University of Botswana
Faculty of Science
Department of Computer Science

TYPE OF PROPOSAL:

New Programme for
BSc Computing with Finance

Approval	Date
Computer Science Department Board	October 6, 2009
Advisory Board	October 13, 2009
Faculty Board	October 28, 2009
Faculty Executive	November 11, 2009
APRPC	January 12, 2010
Computer Science Department Board 2nd Revision	January 21, 2010
Accounting and Finance Department Board	January 26, 2010
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1. Introduction

1.1. Background

The Department of Computer Science has been offering a B.Sc. degree in Computer Science since 1992 and a B.Sc. degree in Computer Information Systems since 2004. The department has also been offering M.Sc. degrees in Computer Science and Computer Information Systems since 2004. The last major review of the curriculum for the B.Sc. degree programmes was in 2003 and no major review has been done for the M.Sc. programmes. Taking into consideration the increasing demand of the industry for IT professionals and the fast development of the computing field, regular revision of curriculum is very important.

Curriculum development is a dynamic process and very much so in the field of computing. Regular revision and updating of the curriculum is vital to improve the quality and relevance of the programmes, to cope with the rapid changes in the computing field, and to adapt the curriculum in relation to the needs and conditions of the industry in the country. In light of this, the Department of Computer Science initiated evaluation of its curriculum in 2008 through external review, internal curriculum review committee, and surveys on ICT human resource needs in the country.

The department has been working on the revision of its programmes to identify the shortcomings of the current curricula and come up with revised curricula for both undergraduate and graduate programmes. In order to identify the shortcomings of the existing curricula and propose modifications, the committee gathered input from various sources. The following are the main sources used during the revision of the current curriculum.

a) the experience gained in the implementation of the programmes,
b) input from students who have been on the programme,
c) the report of the external reviewer,
d) report of a Fulbright Scholar who spent his sabbatical in the department,
e) the Report of the Maitlamo project (Botswana ICT Policy development project 2005),
f) global trends in the field of computing as reported in the ACM/IEEE-CS/AIS/AITP Computing Curricula report.

In addition to the sources listed above, the department conducted a comprehensive survey on the ICT human resource need in the country so that a better picture of the industry can be captured. The main objective of the survey was to identify ICT human resource shortage in both the private and public sector and the type of knowledge and skills required to successfully accomplish their organizational tasks.

This survey helped us to identify the knowledge and skills gap that may exist between the academic and the industry in the country in the area of computing. For this purpose, the committee designed three types of questionnaires to gather data from government

organizations and private companies which have strong IT departments (32), experienced IT professionals (15) and IT vacancies advertised on news papers for the period January 2008 to December 2008 (7 newspapers in the country which are published daily and weekly with a total of 406 vacancies).

An analysis of the survey data reveals that many organizations expect specialized (mainly practical), product specific knowledge and skills from computing graduates. In addition, it was observed that organizations expect organizational skills apart from the technical knowledge. A majority of the organizations who took part in the survey indicated their interest in graduates with knowledge of computing combined with management and/or finance. The challenge is thus to produce graduates who can be as adaptable as possible to different environments with minimum additional training investment. Obviously, an academic degree education can't focus on specific product training but products can be embraced for the practical part of appropriate courses. Academic degree education should provide an adequate knowledge of the principles, concepts and techniques behind such products so that graduates can easily manage different products independently. Therefore, this new curriculum emphasizes the use of more applied hands-on experience, practical applications, exercises, and projects where appropriate. For example, to address practical exposure issues, the department proposed the use of products such as Oracle for the practical sessions of Database related courses. In addition, the department is offering certification courses such as CISCO so that interested students can prepare themselves for the industry. The department is also in the process of establishing other certification courses such as Microsoft which will improve the employability of graduates of the program.

On the basis of the findings and the corresponding assessment of the requirements for the rapid development of the ICT sector, a new programme, namely, **B.Sc. Computing with Finance** has been proposed.

1.2. Rationale

ICT by its nature is applied in many fields and this trend is even reaching fields which were not anticipated a decade ago. Finance on the other hand, is one field that has always benefited from advances in computing. It would be a competitive strategy for the country to be both an ICT and finance hub in Southern Africa. This has clear implications on the ICT human resources produced by the department. The proposed programme, BSc Computing with Finance, is geared towards producing graduates capable of filling the skills shortage in organizations with medium to large computerised finance departments. Other areas that stand to benefit include: Information Systems auditing, financial systems security, and insurance and banking.

