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Using Information Technology Certifications in Problem Solving and Programming Languages for Improving Marketability

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Abstract

To meet the demand of the local industry while remaining effective, academic institutions have started redesigning the computing disciplines by adding Information Technology certifications. This paper examines one component of the Information Systems computing discipline: the problem solving and programming languages. The focus of this study is to show how information technology certifications objectives can be integrated into programming and problem solving courses such as Visual Basic .NET and Java. A case study is used to show how the Microsoft Certified Application Developer certification objectives are integrated into the Visual Basic .NET programming course. A detailed investigation shows that very few textbooks can be used to cover all certification objectives. A detailed master course syllabus is developed to show the coverage of the certification objectives while maintaining consistency of the course. It is anticipated that upon completion of the sequence of programming and problem solving courses, students are able to complete the programming certification exams. Moreover, students with a degree in Information Systems and certificates that provide evidence of their qualification and competency in programming and problem solving will have better opportunities for employment upon graduation.

1. Introduction.

In the last decade, there has been a growing demand for Information Technology (IT) professionals with many skills to answer the needs of the complex and rapidly changing information industry. Among those professionals, the job opportunities for computer programmers and problem solving professionals have become very competitive. To better prepare students for the job market, many academic institutions in North America and in other countries across the world are redesigning their computing curricula. These institutions are adopting programs that not only offer courses that build solid foundations in programming and problem solving but also provide an avenue for building critical IT skills that can lead to certifications.

As a result of this continuous change, all the computing disciplines including the Information Systems (IS) programs are witnessing frequent updating to remain current, effective and to

address the needs of industry. Even though there are many ways to design an IS curriculum, the IS 2002 model curriculum recommendations[1] and the ABET criteria[2] for accrediting Information Systems programs[3] form the blueprint for designing and generating well recognized Information Systems programs. These sets of recommendations and criteria acknowledge the importance of problem solving in the Information Systems curriculum and require its embedding in all courses. Furthermore, these recommendations propose to teach a modern object-oriented programming language.

Currently, there is a move by a number of colleges and universities to form partnership with IT vendors such as Microsoft and Cisco to provide hands-on experience that prepare students for successful entry into the job market and to sit for Industry Certification exams. Many employers are looking for IS graduates to acquire certification in addition to their Bachelor degree. IS graduates can demonstrate that they have the necessary skills to be productive by acquiring one or more appropriate IT certificate. The IEEE and ACM recognize the importance of the IT certifications and provide their members with over four hundred online courses leading to technical certifications.

The purpose of this paper is to examine the IS curriculum and show how to integrate IT certification objectives into problem solving and programming courses[4]. A master course syllabus that shows the integration of IT certification objectives into a programming and problem solving course is developed. It is shown how the Microsoft Certified Application Developer (MCAD) certification objectives are integrated into the Visual Basic .NET programming course. The rest of the paper is organized as follows: Section 2 presents the IS curriculum adopted by Zayed University (ZU)[5], an academic institution located in the United Arab Emirates (UAE). The problem solving and programming sequence of courses is then identified. Section 3 introduces the IT certifications and focuses on Microsoft MCAD certificate and its importance. Section 4 shows how to integrate the MCAD certificate into the sequence of problem solving and programming courses of the curriculum. Section 5 presents the proposed master course syllabus with the certification objectives. Section 6 is the conclusion.

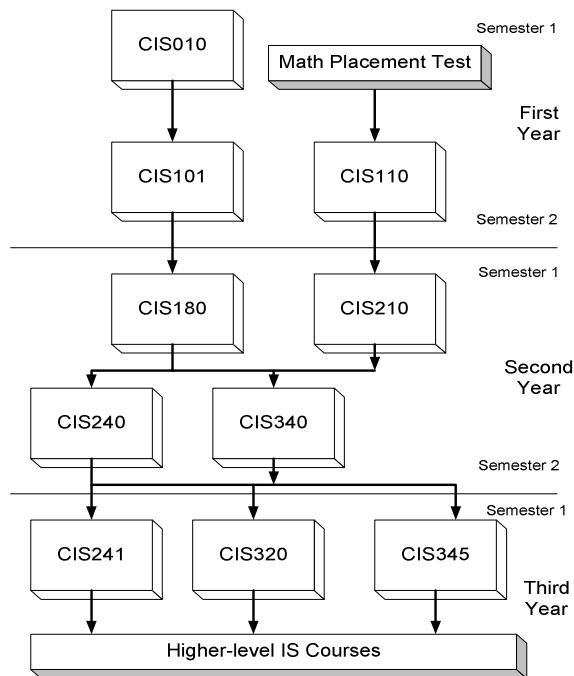## 2. IS course sequence for problem solving and programming.

