SECTION A:	***QUALIFICATION DETAILS***																	
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology																	
TITLE	Bachelor of Science Honours (Data Science)															***NCQF LEVEL***	*8*	
FIELD	Information and Communication Technology		***SUB-FIELD***		Computer Science											***CREDIT VALUE***	*120*	
New Qualification		✓	*Review of Existing Qualification*															
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:

In our every day to day lives we are involved in actives that generates vast amount data, e.g., social media, shopping, finance, and biological process. Data Science is concerned with extracting intelligence from data. This done by applying cutting edge techniques from Statistics, Mathematics and Computer Science. The amount of data involved normally ranges from small, medium, and big scales and of different formats. The techniques used to understand the modern abundance of data are at the intersection of computing and mathematics, including statistics and machine learning, and there is a high demand in industry.

Botswana VISION 2036 recognizes education and skills development as the foundation of development of knowledge-based economy. In line with Pillars 1 and 2, tertiary education providers are mandated to provide quality training opportunities. A qualification in bachelor's Honours in Data Science is thus in line with mandate.

Furthermore, the qualification will aid in making data-driven decision in the bid to attain Sustainable Environment and Sustainable Economic Development.

The qualification is also in line with the goals stated in the National Information and Communications Technology (ICT) Policy (Maitlamo), NDP 11 and ETSSP. The need for a degree in Data Science is also supported by Human Resource Development Council (HRDC) of Botswana, PRIORITY SKILLS AND PROSPECTS report of 2019. In the report Data Science is the basis of at least 4 future jobs listed on page 1 of. There is also a demand from employers in Botswana for Data Science Honours graduates – the statement supported by the documented discussions with the members of the Departmental Stakeholder

Advisory Committee held on October 13, 2016, March 3, 2017, and July 5, 2019 (final approval of qualifications). The minutes of the said meetings are attached to the submission.

PURPOSE:

The purpose of this qualification is to produce graduates who have highly specialized knowledge, skills, and competencies to:

- Develop big data models.
- Analyze big data using different data models.
- Assess the effectiveness of the model to improving business processes.
- Safeguard the ethical use of data in all aspect of their profession.
- Develop solution for big data problems.
- Conduct research under supervision.
- Work and communicate effectively as team member and leader on projects.

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirements:

- A bachelor's degree (NCQF level 7) in the same or a cognate field of study. Admission may also be possible following a Post-Graduate Diploma or a Post-Graduate Certificate.

- Admission through RPL and CAT will be provided through ETP policies in line national RPL and CAT Policies. Policy number AC03 (Recognition of Prior Learning)

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SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
LO1. Analyse big data using different highly specialized methods.	1.1 Extract information and assess trends from big dataset. 1.2 Develop data visualization platforms to visualize trends and gain insight from data. 1.3 Develop custom data models and algorithms to apply on large dataset. 1.4 Assess the effectiveness and accuracy of new data models.
LO2. Improve organizational performance through research and data skill.	2.1 Work with various stakeholders to identify opportunities for an organization to leverage on data to develop new solutions 2.2 Monitor outcomes from data models for effective use of data. 2.3 Develop organisation data frameworks and implement them for effective use of data. 2.4 Develop process and tool to monitor and evaluate organisational performance based on data from different functions.
LO3. Show specialised knowledge and skill to make ethical use of data in all aspects of the profession.	3.1 Ensure compliance on social, legal, and ethical data standards by the organisation and individuals within the organisation.
LO4. Apply specialised skills to conduct research under supervision.	4.1 Develop research problems through stakeholder engagement for solving existing problems. 4.2 Evaluate appropriate theoretical and conceptual frameworks for solving research problem.

	4.3 Utilize appropriate research methods to achieve solutions to identified problems. 4.4 Work independently within give time frames to develop solution. 4.5 Document and communicate findings efficiently, for easy understating for both technical and non-technical audience.
LO5. Apply specialised organizational and leadership skills in managing group work to archive a solution to a given task/problem.	5.1 Contribute successfully and effectively in group work to solve a given tasks. 5.2 Communicate the outcomes of group work effectively for easy understating for both technical and non-technical audience. 5.3 Work effectively as part of a member of a team and lead the team.
LO6. Demonstrate high level of specialised communication and organizational skills	6.1 Develop effective presentations to communicate problem/task and findings. 6.2 Practise time management skills to manage and complete tasks on time.