This programme has been designed to meet the growing demand for specifically trained computing professionals to work in the financial sector. The unique advantage of this programme is that it provides both technical and soft skills of finance and computing, which are complementary to fill the gap between computing and finance. Financial institutions and markets are highly dependent on computerized systems and would obviously benefit from professionals who understand both the technical solutions and the application domain needs to help find innovative solutions to problems.

By combining technical know-how, analytical and problem solving skills with finance knowledge graduates of the programme could contribute more effectively and adapt easily to environments that require exposure of financial concepts and practices.

It is quite apparent from the results of the comprehensive survey conducted by the department that there is need for computing professionals with more than passing knowledge of finance. The primary objective of the conducted survey was to determine areas of ICT human resource shortage in organizations, including government departments and ministries, and the type of ICT skills required to successfully accomplish organizational tasks. The result of the survey revealed that a significant number of organizations with large finance departments support a degree in Computing with Finance. Moreover, the number of financial institutions in the country is increasing significantly.

Lastly, the decline in enrolments in traditional computing programs worldwide has led to a soul searching among computing professionals in academia. One international trend that seems to cut across all regions is the attraction of students to interdisciplinary programs instead of the traditional programs. The introduction of the B.Sc. Computing with Finance is in keeping with international trends in offering interdisciplinary programs with computing as a subfield.

1.3. Sustainability

Looking at the demand for such graduates both locally and internationally, we believe that it can attract a significant number of students. In addition, as the current market indicates, computing professionals working in the financial sector are highly paid. This is one motivation for students to enrol into the proposed programme.

1.4. Employability

Even though computing graduates did not have major difficulties in getting jobs so far, the department has put different mechanisms to improve the employability of its graduates. The first one is industrial attachment. Industrial attachment has dual purposes. First, it serves to expose students to the real world environment where they will apply the knowledge and skills that they have learnt in the University. It also gives them the chance to understand the social, technical, and political issues related to a work environment. The second mechanism is the final year project which demonstrates their ability to integrate knowledge from different areas to solve a real problem. Such an experience is very vital for employment as employers usually prefer graduates with ability to solve real problems. The third mechanism is the provision of industry recognized certificates. The department is already running CISCO certifications training and is also in the process to introduce certification trainings such as Oracle and Microsoft. These certifications improve the chance of employability of the graduates even though the certifications are not part of the core curriculum. Those interested can register and take the training.

1.5. Alignment with the UB Vision

The proposed programme will provide additional choice to students coming to the department who are interested in an inter-disciplinary programme that integrates computing with finance. The programme will also contribute towards UB's priority areas of extending access and participation and the provision of relevant and high quality programmes.

1.6. Aims of the Programme

The programme aims to provide students with the necessary theoretical and practical computer science knowledge with a focus on the finance application domain and transferable skills which enable them to evaluate, select, and apply appropriate models, methods, technologies, and tools in the comprehension, manipulation, and development of complex computer-based finance systems. It also aims to equip students with the ability for critical thinking and life-long learning that helps them keep in pace with the rapid development of technology in the computing and finance fields.

1.7. Objectives of the Programme

The objectives of the programme are to equip students with the following graduate attributes:

- A sound base in the science of computers, finance theory and practice, and in problem solving skills using computers
- Ability to develop and maintain sophisticated financial computer systems that provide risk management services, detect fraud, and ensure compliance with accounting standards
- Interpersonal communication skills, strong sense of social commitment and professional ethics, ability to act independently and organization of thought to solve and analyze abstract and complex problems
- Ability to understand and apply new skills and procedures efficiently and effectively
- The foundation necessary for advanced study in computer science or financial computing
- Critical and creative thinking skills
- Entrepreneurship and employability skills
- Organizational and teamwork skills

1.8. Graduate Profile

In line with the mission of the department, the graduates of this programme will have enhanced capacity for the following

a. Software development - Software design and implementation, development of medium to large scale systems, especially banking, insurance, and finance and investment systems;

b. Developing effective problem solving - Application of computing and finance theory and knowledge of algorithms to ensure the best possible solutions for computational intensive problems in the banking, insurance, and finance and investment sectors;
c. Professional practice - Ability to apply personal goals setting and time management concepts; apply personal decision-making skills; articulate a personal position and respect the opinions of others; adhere to ethical standards; assess organisational and societal impact of computing technological solutions; actively seek and employ current best practices;
d. Devise new ways to use computers in the banking, insurance, and finance and investment areas and innovation in application of computing technology;
e. Working in computing research and development establishments; involvement in entrepreneurial activities;
f. Knowledge advancement in the discipline; and
g. Adaptability to new computing environments.