This study is based on the IS curriculum of the College of Information Systems at Zayed University[5]. ZU is a government sponsored educational institution in the UAE that uses an outcome-based academic model. The IS curriculum[6, 7] at ZU includes courses in the knowledge domains such as General Education, Foundations of Computing IS, Programming and Problem Solving Foundations, Database Management, Web Applications and Management, Hardware and Software Systems, Networks and data communication, Graphics and Multimedia, IS Practice, System Analysis and Design, and other Elective Courses. The IS curriculum is designed to incorporate learning outcomes including problem solving, critical thinking, and information technology.

There are a number of issues and challenges in designing and implementing IS curricula. One of these issues is the selection of a modern appropriate programming language that fulfills the requirements of the ABET criteria as well as the IS 2002 recommendations. ABET requires the student to be proficient in a modern programming language, however, the IS 2002

recommendations include only one course in programming. To become proficient in a modern programming language, students must take at least two courses in problem solving and programming. The curriculum has 30 semester hours of formal IS courses but also assumes use of prerequisite or corequisite courses in communications, mathematics, statistics, and business functions. The IS 2002 curriculum also requires an embedded problem solving and critical thinking framework in all courses. The architecture of the IS curriculum consists of five curriculum presentation areas: information systems fundamentals; information system theory and practice; information technology; information systems development; and information systems deployment and management processes.

The five presentation areas consist of ten courses and one prerequisite course IS.2002.1~10 and IS2002.P0, respectively. The ABET requirement states that at least 30 semester hours of IS must be included in the IS curriculum. A sequence of IS courses which includes problem solving and critical thinking at all course levels has been proposed in an earlier study[4]. These courses satisfy the IS2002 recommendations and the ABET requirements. Furthermore, the sequence of courses in programming and problem solving is designed for students to easily understand concepts of programming while staying focused on problem solving.

In the first year of the IS curriculum students learn how to use productivity tools to solve real-world problems. This is the first exposure students have to the concepts of problem solving. In the second year of the IS curriculum, students learn programming methodology and how to solve a problem without using a particular programming language. Students learn how to create applications using VisualBasic.NET programming language which has become popular among students. They also learn web programming which includes HTML and XML. In the third year of the IS curriculum, students learn programming and problem solving using Java as an implementation tool. Here, students learn advanced concepts of object-oriented programming and Information Technology hardware and software while staying focused on problem solving. The IS elective introduces students to object-oriented programming using COBOL, an alternative programming language. In total, students will spend 30 semester hours between their freshman and junior years learning problem solving and critical thinking. Figure 1 shows the adopted sequence of courses[4] from the first to the third year. The levels in problem solving and critical thinking increase with the course content and this is reflected by the change in color in the diagram that lists the sequence.

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                                          Semester 1
   ┌────────┐
   │ CIS010 │   ┌──────────────────┐
   └────────┘   │ Math Placement Test │
                └──────────────────┘      First
      │                  │                 Year
      ▼                  ▼
   ┌────────┐       ┌────────┐
   │ CIS101 │       │ CIS110 │
   └────────┘       └────────┘
                                          Semester 2

                                          Semester 1
      │                  │
      ▼                  ▼
   ┌────────┐       ┌────────┐
   │ CIS180 │       │ CIS210 │
   └────────┘       └────────┘           Second
                                          Year
   ┌────────┐    ┌────────┐
   │ CIS240 │    │ CIS340 │
   └────────┘    └────────┘
                                          Semester 2

