate to strengthen national research capacity and develop high-level human capital. The renewed Doctor of Philosophy in Computer Science is benchmarked against leading regional and international doctoral programmes and doctoral education standards. The programme provides a research-intensive pathway for graduates of the Master of Science in Computer Science and cognate master's programmes, and supports development of academic staff, researchers, innovators and R&D leaders for Botswana and the region.

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PURPOSE: (itemise exit level outcomes)

The purpose of this qualification is to produce graduates with the most advanced knowledge, skills and competences to:

1. Conduct original scholarly research in emerging areas of Computer Science and publish articles in accredited journals and conferences.
2. Apply the most advanced knowledge of theory and practice of computer science to provide innovative computer-based solutions.
3. Design and develop complex software systems to address technical problems.
4. Demonstrate mastery of professional practice when addressing technical challenges through innovative integration and experimentation of methods, techniques, and tools.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

For entry to a **Doctor of Philosophy in Computer Science**, the following entry requirements shall apply:

- i. Master's Degree (NCQF level 9) in Computer Science or cognate field.
- ii. Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) will be considered according to institutional policies in line with national RPL and CAT policies.

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SECTION B QUALIFICATION SPECIFICATION

GRADUATE PROFILE (LEARNING OUTCOMES)	ASSESSMENT CRITERIA
1. Apply most advanced knowledge and skills in the design and development of software systems.	1.1. Apply advanced knowledge and skills in the specification and design of complex software systems. 1.2. Select appropriate methods and frameworks for the development and deployment of software systems. 1.3. Evaluate the effectiveness of a software system solution. 1.4. Apply ethical standards, protocols, and practices relevant to the discipline.
2. Conduct independent, original, and scholarly research of international standard in emerging areas of Computer Science.	2.1. Critique relevant theory and practice to articulate gaps in an area of interest in computer science. 2.2. Conduct in-depth literature review to select and justify methodological choices for achieving a particular research objective. 2.3. Explore various problem-solving techniques that effectively communicate strategic principles in the construction of computer-based solutions of varying

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	complexity. 2.4. Develop a research proposal of an acceptable standard to address complex research problems. 2.5. Apply analytical, critical, and creative thinking skills to draw appropriate inferences and conclusions. 2.6. Develop proof of concept to demonstrate effectiveness of solution. 2.7. Publish articles in recognized journals or conferences. 2.8. Present research findings in conferences and seminars.
3. Demonstrate mastery of professional practice when innovating applications of computer science to address problems in various application domains.	3.1. Explore new ideas, techniques, and tools. 3.2. Identify, analyse, and synthesize suitable approaches to solve real-life problems. 3.3. Choose a theoretical framework appropriate to a problem in a given application domain. 3.4. Select appropriate research methods and associated research design. 3.5. Explore alternative solutions to a problem and identify the most appropriate option through trade-off analysis. 3.6. Formulate methods to test and confirm the viability of the proposed solution.

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SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	TITLE	Credits Per Relevant NCQF Level			Total Credits
		Level []	Level []	Level [10]	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units					
CORE COMPONENT	Supervised Research and			360	360

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Subjects/Courses/ Modules/Units	Thesis in Computer Science				
STRANDS/ SPECIALIZATION	Subjects/ Courses/ Modules/Units				Total Credits
			Level []	Level [10]	
1.					
2.					
Electives (Select Two).					

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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL

TOTAL CREDITS PER NCQF LEVEL

NCQF Level	Credit Value
10	360
TOTAL CREDITS	360

Rules of Combination:

(Please Indicate combinations for the different constituent components of the qualification)

This qualification has 360 core component credits all at NCQF Level 10. There are no fundamentals and electives. This is a research and thesis based qualification.

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ASSESSMENT ARRANGEMENTS

Assessment will consist of both formative and summative assessments and shall be aligned with learning outcomes and sub-outcomes. Assessment will be carried out by registered and accredited assessors. Assessment will be conducted by suitably qualified individuals who hold qualifications at least at the level being assessed, and preferably at a higher level where applicable, in Computer Science or a related field, with appropriate research, supervision and doctoral assessment experience.

1. Formative assessment

Formative assessment or continuous assessment component of the thesis may include one or more of the following: seminar presentations, proposal defence, progress reports and research publications. Continuous assessment shall contribute 50% to the final grade of the thesis.

