QUALIFICATION SPECIFICATION							SECTION A
QUALIFICATION DEVELOPER	**University of Botswana – Department of Computer Science.**						
TITLE	**Master of Science (Computer Science)**			**NCQF LEVEL**	**9**		
FIELD	**Information Communication technology**		**SUB-FIELD**	**Computer Science**			
New qualification	√	Review of existing qualification					
SUB-FRAMEWORK	General Education		TVET		Higher Education	√	
QUALIFICATION TYPE	Certificate		Diploma		Bachelor		
	Bachelor Honours		Master	√	Doctor		
CREDIT VALUE:					**240**		

RATIONALE AND PURPOSE OF THE QUALIFICATION

Rationale

All sectors of the economy are continually deploying ever-changing complex computer systems in their day-to-day operations. As such, the need for trained professionals to meet the increasing global demand for skilled professionals in computing technology cannot be overemphasized. A master's degree in computer science provides a foundation for a career in Computing and Information technology research and development with specialized professional skills in one or more areas of computer science and leadership, including network security, software development, artificial intelligence, etc. In response to this huge demand, there is a coordinated global curricula development in the field of Computer Science which are continually adapting to the ever-changing technological advancements in the field to meet with the training of required professionals [1].

Moreover, this qualification has been identified as one of those providing important skills needed by the country as seen in occupations listed in the 2016 HRDC's top occupations in Demand report [2]. In addition, the country has seen the need to move towards a knowledge-based economy to realize economic growth that is globally competitive. This includes improvements in the quality of education, which should hasten the country's move from a natural resource-driven economy to a knowledge-driven economy as articulated in the National Development Plan (NDP 11) [3]. Furthermore, the Human Resource Development Council (HRDC, 2016) calls for a need to have advanced computing knowledge and skills required for the country's development and employability of human capital. Therefore, there is a need for strategic curriculum developments within Botswana to align to these developments as endorsed in the country's vision 2036 pillars 1 and 2 which aims at achieving sustainable economic and human social development in the country [4].

The MSc in Computer Science offering has the principal aim of expanding research training capacity and ensuring it is relevant for Botswana, as outlined above. The department has gathered experience in

offering an MSc Computer Science qualification for several academic years and useful observations and comments have been obtained from both staff, students, and other relevant sources as inputs into the current qualification implementation. These sources include previous CS curricula [5]; Botswana Computing skills survey 2017 [6]; Department of Computer Science Report of external Reviewer, 2018 [7]; ACM/IEEE curriculum 2013 [1]; HRDC interim sector skills in Demand report 2016 [8], and the report of the Maitlamo project spelling out ICT policy/strategy for Botswana and the ICT aspects of Vision 2036, both of which have clear implications for computing education and training in the country [8]. The current document describes the qualification that has incorporated these inputs and, also uses some aspects of the inputs to describe its design, especially its relevance.

Purpose

The purpose of this qualification is to produce graduates with Knowledge, Skills and Competences to:

- Develop secure software systems.
- Integrate large-scale software systems.
- Analyze the societal impact of computer systems.
- Manage computing technology resources and projects.
- Conduct research and advance knowledge in computing.

ENTRY REQUIREMENTS (including access and inclusion)

To be admitted to **Master of Science (Computer Science)**, an applicant shall normally have:

- NCQF Level 7 (Bachelor's degree) or its equivalent.
- Entry through Recognition of Prior Learning in line with institutional and National policies where necessary.

QUALIFICATION SPECIFICATION SECTION B

GRADUATE PROFILE (LEARNING OUTCOMES)	ASSESSMENT CRITERIA
1. Critically examine solutions to computing problems.	1.1 Identify the appropriate process to investigate a problem. 1.2 Analyse problems and provide computing solutions. 1.3 Develop innovative solutions to problems. 1.4 Create appropriate documentation of Solutions.
2. Develop computer systems that address problems in different application domains.	2.1. Apply appropriate techniques for systems analysis. 2.2 Select appropriate hardware for a system to be deployed.

	2.3 Construct different models for a system. 2.4 Implement a system based on models constructed. 2.5 Test a system based on requirements. 2.6 Examine system deployment options for a new system. 2.7 Evaluate system performance using appropriate evaluation techniques.
3. Apply appropriate mathematical techniques to solve computing problems.	3.1. Apply discrete mathematics in the analysis and design of algorithms. 3.2 Create models of data for use in databases. 3.3. Implement formal models of software systems. 3.4. Create data structures for advanced problems.
4. Work in collaboration with others	4.1 Apply effective forms of communication technologies. 4.2 Apply appropriate collaborative techniques and tools to facilitate teamwork. 4.3 Build new software systems through teamwork. 4.4 Play leadership roles in teams.
5. Conduct an independent research in Computer Science.	5.1 Identify and assess the main research methods used in Computer Science. 5.2 Select appropriate research method(s) for a research project. 5.3 Undertake a literature search and critical analysis of literature. 5.4 Engage in independent critical thinking, rational inquiry, and self-directed learning.

	5.5 Produce an acceptable dissertation of publishable quality. 5.6 Appraise the ethical issues associated with research and knowledge production in the discipline.

QUALIFICATION STRUCTURE

The Master of Science in Computer Science degree qualification is by coursework and dissertation extending over two years. The course work is normally conducted during the first academic year and is followed by a supervised original research project.