                                          Semester 1
   ┌────────┐  ┌────────┐  ┌────────┐
   │ CIS241 │  │ CIS320 │  │ CIS345 │
   └────────┘  └────────┘  └────────┘      Third
                                           Year
   ┌──────────────────────────────────┐
   │      Higher-level IS Courses       │
   └──────────────────────────────────┘
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CIS010: Introduction to Personal Computer Productivity Tools
CIS101: Introduction to Computer Information Systems
CIS110: Discrete Math I
CIS210: Discrete Math II
CIS180: Programming Methodology and Modeling
CIS240: Object-Oriented Programming and Problem Solving I
CIS241: Object-Oriented Programming and Problem Solving II
CIS340: Web Programming
CIS320: IT Hardware and Software
CIS345: Object-Oriented COBOL (elective course)

Fig.1. Proposed course sequence for problem solving and programming

3. The Microsoft Certified Application Developers (MCAD) certificate.

In the last couple of years, there has been an increasing interest in certifications by individuals, organizations, and academic institutions alike. They are discovering the unique benefits of certification[8]. Earning a certification acknowledges the expertise of the graduate in working with products and technologies of a certain vendor. Moreover, the industry will recognize the certification as a symbol of the skills and knowledge a person has gained through experience. Organizations can benefit a lot when their employees become certified. In fact, a vendor's products help businesses succeed in this very competitive world and IT certification ensures that those businesses are able to identify experts who know how to use those powerful tools and solutions to the best of their advantage. Today, there are over three hundreds certifications in the IT field and this number keep increasing.

The IEEE and the Association for Computing Machinery (ACM) recognize the importance of certification. Over four hundred courses are available online which lead to professional certifications. Each certificate has certain objectives and outcomes. Certain vendors such as Sun Microsystems and Microsoft offer training courses for their certification. Training institutions offer courses for almost any certificates. Community colleges have redesigned their programs where the focus has been placed on a specific field, such as network administration, PC Technician, Help Desk Technician and Customer Service Technician. Some universities have also started offering training which leads to certifications.

The objectives and outcomes of IT certifications which are focused on acquiring certain skills may differ from the objectives developed for the IS courses and curriculum which fulfill the accreditation requirement. The IS curriculum, however, can be strengthened by the integration of IT certifications in areas such as problem solving and programming languages. Two potential IT certificates that can be integrated in this area have been identified. These are the Microsoft Certified Application Developers (MCAD) certification and the Sun Certified Programmer for Java 2 platform certification.

The Microsoft Certified Application Developers (MCAD) certificate is used to develop and maintain department-level applications, components, Web or desktop clients, or back-end data services. This certificate provides students with many skills including the building of Microsoft Windows applications using the Microsoft Visual Basic .NET programming language. The MCAD credential provides industry recognition for professional developers who build powerful applications using Microsoft Visual Studio .NET and Web services. The MCAD candidates are required to pass two core exams and one elective exam in an area of specialization. To fulfill the core certification requirements, a candidate has to pass one exam focused on either Web Application Development or Windows Application Development in the language of his or her choice. Then, the candidate has to pass one XML Web Services and Server Components exam. In addition to the core exam requirements, a candidate must also pass one elective exam that provides proof of expertise with a specific Microsoft server product.

In this paper, the focus is on Microsoft Exam 70-306 on developing and implementing Windows-based applications with Microsoft Visual Basic .NET and Microsoft Visual Studio .NET. The course objectives for Exam 70-306 are listed below:
- Creating User Services
- Add controls to a Windows Form
- Implement navigation for the user interface (UI)
- Implement error handling in the UI
- Implement online user assistance
- Instantiate and invoke a Web service or component
- Implement globalization
- Create, implement, and handle events
- Create a Windows control
- Consuming and Manipulating Data
- Debug, rework, and resolve defects in code
- Deploying a Windows-based Application
- Create a setup program that installs an application and allows for the application to be uninstalled
- Deploy a Windows-based application
- Add assemblies to the Global Assembly Cache
- Maintaining and Supporting a Windows-based Application
- Configure role-based authorization
- Implement identity management

For exam training purposes, Microsoft provides students with two courses, Course 2565 on Developing Microsoft .NET Applications for Windows (Visual Basic .NET) and Course 2389

Programming with Microsoft ADO.NET. This certification exam measures the student's ability to develop and implement Windows-based applications by using Windows Forms and the Microsoft .NET Framework. The skills measured by Exam 70-306 are listed in Table 1.