2. Summative assessment

Summative assessment is conducted in the form of viva oral examination, thesis defence. The viva oral examination is assessed by both external and internal examiners who are suitably qualified in Computer Science or a related field. Summative assessment shall contribute 50% to the final grade of the thesis.

MODERATION ARRANGEMENTS

In accordance with university policies and regulations, internal and external moderation shall be conducted by BQA registered and accredited moderators, or by suitably qualified individuals recognised through the relevant regulatory or institutional framework. Moderators and examiners will hold qualifications at least at the level being moderated or examined, and preferably at a higher level where applicable, in Computer Science or a related field, with relevant research and doctoral assessment experience.

1. Internal moderation requirements

Internal moderation is carried out by registered and accredited moderators, or suitably qualified internal examiners, whose areas of expertise are aligned to the research area being moderated or examined.

2. External moderation requirements

External moderation is carried out by accredited moderators or suitably qualified external examiners from other institutions recruited for this purpose. External moderators and examiners shall have appropriate disciplinary expertise and experience in doctoral supervision, assessment or examination.

RECOGNITION OF PRIOR LEARNING

There is a provision for award of this qualification through RPL in line with institutional and national policies.

Candidates may submit evidence of prior learning and current competence and/or undergo appropriate forms of RPL assessment for the award of credits towards the qualification in accordance with applicable university RPL policies and relevant national-level policy and legislative framework. Implementation of RPL shall also be consistent with requirements, if any, prescribed for the field or sub-field of study by relevant national, regional, or international professional bodies.

CREDIT ACCUMULATION AND TRANSFER

There is a provision for award of this qualification through credit accumulation in line with institutional and national CAT policies.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation

Subject to University of Botswana policies and relevant approval processes, graduates may articulate horizontally into cognate doctoral programmes where research alignment exists, for example:

- Doctor of Philosophy in Information Systems
- Doctor of Philosophy in Data Science and Artificial Intelligence
- Doctor of Philosophy in Information Technology
- Doctor of Philosophy in Software Engineering
- Doctor of Philosophy in Cyber Security

Vertical Articulation

As the terminal academic qualification, vertical progression is normally into postdoctoral research, academic career development, research leadership programmes and professional research fellowships.

Employment Pathways

Graduates may take up advanced roles such as university lecturer or researcher, research scientist, postdoctoral fellow, principal software engineer, systems or solutions architect, cybersecurity researcher or manager, data science or AI research lead, ICT innovation and R&D manager, digital policy and standards specialist, research programme leader, technology transfer specialist and senior consultant in computing-related sectors.

QUALIFICATION AWARD AND CERTIFICATION

1. Minimum standards of achievement for the award of the qualification

To be awarded Doctor of Philosophy in Computer Science qualification, a learner must satisfy appropriate provisions of the institution. A learner is expected to complete a minimum of 360 credits. A candidate should attain a pass grade in the oral examination to be considered for the award of the qualification.

2. Certification

Candidates meeting prescribed requirements will be awarded the qualification **Doctor of Philosophy in Computer Science** in accordance with standards prescribed for the award of the qualification and applicable policies of the institution.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

A comparison was made for the proposed Doctor of Philosophy in Computer Science both regionally and internationally.

Regionally

The qualification was compared with the PhD specialising in Computer Science, University of Pretoria, South Africa; PhD (Computer Science), University of Cape Town, South Africa; PhD Computer Science, University of the Witwatersrand, South Africa; PhD in Computer Science, Stellenbosch University, South Africa; Doctor of Philosophy in Computer Science, Makerere University, Uganda; and Doctor of Philosophy in Computer Science, University of Nairobi, Kenya.

Internationally

The qualification was compared with the PhD in Computer Science and Software Engineering, University of Liverpool, United Kingdom; PhD in Computer Science, University of Arizona, United States; Computer Science MPhil/PhD, University College London, United Kingdom; Doctoral studies in Computer Science, Dr. sc. ETH Zurich, ETH Zurich, Switzerland; PhD in Computer Science, National University of Singapore, Singapore; Doctor of Philosophy (PhD), University of Melbourne, Australia; PhD in Computer Science, School of Computer Science, Carnegie Mellon University, United States; and PhD (Doctorate), TU Delft, Netherlands.