SECTION C

	Title	**Level**	**Credits**
FUNDAMENTAL COMPONENT Subjects / Units / Modules /Courses **(48 credits)**	Algorithms and Data Structures	**9**	**16**
	Computing Research Methods	**9**	**16**
	Object-Oriented Software Engineering	**9**	**16**
CORE COMPONENT Subjects / Units / Modules /Courses **(168 credits)**	Operating Systems	**9**	**16**
	Data Warehousing	**9**	**16**
	Computer Networking and Communications	**9**	**16**
	Supervised Research and Dissertation	**9**	**120**
ELECTIVE COMPONENT Subjects / Units / Modules /Courses **(24 credits)**	Machine Learning	**9**	**12**
	Web-Engineering	**9**	**12**
	Agent-Oriented Systems	**9**	**12**
	Topics in Computing	**9**	**12**
	Grid Computing Systems	**9**	**12**
	Multimedia Computing Systems	**9**	**12**
	Aspect-Oriented Software Development	**9**	**12**
	Information Retrieval	**9**	**12**

Rules of combinations, Credit distribution (where applicable):

This qualification is worth a total of **240 credits,** and it comprises of the fundamental, core, and elective components as follows:
The qualification requires 48 credits of fundamental courses, **168** credits of core courses, and 24 credits of any two (2) elective courses. The total credit a learner must achieve is 240.

MODERATION ARRANGEMENTS

ASSESSMENT

Assessment will consist of both formative and summative assessments and should be aligned with learning outcomes and sub-outcomes. Assessment will be conducted by registered and accredited assessors.

1. Formative assessment

The Formative assessment shall contribute 60% of the final grade.

2. Summative assessment

Summative assessment shall contribute 40% of the final grade.

MODERATION

In accordance with the university policies and regulations, internal and external moderations shall be conducted by BQA registered and accredited moderators.

1. Internal moderation requirements

Internal moderation is carried out by registered and accredited moderators whose area of expertise is in with the courses to be moderated.

2. External moderation requirements

External moderation is carried out by accredited moderators from other institutions recruited for this purpose.

RECOGNITION OF PRIOR LEARNING (if applicable)

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.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation

Learners in this qualification will have the following options for horizontal articulation:

- MSc Computer Information System
- MSc Information Technology
- MSc Data Science
- MSc Cybersecurity
- MSc Software Engineering

Vertical Articulation

Graduates of this qualification will have the following options for postgraduate education:

- Ph.D. Computer Science
- Ph.D. Computer Information Systems
- Ph.D. Data Science
- Ph.D. Information Technology
- Ph.D. Software Engineering

EMPLOYMENT PATHWAYS

Graduates of this qualification will be able to take up the following jobs

- Senior Systems Analysts
- Lead Software Engineer
- Computer Network Manager
- Webmaster
- Manager in Information Technology
- Database Manager
- Director in Information Technology
- Database Administrator/Developer
- IT Solution Architect
- Project Engineer/Manager
- Software Engineer
- System Analyst/Consultant
- System Developer/Engineer
- Web/Mobile Applications Developer
- IT Project Manager

QUALIFICATION AWARD AND CERTIFICATION

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

To be awarded **Master of Science (Computer Science)** qualification, a learner must meet the minimum requirement for credits from the fundamental, core, and elective courses, and pass the MSc Dissertation examination.

The qualification requires candidates to pass 48 credits of fundamental courses, 168 credits of core courses, and 24 credits of elective courses. The total credits a learner must achieve is 240.

2. Certification

Candidates meeting prescribed requirements will be awarded the qualification **Master of Science (Computer Science)** in accordance with standards prescribed for the award of the qualification and applicable policies of the university.

REGIONAL AND INTERNATIONAL COMPARABILITY

A comparison was made for the proposed qualification both regionally and internationally:

Regionally

It was compared with MSc Computer Science offered by:

- University of Pretoria (UP), South Africa
- University of Western Cape (UWC), South Africa.

Similarities

- The proposed qualification is like the ones it was compared with in terms of content scope, the core areas of computer science covered and the emphasis of the qualifications.

Differences

- The two South African qualifications did not have coursework components.
- The proposed qualification prepares students well for research with the one academic year of coursework.
- UP duration is one-year minimum; UWC is two years and the proposed qualification's two years duration is necessary.
- UP and UWC have better-established research groups, but the proposed qualification is offered in a context of a rapidly growing research environment, which, together with the appropriate coursework, ensures that students can successfully complete their dissertations.
- UP also requires submission of an article to an ISI indexed Journal which does not apply to the proposed qualification.
- Credits for the proposed qualifications are higher (240) than those of the two South African qualifications (180)

Internationally

Internationally, a comparison was made with the MSc Computer Science qualifications offered by the

- University of Liverpool (UK)
- University of Arizona (USA).

Similarities

- The proposed qualification generally compares well with the qualifications selected in terms of content scope, the core areas of computer science covered and the emphasis of the qualifications.

- All the qualifications have a full year of coursework and a period for research, which can vary.

Differences

- Credits for the proposed qualifications are higher (240) than those of the University of Liverpool (UK) which it was compared with (180)

REVIEW PERIOD

5 years