Table 1: Exam 70-306 skills.

1. Creating User Services
1.1. Create a Windows Form by using the Windows Forms Designer. • Add and set properties on a Windows Form. • Create a Windows Form by using visual inheritance. • Build graphical interface elements by using the System.Drawing namespace.
1.2 Add controls to a Windows Form. • Set properties on controls. • Load controls dynamically. • Write code to handle control events and add the code to a control. • Instantiate and invoke an ActiveX® control. • Configure control licensing. • Create menus and menu items.
1.3 Implement navigation for the user interface (UI). • configure the order of tabs.
1.4 Validate user input. • Validate non-Latin user input.
1.5 Implement error handling in the UI. • Create and implement custom error messages. • Create and implement custom error handlers. • Raise and handle errors.
1.6 Implement online user assistance.
1.7 Incorporate existing code into a Microsoft Windows-based application.
1.8 Display and update data. • Transform and filter data. • Bind data to the UI.
1.9 Instantiate and invoke a Web service or component. • Instantiate and invoke a Web service. • Instantiate and invoke a COM or COM+ component. • Instantiate and invoke a .NET component. • Call native functions by using platform invoke.
1.10 Implement globalization. • Implement localizability for the UI. • Convert existing encodings. • Implement right-to-left and left-to-right mirroring. • Prepare culture-specific formatting.
1.11 Create, implement, and handle events.
1.12 Implement print capability.

1.13 Implement accessibility features.

2. Creating and Managing Components and .NET Assemblies

2.1 Create and modify a .NET assembly.
   • Create and implement satellite assemblies.
   • Create resource-only assemblies.

2.2 Create a Windows control.
   • Create a Windows control by using visual inheritance.
   • Host a Windows control inside Microsoft Internet Explorer.

3. Consuming and Manipulating Data
3.1 Access and manipulate data from a Microsoft SQL Server™ database by creating and using ad hoc queries and stored procedures.
3.2 Access and manipulate data from a data store. Data stores include relational databases, XML documents, and flat files. Methods include XML techniques and ADO .NET.
3.3 Handle data errors.

4. Testing and Debugging
4.1 Create a unit test plan.

4.2 Implement tracing.
   • Add trace listeners and trace switches to an application.
   • Display trace output.

4.3 Debug, rework, and resolve defects in code.
   • Configure the debugging environment.
   • Create and apply debugging code to components and applications.
   • Provide multicultural test data to components and applications.
   • Execute tests.
   • Resolve errors and rework code.

5. Deploying a Windows-based Application

5.1 Plan the deployment of a Windows-based application.
   • Plan a deployment that uses removable media.
   • Plan a Web-based deployment.
   • Plan a network-based deployment.
   • Ensure that the application conforms to Windows Installer requirements and Windows Logo Program requirements.

5.2 Create a setup program that installs an application and allows for the application to be uninstalled.
   • Register components and assemblies.
   • Perform an install-time compilation of a Windows-based application.

5.3 Deploy a Windows-based application.   • Use setup and deployment projects.
5.4 Add assemblies to the Global Assembly Cache.
5.5 Verify security policies for a deployed application.   • Launch a remote application (URL remoting).

6. Maintaining and Supporting a Windows-based Application
6.1 Optimize the performance of a Windows-based application.
6.2 Diagnose and resolve errors and issues.
7. Configuring and Securing a Windows-based Application
7.1 Configure a Windows-based application.
7.2 Configure security for a Windows-based application. • Select and configure authentication type. Authentication types include Windows Authentication, None, forms-based, Microsoft Passport, and custom authentication. • Specify the security level for an application. • Use custom attributes to configure security.
7.3 Configure authorization. • Configure role-based authorization. • Implement identity management.