Title

The University of Botswana title, Doctor of Philosophy in Computer Science, is consistent with the dominant title pattern observed in Makerere University, University of Nairobi, Stellenbosch University, University of Arizona and National University of Singapore. Differences in titles, such as University of Pretoria's PhD specialising in Computer Science, University of Cape Town's PhD (Computer Science), University of Liverpool's PhD in Computer Science and Software Engineering, University College London's Computer Science MPhil/PhD route, ETH Zurich's Dr. sc. ETH Zurich, University of Melbourne's generic Doctor of Philosophy (PhD), and TU Delft's PhD (Doctorate), reflect institutional and national naming conventions rather than differences in doctoral level.

NQF Level

The proposed qualification is at NCQF Level 10. This is directly comparable with the South African comparator qualifications at NQF Exit Level 10, including University of Pretoria, University of Cape Town, University of the Witwatersrand and Stellenbosch University. International comparators are doctoral degrees in their respective systems and are therefore equivalent in academic level even where no NQF level is stated.

Duration

Duration has been selected as the comparability domain to avoid concurrent use of credit and duration systems. Where benchmark evidence specifies duration, comparator qualifications normally fall within doctoral timeframes of about three to four years full-time, with examples such as University of the Witwatersrand at two to four years, Stellenbosch University at three years, Makerere University at four years, University of Nairobi at three to five years, University of Liverpool at three to four years, University College London at four years, and TU Delft at four years. These durations support comparability of expected doctoral workload and research intensity.

Main Exit Learning Outcomes

The proposed qualification is similar to all comparators because it requires independent original research, advanced theoretical and methodological competence, scholarly communication and a doctoral thesis. This similarity is explicit in the University of Pretoria, University of Cape Town, University of the Witwatersrand, Stellenbosch University, Makerere University, University of Nairobi, University of Liverpool, University of Arizona, University College London, ETH Zurich, National University of Singapore, University of Melbourne, Carnegie Mellon University and TU Delft qualifications.

Domains/Modules

The proposed qualification is research and thesis-based. It is similar to thesis-centred qualifications at University of Pretoria, University of Cape Town, Stellenbosch University, University of Liverpool, University of Melbourne and TU Delft. It differs from structured doctoral models at Makerere University, University of Nairobi, University of Arizona, National University of Singapore, Carnegie Mellon University and ETH Zurich, which include coursework, qualifying evaluations or formal doctoral training. The difference is a delivery model difference, not a difference in doctoral level, because the proposed qualification achieves breadth and depth through supervised research, departmental research themes, proposal development, seminars and thesis examination.

Assessment Weightings

The proposed qualification explicitly weights formative assessment at 50% and summative viva oral examination at 50%. Most comparator qualifications do not express doctoral assessment in percentage weightings, but they use comparable assessment strategies such as proposal approval, progress monitoring, thesis examination, external examination and oral defence. The University of

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Melbourne differs by using external thesis examination without a standard oral examination component, while United Kingdom and many other comparators use viva voce or oral defence.

Qualification Rules and Standards

The proposed qualification is comparable with the benchmark set because admission is based on an appropriate master's degree or cognate qualification, supervisor alignment, research ethics where applicable, progress milestones, submission of an original thesis and successful doctoral examination. Some comparators add coursework, qualifying examinations or formal doctoral education requirements, for example University of Arizona, Carnegie Mellon University, National University of Singapore, Makerere University, University of Nairobi, ETH Zurich and TU Delft. These additions strengthen structure but do not make the proposed qualification lower in level, because the proposed qualification remains anchored in original research and doctoral examination.

Education and Employment Pathways

Across the comparators, graduates progress to postdoctoral research, academic careers, research scientist roles, R&D leadership, senior specialist computing roles, innovation management, consultancy and technology policy roles. The proposed qualification offers the same pathways, with horizontal articulation into cognate doctoral fields and employment pathways in academia, government, industry, agriculture, digital policy, cybersecurity, AI, software engineering, data science and ICT innovation.

Overall conclusion

The University of Botswana Doctor of Philosophy in Computer Science is at par with and equivalent to the regional and international qualifications benchmarked. Similarities are strongest in level, purpose, doctoral outcomes, original thesis requirement, research intensity and graduate pathways. Differences relate mainly to national title conventions, duration statements, structured coursework requirements, qualifying examinations and assessment format. These differences are acceptable variations in doctoral education models and do not reduce the comparability of the proposed qualification.

REVIEW PERIOD

The qualification will be reviewed every 5 years.

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CODE (ID)			
REGISTRATION STATUS	BQA DECISION NO.	REGISTRATION START DATE	REGISTRATION END DATE
LAST DATE FOR ENROLMENT		LAST DATE FOR ACHIEVEMENT	