The New Computer Science BS Structure

Mohammed El-Affendi

Department of Computer Science



**Preface**

The department of computer science spent more than a year revising its current BS Program. The revision process took into consideration the following:

1. Feedback from faculty members and students regarding most of the issues.
2. Recent developments in the field as indicated by international best practices and recommendations of the ACM/IEEE Curriculum Committee
3. Feedback from alumni and employers. The department conducted direct meetings with some of the employers and consulted some of the alumni regarding the current status and future of the BS Program
4. Local society needs as indicated by job opportunities and current practice in employers circles
5. Feedback from external reviewers including Professor Hamid Arabnia and Professor Munther Dehleh

The revision resulted in the following: (Summary of the Modifications)

1. **Modification of the BS Program Core component: Two new courses have been added to the core, and one course has been removed from the College Requirements.**
2. **The abolition of the complimentary electives component (the concept not the courses)**
3. **Introduce new electives to cover some of the emerging topics and areas**
4. **Adopt an object first approach to teach CS1 and CS2, and use Java as a vehicle for instructing the fundamentals of programming.**
5. **Increase the number of contact hours for some of the current elective courses.**

The revision has been based on the “Curriculum Revision Policy” developed by the department. According to this policy, the revision conducted is a Minor Revision.

The details of the revision are given in the subsequent sections.

**Document Contents:**

1. **Summary of Modifications the BS Core Component …………. 5**
2. **Modifications to the BS Core Component ……………………… 6**
3. **Course descriptions for the New or Modified Core Courses ….. 18**
4. **The List of Proposed New Electives …………………………….. 24**
5. **Course Descriptions for the New Electives ……………………... 25**
6. **The Proposes Business Minor for CS Students ………………… 41**
7. **Rules and Conditions for Declaring the Business Minor ………. 42**
8. **Justifying the Business Minor ………………………………….. 43**
9. **Increasing the Contact Hours for Some Elective Courses ……... 47**

**Section 1**

**Modifications to the BS Core Component**

**Summary of Modifications to the BS Core Component:**

* Abolish the complementary set (the concept, not the courses).
* Increase the core component credit hours to 29 (original 23 + 6 gained from the abolishment of the complimentary set)
* Introduce a new core web development course (based on current best practices and market needs).
* Introduce a new core security course (Based on the recommendations of the ACM/IEEE -2008 Report issued by the ACM/IEEE Curriculum Committee)
* Remove the digital logic design course (CS151) and distribute its contents between the architecture (CS355) and computer organization (now CS175) courses
* Adopt an Object-First approach to teach CS101 and CS102 and use Java to teach these courses.

**Prince Sultan University**

**College of Computer & Information Sciences**

**Department of Computer Science**

**Main Features of the Modified CS BS Program**

1. **Introduction**

As part of the department efforts to update its programs, CS curriculum committee conducted a major revision of the CS BS program and recommended some modifications. The recommended modifications have been approved by the department Council in its 10th meeting on 10/5/2009.

One of recommended modifications is to update the BS core set based on the new developments in the field and the experience of the past 10 years. This document describes the recommended modifications in some detail.

1. **The Review Process:**

The CS department recently adopted a Curriculum Review and Development (CRD) Policy based on international best practices and local experiences. According to this policy, three levels of program revision and development are allowed:

1. Internal revision, which addresses only the content of courses, pedagogical approaches, tools, type of programming language and similar issues. This sort of revision is approved locally by the department.
2. Minor revision which leads to modifications in the structure of the program, with no changes to the mission and objective. These changes require the approval of the college council
3. Developing new programs: This requires the approval of the College Council and the University Council

The changes proposed in this document are in the context of category (B), Minor Revision. According to the CS CRD Policy, the process of performing minor changes may be described as follows:

**Minor Program Review Process**

1. Collect and monitor information and feedback regarding the current program from stakeholders and related organizations. The curriculum review committee in each department may use different approaches to collect information and feedback from stakeholders. Stakeholders include: faculty, students, employers, industry organizations, parents etc. Related organizations include Accreditation Organizations, Standards Organizations, and Curriculum Development Organizations, local and international universities.
2. Assess the current program in view of the information compiled at step 1 above.
3. If there is a need for change or update, submit a “Curriculum Update” request to the Department Council.
4. If the council approves, perform the indicated modifications, update and submit a full document to the department council.
5. On approval by the department council, the document is raised to the College Council
6. On approval from the College Council, the updated curriculum document is submitted to the Vice Rector for Research and Academic Affairs.
7. **Surveys, Consultation and Feedback from Constituencies**:

Based on the CS CRD Minor Revision Policy stated above, we conducted the following as a prerequisite for the revision:

1. A survey of best practices at the international and local levels. The curriculum committee looked at current practices in many international and local schools.
2. A survey of the latest recommendations of the ACM/IEEE Curriculum Committee. The latest document in this respect is “Computer Science Curriculum 2008” [ ].
3. Feedback from Faculty
4. Feedback from students
5. Feedback from Alumni
6. Feedback from Employers
7. **Justifications: Recent Developments in the Field and the Local Environments:**

The CS Curriculum Committee has been monitoring the local and international developments regarding the program and the computer science specialization. At the local level, the major developments affecting the program may be summarized as follows:

* The emergence of the web as a defacto distributed platform for software development and application deployment. The age of standalone systems is now a matter of the past.
* Information Security is gradually becoming a very important topic and a major issue in deploying and managing enterprise systems
* New generations of software development techniques and platforms appeared in the market
* Employers are continuously stressing the importance of leadership, communication skills and team work.

Another significant development in the area is the publication of the **ACM/IEEE “Computer Science Curriculum 2008”** in December 2008. The ACM/IEEE Computer Science Task Force is the major body responsible for revising Computer Science Curricula. They usually produce a major report every 10 years. Their regular report is due in 2011, but they felt it necessary to publish an interim report at the end of 2008 because of the quick significant development in the field.

1. **Modifications:**

Based on the recommendations of the ACM/IEEE Committee (Document: Computer Science Curriculum 2008, published in Dec 2008), and the feedback from faculty, students and other stakeholders, the following modifications have been applied to CS BS program::

* Abolish the complementary set (the concept, not the courses).
* Remove the digital logic design course (CS151) and distribute its contents between the architecture (CS355) and computer organization (previously CS251, now CS175) courses
* Change the course code of the Computer Organization course from CS251 to CS175 and name it “Computer Organization & Digital Logic”.
* Increase the core computer science component credit hours to 29 (original 23 + 6 gained from the abolishment of the complimentary set and the removal of CS151)
* Introduce a **new core web development course CS371** (based on current best practices and market needs).
* Introduce a **new core security course CS391** (Based on the recommendations of ACM/IEEE -2008 Report issued by the ACM/IEEE Curriculum Committee)
* Adopt an Object-First approach to teach CS101 and CS102 and use Java to teach these courses.
* Introduce new electives to cover new emerging topics

Based on these modifications, the CS BS structure changes as follows:

Table 1: CS Program Requirements after Modifications

|  |  |
| --- | --- |
| Category | Credits |
| University Requirements | 40 |
| College Requirements | 41 |
| Program Requirements | 53 |
| Total | **134** |

The Program requirements (53 credits) are distributed as follows

Table 2: Distribution of CS Program Requirements Credits after Modifications

|  |  |
| --- | --- |
| Category | Credits |
| Core Courses | 29 |
| Specialization Electives | 18 |
| Business background Courses | 6 |
| Total | **53** |

Based on these recommendations, the college requirements set will change as follows:

Table 3: The New College Requirements Set: (CS151 Removed)

**Course Course Title Credits**

|  |  |  |
| --- | --- | --- |
| **MATH 113** | Calculus 2 | 3 |
| **CS 101** | Computer Programming I | 4 |
| **CS 102** | Computer Programming II | 3 |
| **CS 210** | Data Structures | 3 |
| **CS 175** | Computer Organization and Digital Logic | 3 |
| **CS 285** | Discrete Math | 3 |
| **CS 330** | Operating Systems | 3 |
| **CS 331** | Computer Networks | 3 |
| **CS 490** | Internship | 3 |
| **CS 498** | Graduation Project I | 1 |
| **CS 499** | Graduation Project 2 | 3 |
| Free Electives | 3 Courses | 9 |

**Total 41**

The new core set now consists of 9 courses, totaling 29 credit hours:

Table 4: The CS Core Courses (29 credits)

**Course Course Title Credits**

**CS Courses**

|  |  |  |
| --- | --- | --- |
| **CS 225** | Software Engineering: Design and Development | 3 |
| **CS 311** | Design and Analysis of Algorithms | 3 |
| **CS 320** | Programming Languages: Concepts & Paradigms | 3 |
| **CS 340** | Introduction to Database Systems | 3 |
| **CS 371** | Web Development | 3 |
| **CS 391** | Computer & Network security | 3 |

**Math Courses**

|  |  |  |
| --- | --- | --- |
| **Math xxx** | MATH 221 Numerical Analysis OR  MATH 223 Linear Algebra | 3 |