2. Expected Intake and Outputs

The following table presents the projected student intake and output of the programme.

Table 1: Projected student intake & output

	2010/2011	2011/2012	2012/2013	2013/2014
Intake	**30**	**30**	**30**	**30**
Output	**0**	**0**	**0**	**25**
Attrition rate	**2**	**2**	**1**	**0**

3. Resources

3.1. Human Resources

Department of Computer Science

The staff to student ratio, taking into consideration the GEC course, is about 1:100 and without the GEC course is 1:10. Attracting the necessary human resources requirement for the department has been a source of challenge since the inception of the department because of high demand for computing academicians globally.

The curriculum being proposed will allow the department of Computer Science to attract more students into our programmes. This will essentially require more teaching staff and assistants. But if the trend from recent years persists, not only are we going to be in short of teaching staff, we will also be facing a problem of recruiting enough capable teaching assistants. As most courses are drawn from Computer Science and Accounting and Finance, the requirement for new staff members is not urgent. The programme can be run with the existing staff. However, it is important to fill those positions as per the department's establishment in order to strengthen the programme. The major problem for the department

so far has been the difficulty of recruiting senior staff members to fill the existing positions. Currently, the department has 2 associate professors, 4 senior lecturers, and 17 lecturers.

Department of Accounting and Finance

All the courses included in the program are currently being offered in the department; hence no new expertise will be required. The program will however increase staff load and it is requested that this be catered for through increasing establishment. This increase can be effected yearly starting with one position in the academic year 2011/12 to cater for increased enrolment in ACC100. Thereafter, requests will be made through the normal budgeting process based on enrolment.

3.2. Physical Resources

3.2.1. Available Physical Resources

The department of Computer Science has six laboratories dedicated to undergraduate students and two laboratories to graduate student research. There are two other research laboratories for lecturers and students. Find following how the laboratories are designated:

- Computer labs 232-117 and 232-118 are used for teaching programming in the UNIX environment.
- Computer labs 232-119 and 232-120 are used for teaching programming in the Microsoft Windows environment.
- Computer labs 232-115 and 232-116 are dedicated for final year projects and primarily used by final year students.
- Computer labs 232-111 and 232-112 are used for graduate students research and teaching.
- Computer lab 233-G05 is used for computer network teaching and research (this is also a faculty lab).
- Computer lab 229-2 and others within the university are for GEC 121 and GEC122.
- Computer lab 232-116 is a small office converted to be the staff research laboratory.

3.2.2. Additional Physical Resources Requirements

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The physical resources at the moment require upgrading due mainly to the increase in class sizes, mostly from other faculties requiring the services of the department. This is forecasted to increase due to faculties offering programmes with a significant IT requirement. To mention a few of these faculties, we have Humanities, Science, FET, Social Sciences, Education, etc.

The department of Computer Science takes cognizance of the plan to provide more computing laboratories in the new multi-disciplinary and health sciences buildings. However, the current laboratories need to be upgraded to improve the quality of service we are offering

to our students and the University. The computers, especially our server farm, are in dire need of larger uninterrupted power supply units to cater for the incessant power disruption within campus. Hopefully, the new laboratories will be equipped appropriately and in line with the department's mission and vision.

Therefore, as part of this proposed program, what the department requires is the upgrading of the existing laboratories and fully furnishing the new computing laboratories in the new building which can be handled according to the normal budget process.

Department of Accounting and Finance

The course BIS 309 - Accounting Information Systems is laboratory based and will hence require additional equipment and software to cater for the increased enrolment. This is a third year course and therefore these additional resources will not be required in the first two years. This will be requested through the annual budget process.

3.2.3. Available Physical Facilities and Future Needs

The available physical facilities and future departmental needs are as specified in Table 2 below.