4. Integrating MCAD certification objectives into programming courses.

There are many textbooks to teach the concepts of programming in Visual Basic .NET[9, 10, 11]. However, most of the textbooks focus on the syntax of the language rather than the concepts in problem solving. Course instructors select their textbooks to fulfill the objectives of the course while focusing on teaching problem solving. However, if we wish to integrate the certification objectives into the course, selecting the textbook becomes very critical. Very few textbooks can be used to cover all certification objectives. A book such as "Visual basic .NET How to Program"[12] by Dietel, Dietel & Nieto, 2002, can be used to cover most of the certification objectives. On the other hand, the book titled "Programming with Microsoft Visual Basic .NET"[9] by Diane Zak, 2002, only covers about 30% of the certification objectives. In fact, comprehensive Visual Basic .NET textbooks such as Dietel, Dietel & Nieto were written to be covered in two semesters. Most of Visual Basic .NET textbooks, however, are designed to be covered in one semester. These books even though they do not cover all certification objectives are, for a number of reasons, very well suited to teach the first programming course in the IS curriculum. Table 2 lists the contents of the selected textbook along with the certification course objectives that are addressed by the textbook.

Table 2: Mapping certification course objectives.

Textbook Course Topics	Skills by Exam 70-306
Chapters 1 ~ 3: Introduction Chapters Computers, Internet, Visual basic .NET, Visual Studio .NET, IDE, Visual Basic Programming	1.8, 1.12,
Chapters 4 ~ 5: Control Structures I & II If/then/Else, While, Do/While, Do/Until, For/Next, Select case, Do/Loop While, Do/Loop Until, Exit	
Chapters 6: Procedures Sub, Function, Methods, Passing variables by arguments, Recursion	1.5,

Chapters 7 Arrays Arrays, Passing arrays to procedures, Passing arrays by values reference, Sorting, Searching, Multidimensional arrays	
Chapters 8 ~ 10: Object-Oriented Programming Class scope, Constructor, Garbage collection, Shared class members, Base classes and derived classes, Protected and friend members, Inheritance, Hierarchy, Polymorphism, Abstract classes and methods, Creating and using interfaces	1.1
Chapters 11: Exception Handling Exception hierarchy, Finally block, Exception properties, Handling overflow	7.1, 7.2
Chapters 12 ~ 13: Graphic User Interface Labels, Textboxes, Buttons, Panels, Checkboxes, Radiobuttons, Pictureboxes, Listboxes, Comboboxes, TreeViews, ListViewsMDI windows	1.1, 1.2, 1.3, 1.4, 1.5, 1.11, 2.2,
Chapters 14: Multithreading Treads states, Treads priorities, Threads synchronization, Thread scheduling	
Chapters 15: String Characters and regular Expressions String constructor, String length and character properties, CopyTo method, Comparing strings, Class StringBuilder, Char methods	
Chapters 16: Graphics and Multimedia Color control, Font control, Drawing objects, Multimedia	
Chapters 17: Files and Strings Classes file and directory, Creating a sequential access file, Random access file	1.4
Chapters 18: XML XML documents, XML Namespaces, DOM, DTDs, XML schema	3.2
Chapters 19: Database, SQL and ADO .NET Relational database, SQL, ADO .NET object module, Reading writing XML files	3.1, 3.2,
Chapters 20~21: ASP .NET, Web Forms and Web Controls, Web services HTTP transaction, Creating and running forms, Web controls, Session tracking, Tracing, Web services, SOAP, Publishing web services	1.9, 4.2, 4.3, 7.3
Chapters 22: Networking Stream Based Sockets and Datagrams Establishing a simple server, Establishing a simple client, Client/Server interaction	
Chapters 23 ~24: Data Structures, Collection and Accessibility Linked lists, Stacks, Queues, Trees, Collection classes, Web accessibility, Accessibility in Visual Studio .NET, Accessibility in Visual Basic .NET	1.13

5. Master course syllabus with certification objectives.

An examination of the certification objectives mapping into the textbook topics as listed in Table 1 shows that some objectives are not covered by the selected textbook. Objectives 5.1 ~ 5.5 on deploying a Windows-based Application, and 7.1 ~7.2 on Configuring and securing a Windows-based application. These objectives can be covered by the reference book titled "Programming with Microsoft Visual Basic .NET: An Object-Oriented Approach" by M. Ekedhal and W. Newman[13]. Appendix II lists the contents of the chapters of the textbook. Moreover, the objective 1.10 on implementing globalization and 1.6 on implementing online user assistance are not addressed by the selected textbook. Some chapters in the textbook do not contribute to the certification objectives such as Chapter 14 on multithreading.

