SECTION A:	**QUALIFICATION DETAILS**
QUALIFICATION DEVELOPER (S)	UNIVERSITY OF BOTSWANA

TITLE	Bachelor of Science in Statistics			**NCQF LEVEL**	7
FIELD	Natural, Mathematical and Life Sciences	**SUB-FIELD**	Statistics	**CREDIT VALUE**	544

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: The current report (2019) on the Human Resource Development Council (HRDC) of Botswana's Priority Skills and Employment Trends' job rankings put data analysts and/or scientists, machine learning and big data specialists high on the list of the future jobs as suggested by the World Economic Forum. All these are specialised, 'new millennial' jobs that are directly related to the study of statistics as a science of decision-making. Furthermore, statistical, mathematical, and related associate professionals have been listed amongst the top occupations in demand in the research, innovation, science, and technology (RIST) sector. These top occupations are informed by national priorities as outlined in the VISION2036, National Development Plan (NDP 11) and long-term strategies of the different sectors of the economy.

The Bachelor of Science in Statistics qualification offers an opportunity to provide Botswana with a cadre of statisticians who will be highly equipped with great analytic skills and market-ready to provide technical support

required by the different sectors of the economy. The knowledge in statistics provides the students with the necessary analytical tools and quantitative reasoning to extract useful information from both the small and big data sets. This would enable the students apply knowledge acquired in different sectors, ranging from government departments to non-governmental organisations, to business, and to secondary schools, universities, and research institutions. A statistician can be involved in helping shape government policy, management of investment portfolios in the financial sector, setting up clinical trials for the newly developed live saving drugs/vaccines or developing algorithms that can help scientists process and analyse genomic data.

Furthermore, the qualification is expected to help the graduates to undertake higher level studies such as BSc (Hons), Masters and PhD programs in statistics and its allied subjects such as Actuarial Sciences, Data Science/Analytics, Bioinformatics, Risk Management, and others.

PURPOSE: The purpose of this qualification is to produce a graduate with the knowledge, skills, and competences to:

i. perform data collection, design experiments or surveys and critically analyze various types of data found in the work environment.
ii. solve complex statistics-related problems, engage in critical analysis of data and have other generic skills such as written and oral communication, computer-literacy and great interpersonal skills infused through assessments and multicultural environment.
iii. demonstrate initiative and responsibility, perform their duties in a professional and ethical manner, and be able to provide intellectual leadership.

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry into a Bachelor of Science in Statistics program requires an applicant to have:

I. Certificate IV, NCQF level 4 (TVET/HE) or equivalent
II. RPL and CAT are applicable for admission

SECTION B	QUALIFICATION SPECIFICATION
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
LO1 – Solve complex problems in a range of mathematical and statistical applications using calculus	1.1. Integrate knowledge and ideas of different mathematical techniques and use appropriate techniques to solve and/or establish theoretical results in probability and statistics. 1.2. Apply differentiation to optimization problems arising from theory of estimation and related applications in business, social and life sciences. 1.3. Examine and apply various techniques of integration to establish different measures of probability distributions that are used for modelling natural phenomena. 1.4. Effectively write mathematical solutions or proofs in a clear, logical, and concise manner for others to be able to understand and follow your solutions.
LO2 – Apply specialised techniques from linear algebra to solve statistical and real-life applications	2.1. Formulate a logistics, operations, or project management problem as a linear programming problem. 2.2. Compute and apply a (generalized) inverse of a matrix to solve systems of linear systems arising from logistics, operations, or project management problems. 2.3. Decompose a given matrix to a simpler canonical form to establish properties of a linear system and to also reduce the computational burden that would be required with the initial matrix. 2.4. Represent multivariate data arising in business, social and life sciences in a compact matrix form and apply appropriate techniques of linear algebra to transform and/or analyse the data.

LO3 – Define, derive and apply specialised knowledge of probability and mathematical statistics to real life applications	3.1. Distinguish and execute between discrete and continuous random variables and their probability distributions to be able to identify the most appropriate for a given real life problem. 3.2. Execute an appropriate probability distribution to compute probabilities of some well-defined event for a given real life problem. 3.3. Demonstrate the specialised Bayesian statistics knowledge and understanding on how one can incorporate prior knowledge of a problem under study to improve the results of the fitted model. 3.4. Derive mathematical expectations, generating functions, marginal and conditional distributions, and convolutions of standard statistical distributions and apply them in different research problems.
LO4 – Integrate and apply statistical methods, theory of estimation and hypothesis testing to solve real life problems	4.1. Compute and discuss desirable properties of a given estimator to establish its appropriateness for a given research problem. 4.2. Apply linear models to real-world problems related to either scientific inquiry, management or decision making. 4.3. Execute and apply the most important estimation techniques such as maximum likelihood, least squares method and method of moments to compute point and interval estimators for a given research problem. 4.4. Conduct an appropriate parametric and non-parametric statistical test for various hypotheses that can arise from different research problems. 4.5. Interpret the statistical test results and conclude on the statistical significance of the results.
LO5 – Independently develop and apply an appropriate study design for a given research problem	5.1. Develop a basic or specialised study design using either a sample survey or an experiment for research problems in agriculture, business, health, social and life sciences. 5.2. Implement the study design and monitor the experiment or field survey to ensure professional

	integrity during both data collection and analysis stages. 5.3. Critically analyse survey or experimental data and interpret the results to inform decision-making and policy formulation. 5.4. Organise and effectively disseminate the experimental or survey results to other stakeholder through either workshops, seminars, or publications.
LO6 – Use a statistical software to extract, transform, explore, and analyse data	6.1. Capture and store data into an appropriate format for data analysis. 6.2. Import, clean and transform data from other data management software to ensure high quality of the data sets before analysis. 6.3. Carry out exploratory data analysis using different statistical techniques such as graphs and tables to aid interpretation of the results and present main data features. 6.4. Execute different software to fit appropriate statistical model to the given data.
LO7 – Independently identify and formulate a real-life problem as a statistical research project	7.1. Identify a possible research problem that can be studied from a given scenario. 7.2. Formulate measurable research hypotheses for a given research problem. 7.3. Critically review the current literature in the subject area of the identified research problem. 7.4. Identify appropriate statistical methodology and apply it to critically analyse the data. 7.5. Communicate and disseminate the statistical methods used and results to both statisticians and non-statisticians in an effective manner.

SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	**TITLE**	**Credits Per Relevant NCQF Level**			**Total** (**Per** Subject/ Course/ Module/ Units)
		Level [6]	**Level [7]**	**Level [8]**	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units	ICT	20			20
	Communication and Writing Skills	20			20
CORE COMPONENT Subjects/Courses/ Modules/Units	Calculus and Real Analysis	28	36		64
	Linear Algebra		24		24
	Probability	14	24	12	50
	Statistical Methods	14	24		38
	Statistical Distributions		36		36
	Statistical Inference		24	12	36
	Sampling Theory and Applications		36	12	48
	Statistical Computing		12		12
	Research Project		24		24
	Econometrics		36		36

ELECTIVE/ OPTIONAL COMPONENT Subjects/Courses/ Modules/Units	Statistical Quality Control		12		12
	Operations Research		12	12	24
	Health Statistics		24		24
	Applied Stochastics Processes			12	12
	Generalised Linear Models			12	12
	Agricultural Statistics		12		12
	Multivariate Data Analysis		12		12
	Advanced Experimental Design			12	12
	Science Based Courses	24	36		60
	Electives/General Education Courses (GEC)		64		64

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	**Credit Value**
Level 6	120
Level 7	448
Level 8	84
TOTAL CREDITS	**652**
Rules of Combination:	

(Please Indicate combinations for the different constituent components of the qualification)
For a student to graduate with a Bachelor of Science in Statistics degree, they must have acquired 544 credits as follows: - Fundamentals: 40 - Core courses: 332 - Optional Courses: minimum of 172

ASSESSMENT ARRANGEMENTS

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

5.1 Formative assessment

Formative assessment or continuous assessment contributing towards the award of credits should be based on course outcomes. Unless otherwise specified in the departmental regulations, the continuous assessment will consist of at least two pieces of work. The contribution of continuous assessment to the final grade is **40 - 50 %.**

5.2 Summative assessment

For taught courses, candidates may undergo assessment including written and practical examination, simulated and practical projects. Summative assessment contributes **50 - 60 %** to the qualification.

MODERATION ARRANGEMENTS

The internal and external moderation will be done by BQA registered assessors and moderators. The assessment and moderation policies of the University aligned with that of BQA shall apply.

RECOGNITION OF PRIOR LEARNING

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

CAT policy shall be applied.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

The Bachelor of Science in Statistics qualification provides career-path articulation options leading to a variety of horizontal articulation and vertical articulation as follows:

Horizontal Articulation

a. Professional certificates: Banking, Insurance, Risk Management, NCQF Level 7.

Vertical Articulation

a. Honours degree: Statistics/Applied Mathematics/Actuarial Science/Data Science/Analytics, NCQF Level 8

b. Post Graduate Diploma in Statistics.

c. Master's Degree in Statistics/Applied Mathematics/Actuarial Science/Data Science/Analytics, NCQF Level 9.

Employment wise, graduates will have requisite competencies and attributes to work as:

a. Statisticians
b. Data analysts
c. Data scientists
d. Risk analyst
e. Data clerks
f. Research assistant

QUALIFICATION AWARD AND CERTIFICATION

Minimum requirements of achievement for the award of the qualification

A candidate is required to achieve a minimum of 544 credits inclusive of the core, optional, elective and GEC components, to be awarded qualification in Bachelor of Science in Statistics.

Certification

Candidates meeting prescribed requirements will be awarded a certificate.

REGIONAL AND INTERNATIONAL COMPARABILITY

The Bachelor of Science in Statistics degree is generally comparable in terms qualification credits, course content, exit level outcomes, assessment criteria and employment pathways with the regional and international qualifications considered. The qualification facilitates both the vertical and horizontal articulation in the academic progression in the area of statistics.

The Bachelor of Science in Statistics Degree is bench marked with similar programmes offered by other Universities regionally and internationally. Regionally, University of Pretoria, South Africa was considered and Internationally University of Sheffield, United Kingdom was considered.

There are no major differences between the BSc (Stat) Single major degree offered by the University of Botswana and the BSc (Mathematical Statistics) offered by the University of Pretoria. The core courses are

generally of the same content and quality; differences are in the optional courses. With Pretoria learning more towards actuarial sciences courses.

In comparison with the BSc (Mathematical and Statistics) offered by the University of Sheffield, the core courses offered in the BSc (Stat) Single major degree at the University of Botswana are similar in content and quality. However, the BSc programme offered by the University of Sheffield learns more towards statistical computing and life skills. It must be noted that the entry requirements for the two programmes differ markedly: The entry requirement for the BSc (Mathematical and Statistics) offered by the University of Sheffield is an A-Level whereas the entry level for the BSc (Stat) Single major degree at the University of Botswana is BGCSE with at least a C credit.

REVIEW PERIOD

The program will be reviewed every 5 years