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SECTION C	***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***			***Total*** ***(Per** Subject/ Course/ Module/ Units)*
		Level [8]	***Level [4]***	***Level [ ]***	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*					
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Advanced Machine learning	**84**			**84**
	Big Data Analytics	**12**			**12**
	Individual Research Project in Data Science	**12**			**12**
	Group Design Project	**24**			**24**
	Advanced Research Methodologies	**24**			**24**
ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	Big Data Mining	**9**			**9**
	Advanced Computational Biology	**9**			**9**
	Advanced Cryptography	**9**			**9**

	Big data in Physics	**9**			**9**
	Advanced Computational Finance	**9**			**9**
	Big data Natural Language Engineering	**9**			**9**
	Big data Algorithms	**9**			**9**
	Advanced Computational Statistics	**9**			**9**
	Big Data Databases	**9**			**9**
	Big Data Technologies	**9**			**9**

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SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
Level 8	***120***
TOTAL CREDITS	***120***

Rules of Combination:

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

The qualification consists of **120 credits** for BSc (Honours) with **84 credits** Core Components and **36 credits** made from choosing several Elective Components.

Table 1 Credit Distribution

Level	Credit
8(30% minimum research)	120 (36 credits for research, 24 from research project and 12 from advanced research methodologies) which equals 30%
Total	**120 (36 from elective)**

Rule

The qualification in BSc Honours (Data Science) is a 1 year degree where students will be awarded an Honours degree after completing and attaining the full 120 credits.

Candidates are required to select a total of 36 credits of electives throughout the programme all from level 8. The electives allow students to focus on an area of their interest within the Data Science discipline.

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ASSESSMENT ARRANGEMENTS

Assessment Strategies, Requirements and Weightings:

ASSESSMENT

All assessments, formative and summative, leading/contributing to the award of credits or a qualification should be based on learning outcomes and/or sub-outcomes.

Formative Assessment

Formative assessment or continuous assessment contributing towards the award of credits should be based on course outcomes. This can include tests, assignments, and projects as well as simulated and real work settings. The contribution of formative assessment to the final grade shall be minimum 30% but not exceed 40%.

Summative Assessment

Candidates may undergo assessment including written and practical and simulated projects. The final examination for each course may contribute form 70% up to 60% of the final mark for that course. Hence, CA/Exam ratio will vary from 30/70 to 40/60.

All assessment shall be carried out by BQA registered and accredited Assessors.

MODERATION ARRANGEMENTS

Internal and external moderation shall be in accordance with applicable policies and regulations. Pre-assessment moderation will be carried out before administering assessments that contribute towards the award of credits in this qualification and post-assessment moderation will be carried out after the assessment tasks have been marked.

All necessary documents including qualification document, alignment matrices, assessment instruments and assessment criteria/rubrics should be available.

Criteria for Selection of Assessors and Moderators

Assessors and moderators must have valid registration and accreditation with all relevant bodies such as Botswana Qualifications Authority (BQA)

RECOGNITION OF PRIOR LEARNING

Recognition of prior learning is applicable for this qualification.

CREDIT ACCUMULATION AND TRANSFER

Credit accumulation and transfer is applicable for this qualification.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Learning Pathways

Horizontal Articulation:

- BSc Honours (Statistics)
- BSc Honours (Applied Mathematics)
- BSc Honours (Computer Science)

Vertical Articulation:

- MSc Data Science
- MSc Big Data Analytics
- MSc Computer Science
- MSc Computational Statistics

Employment Pathways

There is strong market demand for data scientists from all sought of sectors including:

- Machine Learning Scientist.
- Applications Architect.
- Enterprise Architect.
- Data Architect.
- Infrastructure Architect.
- Data Engineer.

QUALIFICATION AWARD AND CERTIFICATION

QUALIFICATION AWARD:

To be awarded a Bachelor Hons (Data Science), a candidate is required to achieve a minimum of **120** credits inclusive of 84 credits for Core courses, 36 credits for Optional/ Elective Courses.

CERTIFICATION:

Candidates meeting prescribed requirements will be awarded a Bachelor of Science (Honours) Data Science and official transcripts.