5.1. MCAD integration.

Some of the Certification objectives, such as deploying a Windows-based application, may not be covered by the first programming course in Visual Basic .NET in the sequence of programming and problem solving courses. Ideally, it will be better to adopt a textbook which addresses the certification objectives as well as the treatment of problem solving and early coverage of the object orientation. However, at the present time such a textbook is not available in the market. A master course syllabus that covers the course topics and integrates the certification objectives is shown in Table 3.

Table 3. Master course syllabus.

Problem Solving & Programming Using Visual Basic .NET
Credit hours: 3
Course Description:
This course provides students with the basic concepts in program design and development to build Microsoft Windows Forms applications by using the Microsoft .NET Framework and the Microsoft Visual Basic .NET programming language. A disciplined approach to problem solving and algorithm development using object-oriented concepts is stressed. The course covers the major topics for Windows client application programming on the .NET Framework. These topics include: Window Forms, Window Controls, Syntax and semantics, input/output, selection, iterative constructs, methods, classes, data types, arrays, strings, exceptions handling, file processing, graphical user interface, Web access, XML, Web services consumption, debugging, security, and deployment issues for desktop applications. The course also covers objectives of the Microsoft MCAD allowing students to take the certification exam upon completion.

Textbook: Visual Basic .NET How to Program, 2nd edition
Author: Dietel Dietel Nieto
Publisher: Prentice Hall, 2002

Reference: Programming with Visual basic .NET: An Object-Oriented Approach
Author: Michael Ekedahl and William Newman
Publisher: Course Technology, 2003

Course Objectives:
Learn and understand the concepts of problem solving and program design
Learn good programming techniques including UML and naming conventions
Learn about designing and creating a graphical user interface (GUI)
Learn programming constructs including assignments, loops, and conditions
Successfully utilize the Visual Basic .NET programming language
Learn about objects and events
Be able to independently design algorithms to solve real-world problems
Have a basic understanding of the principles of the Object Oriented design
Complete the Microsoft MCAD certification objectives.
Take the Microsoft MCAD exam

Suggested Evaluation Procedure
Two Tests (closed book)	50%
Homework/Projects	20%
Certification Exam	30%

Course Topics and Certification Objectives

Week/ Period	Course Topics	Book/ Sections
1	Introduction to computers, Internet and Visual Basic .NET Introduction to Visual Studio .NET IDE	1.1~1.19, 2.1~2.7
2	Introduction to Visual Basic Programming, Simple programs, Decision making, Arithmetic, Memory concept, Control structures	3.1~3.8 4.1.15
3	Control structures, Procedures Selection structure, Repetition structure, Select case multiple selection structure, Sub procedures, Functions, Methods	5.1~5.4 6.1~6.18
4	Arrays Declaration, Allocation of arrays, Initialization, Using arrays, Passing arrays to procedures, Searching array, Multidimensional arrays	7.1~7.11
5	Object-Oriented programming Object, Class, Properties, Abstraction, Inheritance, Base class, Derived class, Polymorphism **Exam 1(Closed Book)**	8.1~8.16 9.1~9.7 10.1~10.10
6	Exception handling, GUI design Windows Forms, Event-handling, Control properties, Menus, Multiple-Document-Interface Windows, User defined controls	11.1~11.8, 12.1~12.10, 13.1~13.11
7	Strings, Characters, Expressions Strings, Locating, Extracting, Concatenating strings, String methods, Char methods	15.1~15.17
8	Files and Streams Data hierarchy, Files, Streams, Class file and Directory, Creating sequential files, Reading data, Random access file. *Review of Certification Objectives*	17.1~17.11
9	Extensible Markup Language XML documents, XML namespaces, DOM, DTDs, XML schemas, Extensible StyleSheets, XslTransform	18.1~18.8
10	Database and ADO .NET Relational database, SQL, basic query, Merging data, Joining data, Statements, ADO .NET object model, Programming with ADO .NET	19.1~19.8
11	ASP .NET, Web Forms, Web services HTTP, Transaction, System architecture, Creating a Web Form, Running a Web Form, Web services, Publishing and consuming Web services	20.1~20.10 21.1~21.9
12	Deploying a VB .NET Application Deployment in Visual Basic .NET, Create a setup project, How to deploy to different media, Add a deployment project to a solution, Deployment support files, Create custom installer dialog boxes	Chapter 14 in M. Ekedhal textbook
13	Networking, Streams-based sockets and datagrams, data structures Establishing a server, Establishing a client, Client/server interaction, Self relational classes, Stacks, Queues, Trees	221.~22.6, 23.1~23.7
14	Accessibility Regulations, Resources, Web accessibilities, Focusing on structures to improve readability, Accessibility in Visual basic, in XHTML, in XML .NET, Internet and Web resources	24.1~24.16
15	**Exam 2 (Closed Book)** *Review certification objectives* *Review of the certification exam*	21.4 21.5 21.7, 21.8
16	**Certification Exam (closed book)**	