**Physics Courses**

|  |  |  |
| --- | --- | --- |
| **PHY 105** | Physics I | 4 |
| **PHY 205** | Physics II | 4 |
| **Total** | | 29 |

A total of 17 new electives have been added (indicated in red in the table below:

Table 5: The CS Electives (Choose 6 courses (18 credits))

**Course Course Title Credits**

|  |  |  |
| --- | --- | --- |
| **CS315** | Parallel and Multicore Programming |  |
| **CS 336** | Network Operations and Administration | 3 |
| **CS 375** | Web Design | 3 |
| **CS 381** | Systems Programming | 3 |
| **CS 387** | Mobile Application Development | 3 |
| **CS 415** | Wireless Sensor Networks | 3 |
| **CS 421** | Compiler Construction | 3 |
| **CS 425** | Advanced Software Engineering | 3 |
| **CS 427** | Network Design | 3 |
| **CS 430** | Advanced Operating Systems | 3 |
| **CS 432** | Computer-Data Security and Privacy | 3 |
| **CS 433** | Internet Technologies | 3 |
| **CS 435** | Distributed Systems | 3 |
| **CS 437** | Introduction to Parallel Computing | 3 |
| **CS 439** | Search Engines and Information Retrieval | 3 |
| **CS 440** | Database Mgt. Systems: Design & Imp. | 3 |
| **CS 447** | Building E-Commerce Systems | 3 |
| **CS451** | Enterprise Resource Planning and Automation | 3 |
| **CS455** | Computational Bioinformatics | 3 |
| **CS460** | Introduction to Robotics | 3 |
| **CS 462** | Topics in Multimedia | 3 |
| **CS465** | Machine Learning | 3 |
| **CS469** | Digital Image Processing | 3 |
| **CS 470** | Advanced Artificial Intelligence | 3 |
| **CS471** | Data Mining | 3 |
| **CS 476** | Natural Language Processing | 3 |
| **CS477** | Business Process Management | 3 |
| **CS478** | Content Management | 3 |
| **CS480** | Business Intelligence | 3 |
| **CS 483** | Computer Arabization | 3 |
| **CS 489** | Selected Topics in Computer Science | 3 |
| **CS 494** | Industry Link | 3 |
| **CS495** | Emerging Topics | 3 |
| **IS 3xx** | - | 3 |
| **IS 4xx** | - | 3 |
| **CS355** | Computer Architecture | 3 |
| **CS360** | Computer Graphics | 3 |
| **CS365** | Human Computer Interaction | 3 |
| **CS370** | Introduction to Artificial Intelligence | 3 |
| **CS412** | Theory of Computation | 3 |

**OVERVIEW OF THE COMPUTER SCIENCE PROGRAM**

|  |  |  |
| --- | --- | --- |
|  | **Courses** | **Credits** |
| University Requirements | | 40 |
| College Requirements | | 41 |
| Program Requirements | | 53 |
|  | **Total** | **134** |

**THE COMPUTER SCIENCE PROGRAM ACCORDING TO MAJOR DISCIPLINES**

|  |  |  |
| --- | --- | --- |
|  | **Courses** | **Credits** |
| Computer Sciences | | 71 |
| Mathematics and Statistics Sciences | | 20 |
| Humanities, Social Sciences and Business Studies | | 34 |
| Free Electives | | 9 |
|  | **Total** | **134** |