Table 2: Available physical resources and future needs

	Laboratory	Current State	Future Requirement
1	232/105 Fourth Year Laboratory	– 23 PCs(MS Windows XP) – 1 security camera – 2 x 24 port Cisco switches – 30 garden chairs	– Newer Machines (MS Vista compatible) – 17 " TFT Screens – Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
2	232/106 Fourth Year Laboratory	– 23 PCs(MS Windows XP) – Limited to 30 PCs – 1 Security camera – 2 x 24 port Cisco switches – 30 garden chairs	– New machines(MS Vista compatible) – 17 " TFT Screens – Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
3	232/109 Server Room	– 3 Linux/Servers – 3 MS Windows Servers – No security camera	– Security camera – New master network switch
4	232/111 Master's Laboratory	– 8 PC's(MS Windows XP) – 1 security camera – 1 x 24 port Cisco switch	– 15 PC's(MS Vista Compatible) – Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
5	232/112 Master's Laboratory	– 30 thin clients – 1 security camera – 1 x 24 port network	– Mounted overhead projector – Extra security camera

		switch	– New network switch – Proper laboratory chairs
6	232/116 Research Laboratory	– Connection to network via UTP cabling – CCNA Bundles for networking course.	– Fibre optic cabling – Mounted overhead projector – Security camera – New network switch – Proper laboratory chairs – Blade server for High performance computing.
7	232/117 Second Year Programming Lab	– 40 PC's running Linux – 2 x 24 port Cisco switches – 1 security camera – 40 garden chairs	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
8	232/118 Second Year Programming Lab	– 30 PC's running Linux – 2 x 24 port Cisco switches – 1 security camera – 30 garden chairs	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory
9	232/119 Third Year Laboratory	– 30 PC's(MS Windows) Vista capable – 2 x 24 port Cisco switches – 1 security camera – 30 garden chairs	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
10	232/120 Third Year Laboratory	– 30 PC's(MS Windows) Vista Capable – 2 x 24 port Cisco switches – 1 security camera – 30 garden chairs	– Mounted overhead projector – Extra security camera – New network switch – Proper laboratory chairs
11	209/2 GCE Laboratory	– 29 PC(MS Windows) 5years old	

4. Departmental Regulations

4.1. Preamble

The department has found it prudent to update its entrance requirements to be able to compete fairly for students with its competitors. Therefore, entry to the programme will be direct entry to year 1.

4.2. General Provisions

Subject to the provisions of General Academic Regulations, the following Departmental Regulations shall apply.

4.3. Programmes and Titles of Programmes

The programme is a single major programme leading to the award of B.Sc. Computing with Finance.

4.4. Entry Requirements

Subject to the General Academic Regulation 00.5, the following departmental programme entry requirements shall apply for the programme:

For entry to the BSc Computing with Finance, the following entry requirements shall apply.

i) For entry into 100-level, candidates must have a minimum grade of C in Mathematics and two other science subjects with Computer Studies recognized as a science subject, with a minimum grade of C in English.

ii) For entry into the programme at higher level:

a. Transfer students from a Computing with Finance or equivalent programme from a higher institution considered equivalent to the University of Botswana, subject to General Academic Regulation 00.313.
b. Candidates holding a post Secondary qualification which is considered by the department as being at least equivalent to the 100-level of the programme. For those who do not meet this criterion, they may be required to take some 100-level courses.

4.5. Assessment

Subject to the General Academic Regulation 00.81, the following Special Regulations shall apply:

a. Where examination is involved in the assessment of a computer science course, the weighting between CA and examination shall be 1:1 for practical courses and 1:2 for theoretical courses and the final grade shall be calculated as weighted average of CA marks and Final Exam marks.
b. Duration of Final Exams – 2 to 3 hours.
c. CA marks will be calculated based on at least three assessments for a course
d. Specific requirements for CA marks calculations shall be as specified for each course.
e. The final year project course, CSI405, shall be assessed according to the guidelines provided by the department.

4.6. Additional Streams

Additional streams of specialization areas shall be defined from time to time as the department may deem necessary.

4.7. Progression from Semester to Semester

Regulations governing progression are as set out in General Regulations 00.9.

4.8. Award

To be awarded a degree, a student must satisfy appropriate provision of General Academic Regulation 23.71.

5. Program Structure

5.1. Preamble

a. Most of the courses for this program are drawn from the three programmes, namely, Computer Science, Accounting, and Finance. The Computer Science program has been revised recently with a major review. The revision changed the duration of the programme from 3 years to 4 years and introduced a number of new courses and modified many of the existing ones. This program takes advantage of the revised program by incorporating those new courses and modified courses which are relevant for this program. Therefore, there are no new Computer Science courses specifically designed for this programme.

b. As mentioned above, the courses are drawn from the three programs, which have strict pre-requisite sequence, and hence much of the credits are taken by those courses. Therefore, we were not able to increase the credits for optional and elective courses.