5.2. Sun Certification for Java 2 Programmer.

Similarly, the Sun Certification for Java Programmer certification objectives can be mapped into the Java programming course objectives. There are hundreds of textbooks to teach Java. Course instructors select their textbooks that fulfill the objectives of the course and provide knowledge on problem solving. However, if we wish to integrate the certification objectives into the course, selecting the textbook becomes very critical. Very few textbooks can be used to cover all certification objectives. In fact, comprehensive Java textbooks such as "Java How to Program"[14] by H. Deitel & P. Deitel, 2002, were written to be covered in two semesters. Most of Java textbooks, however, are designed to be covered in one semester. These books even though they do not cover all certification objectives are, for a number of reasons, very well suited to teach the first programming course in the IS curriculum.

The certification objectives as developed by Sun are divided into nine sections, and the exam consists of 59 multiple choice questions. Some of the objectives are normally covered in the first course in programming, however, some topics such as multithreading may not be covered in the first course in programming. A course syllabus can be generated based on the selected textbook. Then the objectives of the certification can be mapped into the course topics. The certification objectives which are not covered by the course syllabus can then be identified. The course syllabus is then modified to include the certification objectives. These objectives can be added to the course syllabus so that student can take the certification exam as a part of the course requirement. One option is to give the students the choice to enroll for the course and the certification and earn four credit hours or enroll just for the course and earn three credit hours.

6. Conclusions.

This paper examined the problem solving and programming languages sequence of courses of the Information Systems program and showed how IT certifications objectives can be integrated into the curriculum. A case study was used to show how the Microsoft Certified Application Developer certification objectives are integrated into the Visual Basic .NET programming course of the curriculum. Visual Basic .NET is a modern programming language to introduce object-oriented programming and problem solving concepts. A book survey showed that very few textbooks can be used to cover all certification objectives. A detailed master syllabus was developed to show how to cover the certification objectives along with the course topics in one semester. A similar integration for the Sun Certified Programmer for Java 2 certification for the Java course, another modern programming language, can be done. It is anticipated that upon completion of the sequence of programming and problem solving courses, students will be able to complete the programming certification exams. Moreover, students with a degree in Information Systems and certificates that provide evidence of their qualification and competency in programming and problem solving will have better opportunities for employment upon graduation.

7. References.

1. IS 2002: Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems, http://www.acm.org/education/curricula.html#IS2002

2. Criteria for Accrediting Computing Programs, Computing Accreditation Commission. http://www.abet.org/criteria_cac.html http://www.abet.org/images/Criteria/C001%2004-05%20CAC%20Criteria%2011-18-03.pdf

3. J. Gorgone, G. Davis, J. Valacich, H. Topi, D. Feinstein and H. Longenecker, IS 2002: Model curriculum and guidelines for undergraduate programs in information systems, 2002. http://www.acm.org/education/is2002.pdf

4. F. Bouslama, A. Lansari, and A. Al-Rawi, "Information systems curriculum optimization for effective learning of problem solving", in Proc. of the 2004 American Society for Engineering Education Annual Conference & Exposition-ASEE2004, Session 1793, Salt Lake City, Utah, June 20-23, 2004.