COMPUTER SCIENCE COURSE PREREQUISITES DIAGRAM

STAT101

**CS 101**

**CS 320**

**CS 102**

**CS 175**

**CS 331**

**CS 210**

**CS 340**

**CS 225**

**CS 285**

**CS 360**

**CS 370**

**CS 412**

**CS 365**

**CS 330**

**CS 355**

**CS 421**

**CS 336**

**CS 440**

**CIS 425**

**CS 311**

**CS 476**

**CS 470**

**CS 432**

**CS 462**

**CS 381**

**CS 433**

**CS 435**

**CS 437**

**CS 375**

**CS 387**

**CS 469**

**CS 415**

**CS 427**

**CS 447**

**CS 439**

**CS 451**

**CS 478**

**CS 477**

**CS 460**

**CS 315**

**CS 455**

**CS 465**

**CS 471**

**STAT101**

**CS 480**

**Instructor Consent**

**CS 495**

COMPUTER SCIENCE MAJOR SUGGESTED STUDY PLAN

**Year (1) Semester (1) Hrs Year (1) Semester (2)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| **CS101** | Computer Programming I | 4 | CS102 | Computer Programming II | 3 |
| **MATH111** | Calculus I | 3 | CS175 | Computer Org. and Digital Logic | 3 |
| **ENGL 101** | English Writing I | 3 | ENGL 103 | English Writing II | 3 |
| **SCI 101** | Intro. To Physical Sciences | 3 | STAT 101 | Intro. To Statics & Prob | 3 |
| **ISC101** | Islamic Ethics | 2 | MATH 113 | Calculus II | 3 |
| **ARAB 101** | Arabic Writing I | 2 | ISC 103 | Islamic Economic System | 2 |
| **PE xxx** | Physical Education | 1 |
| **Total 18 Total 17** |  |  |  |  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year (2) Semester (1) Hrs Year (2) Semester (2)** |  |  |  |  |  |
| **CS210** | Data structures & Alg | 3 | CS225 | Software Eng: Design & Dev | 3 |
| **CS285** | Discrete Math. For Comp. | 3 | ETHC303 | Eth. & Soc. Aspects of Comp. | 3 |
| **PHY105** | Physics I | 4 | CS330 | Intro. To Operating Sys. | 3 |
| **MATHXXX** | L. Algebra/Numerical Anal. | 3 | CS320 | Programming Languages | 3 |
| **COM201** | Communications Skills | 3 | PHY205 | Physics II | 4 |
| **ISC105** | Holy Quran Sciences | 2 | PEXXX | Physical Education | 1 |
| **Total 18 Total 17** |  |  |  |  |  |

THIRD YEAR COURSE SEQUENCE (INTERNSHIP OPTION)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year (3) Semester (1) Hrs Year (3) Semester (2)** |  |  |  |  |  |
| **CS311** | Design & Anal. Of Algo. | 3 | CSxxx | CS Complement./Electives | 3 |
| **CS331** | Data Comm. & Com. Nets | 3 | CSxxx | CS Complement./Electives | 3 |
| **CS340** | Intro. To Database Systems | 3 | CS391 | Computer and Network Security | 3 |
| **CS371** | Web Development | 3 | ----- | Free Electives-2 | 3 |
| **----** | Free Elective-1 | 3 | PSY101 | Intro. To Psychology | 4 |
| **ARAB 103** | Arabic Writing II | 2 | ISC203 | New Financial Transactions | 1 |
| **Total 17 Total 17** |  |  |  |  |  |

FOURTH YEAR COURSE SEQUENCE (INTERNSHIP OPTION)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year (4) Semester (1) Hrs Year (4) Semester (2)** |  |  |  |  |  |
| **CSxxx** | CS Complement./Electives | 3 | CSxxx | CS Complement./Electives | 3 |
| **CSxxx** | CS Complement./Electives | 3 | CSxxx | CS Complement./Electives | 3 |
| **CS490** | Internship in CS | 3 | CS499 | Senior Project II | 3 |
| **CS498** | Senior Project I | 1 | --- | Business Course-2 | 3 |
| **---** | Business Course-1 | 3 | ---- | Free Elective-3 | 3 |
| **ARAB 203** | Arabic Writing III | 2 |
| **Total 15 Total 15** |  |  |  |  |  |

THIRD YEAR COURSE SEQUENCE (CO-OP OPTION)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year (3) Semester (1) Hrs Year (3) Semester (2)** |  |  |  |  |  |
| **CS311** | Design & Anal. Of Algo | 3 | CSxxx | CS Complement./Electives | 3 |
| **CS331** | Data Comm. & Com. Nets | 3 | CSxxx | CS Complement./Electives | 3 |
| **CS340** | Intro. To Database Systems | 3 | CS391 | Computer and Network Security | 3 |
| **CS371** | Web Development | 3 | CSxxx | CS Complement./Electives | 3 |
| **----** | Free Elective-1 | 3 | PSY101 | Intro. To Psychology | 3 |
| **ARAB103** | Arabic Writing-II | 2 | --- | Business Course-1 | 3 |
| **ISC203** | New financial Transactions | 2 |
| **Total 19 Total 18** |  |  |  |  |  |

FOURTH YEAR COURSE SEQUENCE (CO-OP OPTION)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Year (4) Semester (1) Hrs Year (4) Semester (2)** |  |  |  |  |  |
| **CS492** | Co-Op in Computer Science (Continuation from Summer before) | 10 | CSxxx | CS Complement./Electives | 3 |
| CSxxx | CS Complement./Electives | 3 |
| CSxxx | CS Complement./Electives | 3 |
| ARAB 203 | Arabic Writing III | 3 |
| --- | Business Course-2 | 4 |
| --- | Free Elective-2 | 1 |
| **Total 10 Total 17** |  |  |  |  |  |