5.2. Structure

Semester I

Courses	Type	Credits	Prerequisite
CSI141 Programming Principles	Core	3	
CSI161 Introduction to Computing	Core	3	
MAT111 Introductory Mathematics I	Core	4	
CSI131 Discrete Structures I	Core	3	
GEC111	GEC	2	
GEC121	Exempt		
Total		**15**	

Semester II

Courses	Type	Credits	Prerequisite
ACC100 Introduction to Accounting	Core	3	
CSI142 Object-Oriented Programming	Core	4	CSI141
MAT122 Introductory Mathematics II	Core	4	MAT111
CSI132 Discrete Structures II	Core	3	CSI131
GEC112	GEC	2	
GEC122	Exempt		
Total		**16**	

Semester III

Courses	Type	Credits	Prerequisite
CSI242 Data Structures	Core	3	CSI132, CSI142
FIN200 Business Finance	Core	3	
MAT221 Calculus I	Core	3	
Min 6 credits from:			
ECO111 Basic Microeconomics	Optional	3	
MGT202 Small Business Management	Optional	3	
LAW251 Foundations of Business Law	Optional	3	
Total		**15**	

Semester IV

Courses	Type	Credits	Prerequisite
CSI262 Database Concepts	Core	3	CSI242
ACC200 Financial Accounting I	Core	3	ACC100
CSI251 Computer Architecture & Organization	Core	3	CSI141, CS161
STA114 Business Statistics	Core	3	
Min 3 credits from:			
ECO112 Basic Macroeconomics	Optional	3	
	Optional	3	
Total		**15**	

Semester V

Courses	Type	Credits	Prerequisite
CSI354 Operating Systems	Core	3	CSI242, CSI251
FIN301 Financial Institutions and Markets I	Core	3	FIN200
CSI374 Computer Networks	Core	3	CSI141, CSI251
CSI342 Systems Analysis & Design	Core	3	CSI262
ACC302 Auditing I	Core	3	ACC200
Total		**15**	

Semester VI

Courses	Type	Credits	Prerequisite
FIN302 Financial Planning and Forecasting	Core	3	FIN200
CSI315 Web Technology and Applications	Core	3	CSI262, CSI374
FIN300 Financial Management	Core	3	FIN200
CSI341 Introduction to Software Engineering	Core	3	CSI342
Min 3 credits from:			
CSI392 Human Computer Interaction	Optional	3	CSI342
MGT303 Entrepreneurship and New Business Formation	Optional	3	MGT202
Total		**15**	

Winter Semester

Course	Type	Credits	Prerequisite
CSI352 Industrial Attachment	Core	3	CSI354, CSI374, CSI342

Semester VII

Courses	Type	Credits	Prerequisite
CSI471 Software Design	Core	3	CSI341
CSI481 Databases	Core	3	CSI262
CSI322 Algorithms	Core	3	CSI242
CSI472 Social Informatics	Core	3	CSI352
Min 3 credits from:			
FIN402 International Business Finance	Optional	3	FIN301
CSI441 Requirements Engineering	Optional	3	CSI341
CSI432 Intelligent Systems	Optional	3	CSI342
Total		**15**	

Semester VIII

Courses	Type	Credits	Prerequisite
CSI405 Project	Core	4	CSI352, CSI315, CSI341
CSI452 Information Security Administration	Core	3	CSI374
BIS309 Accounting Information Systems	Core	3	ACC200
Min 6 credits from:			
FIN404 Investment Analysis and Portfolio Management	Optional	3	FIN300
FIN403 Financial Institution and Markets II	Optional	3	FIN301
CSI416 Web Computing	Optional	3	CSI315
CSI444 Software Project Management	Optional	3	CSI471
Total		**16**	

6. Credit Summary

		Core	Optional	GEC	Total
Year 1	Sem. 1	13		2	15
	Sem. 2	14		2	16
Year 2	Sem. 1	9	6		15
	Sem. 2	12	3		15
Year 3	Sem. 1	15			15
	Sem. 2	12	3		15
	Winter Sem.	3			3
Year 4	Sem. 1	12	3		15
	Sem. 2	10	6		16
Total		**100**	**21**	**4**	**125**