5. Zayed University Catalogue, http://www.zu.ac.ae/

6. A. Al-Rawi, A. Lansari and F. Bouslama, "Model curriculum for undergraduate degree programs in information systems", in Proc. of the 2004 American Society for Engineering Education Annual Conference & Exposition-ASEE2004, Session 2558, Salt Lake City, Utah, June 20-23, 2004.

7. F. Bouslama, A. Lansari, A. Al-Rawi, and A. Abonamah, "A novel outcome-based educational model and its effect on student learning: curriculum development and assessment", Journal of Information Technology Education, Special Issue on Information Technology in the Assessment Process of Student Learning, Vol. 2, pp. 203-214, 2003.

8. F. Zeng, A New Approach to Integrate Computer Technology Certification into Computer Information System Programs, *Annual ASEE Conference*, Salt Lake City, Utah, Session 2558, 2004. http://www.asee.org/acPapers/2004-1708_Final.pdf

9. Diane Zak, Programming with Microsoft Visual Basic .NET, Course Technology, 2002 ISBN 0-619-01662-0.

10. Evangelos Petroutsos, Visual basic .NET, Cybex, 2002, ISBN: 0-7821-2877-7

11. Shelly Cashman Quasney, Microsoft Visual Basic .NET Comprehensive Concepts and Techniques, Course Technology, 2003, ISBN: 0-7895-6549-8

12. Deitel Deitel Nieto, Visual Basic .NET How to Program Second Edition, Prentice Hall, 2002, ISBN 0-13-029363-6

13. Michael Ekedahl and William Newman, Programming with Visual basic .NET: An Object-Oriented Approach, Course Technology, 2003, ISBN 0-619-01658-2

14. H. Deitel and P. Deitel, Java How to Program, 4th Edition, Prentice-Hall, 2002.

Biography

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Appendix I

Michael Ekedahl and William Newman Textbook Contents

Chapters	Content
Chapters 1 & 2: Getting Started	Introduction to Visual basic .NET, IDE, Windows, Toolboxes, Solution, Project, Forms, Designing interfaces, Code editor, Errors
Chapters 3 ~ 6: Data Types, Variables, Decision Making, Strings, Functions, Repetition, Multiple forms	Numeric data types, Storing data in variables, Declaring variables, Namespaces, Using methods, Intrinsic functions, Constants, Dates, Decision making, If statements, Select case, String data, String manipulations, Function procedures, Sub procedures, Loops, Drawing, Printing a report, Adding an existing Form
Chapters 7: Arrays, Lists	Storing data in collections; Handling strings, characters, and dates; Working with folders and files
Chapters 8 & 9: Database Processing	Creating menus, Creating event handlers for menus, ADO .NET, Establishing a database connection, DataAdpter, DataSet, Data binding, Modifying records, Master-detail relationships, Complex binding, DataSet relation, DataGrid control
Chapters 10: Dialog Controls, Error Handling	Application class, Structured error handling, OpenFileDialog control, SaveFileDialog control, RichTextBox control, Handling resize events, Linking to Web pages
Chapters 11 & 12: Creating MDI Application, Creating Reusable Components	Multiple-Document Interface (MDI) applications, MDI child, MDI parent, Merging menus in MDI, Referencing objects, Organizing procedures, Sharing code between MDI Forms, Windows common controls, Component creation, Author, Developer, Root namespace, Class events, Class instance, Class data, Enumeration, Creating a method, Public property procedures, Overloading
Chapters 13: ASP .NET	Creating an ASP .NET Web application, IIS manager, HTML page, Start page, Second Web Form, Hyperlinks, HTML graphic elements, Web Forms, Event handlers for Web Forms, Validation controls, Database in Asp .NET, DataGrid control
Chapters 14: Deploying a Visual Basic .NET Application	Deployment with Visual basic .NET, Creating a setup project, Deploying to different media, Adding a deployment project, Deploying support files, Adding file associations, Creating custom installer, Installing the .NET framework