REGIONAL AND INTERNATIONAL COMPARABILITY

BENCHMARKING

The following international universities have been considered:

1. The IT University of Copenhagen (Denmark): BSc in Data Science

2. Warwick University (the UK): BSc in Data Science

3. The Chiminade University (the US): BSc in Data Science, Analytics and Visualisation

4. The University of San Francisco (the US): BSc in Data Science

The IT University of Copenhagen in Denmark offers a BSc degree in Data Science. On their website, a Data Scientist is defined as someone with comprehensive analytical and technical skills covering all aspects of handling and analysing data. The learner gains skills to be able to work in interdisciplinary teams and use their organisational knowledge and market understanding to make a difference. Businesses and other organisations accumulate enormous quantities of data for software market research, disaster prediction, investment analysis, policy development, artificial intelligence and more. The graduate of the Data Science program possesses enough skillsets to undertake any role in the described areas. During the programme, the Learner receives extensive teaching in the technical subjects of Mathematics and Statistics for Data Sciences, data visualisation, Programming, Machine Learning, Algorithms Development and Data Management. The Modules listed here are included in these Data Science programme design as they form the core part of Data Science. A graduate of the degree programme has direct access to MSc in Computer Science as well as MSc in Digital Innovation and Management. As already outlined the IT University of Copenhagen have similar module as those proposed in this document. Furthermore, the programme proposed in this document offer graduate with a variety of entrepreneurial skill should graduates wish to peruse a career in Data Science business development.

Warwick University in the UK offers a BSc Programme in Data Science. The entry requirements to this programme are based mostly in the A Level Mathematics. The University has made the curriculum as flexible as possible as the learner progresses through the degree. There is enough room to select some electives from different departments. At the second year, the learner has access to 15% of optional modules and at the third year the learner has 60% of optional modules. The programme is designed to have contact time of 15 hours per week and the class sizes are capped at 180 students. The assessment of the programme is such that the first-year counts for 10% of the degree, the second year contributes 30% while the third and final year contributes 60% of the final BSc degree. As proposed by the Data Science programme in BIUST, the curriculum from Warwick University allows students to take a year off from the programme and study abroad from different partner universities. Students can also pause the programme midway and undertake some paid work and return to the programme later. The Core modules of the programme are Programming for Computer Scientists, Mathematical Programming, Mathematical Analysis, Statistical Laboratory, Introduction to Probability, Algorithms, Software Engineering, Mathematical Statistics and Data Science Project. The University offers a pool of optional modules that students can choose from. Some of the modules in the pool include among other Decisions and Behaviour, Machine Learning, Statistical Genetics, Mathematics for Random events etc. Modules like the ones offered at Warwick University have been included in the proposed document by the Botswana International University of Science and Technology. From this benchmarking exercise, it is evident that Programming, Mathematics, Statistics, Algorithms, Database Management all form the core part of Data Science. These modules have been identified as core to the Data Science Programme in this document. Like before the major difference is the entrepreneurial skills added in this document.

The Chiminade University in the United States of America offers a BSc Degree in Data Science, Analytics and Visualisation. The programme is about preparing graduates for the data revolution that is occurring in every sector of the economy. Data Science is a fastest growing sector in Computer Science with millions of emerging jobs. The programme is tailor made to allow the graduates to specialise in business analytics, healthcare informatics, environmental analytics and more. A graduate from this programme is indispensable to a wide range of employer organisations who use high volumes of data to advance their missions. The learner is also exposed to pre graduation internships and real-world projects with big companies, and this presents an opportunity to meet future employers which we also offer in the form of industrial attachment. The information presented does not contain the detailed credits breakdown as it requires registration which we provided.

The University of San Francisco (the US) also offers an undergraduate degree in Data Science. The graduate of Data Science from the University of San Francisco is ready made to acquire, manage, and explore the data. This includes predicting consumer behaviour, extracting information from medical images, uncovering hidden stock market indicators, studying human genetic structures, etc. Students are expected to have covered areas of Mathematics, Computer Science, Economics, Data Driven Visualisation, Software Development, research projects and more. The modules discussed in the University of San Francisco also appear in the programme design for Botswana as they form the main backbone of a Data Science Programme. Like before the major difference is the entrepreneurial skills added in this document and credit breakdown.

In terms of regional benchmark, there is no regional university offering the programme at this level. Only at Wits University which something similar is offered at NQCF Level 9.

The programmes BSc (Hons) and BSc in Data Science have been designed to equip learners with knowledge that fits the international market.

REVIEW PERIOD

The qualification will be reviewed every five (5) years.

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