

Enhancing The Graduate Information Systems Curriculum: A Career Skills Oriented Approach

Benjamin Khoo, PhD, New York Institute of Technology, USA
Peter Harris, CPA, MBA, New York Institute of Technology, USA

ABSTRACT

The Information Systems (IS) curriculum needs to be updated frequently due to the rapid rate of advances in information systems (IS) and the technologies that drive IS, and also industry's skill requirement of IS graduates. This paper describes a Career Skills Oriented Approach to enhance the graduate IS curriculum based on current information from recent career skills studies, United States Bureau of Labor Statistics (BLS), MSIS2000 model curriculum recommendations, the current demand for information security professionals, professional certifications in demand, and the resources required.

Keywords: graduate curriculum, information systems, career skills

INTRODUCTION

The mission of a typical Information System (IS) program is to develop, publicize and apply knowledge of information system (IS) and the technology that drives IS. To fulfill this mission, the program will:

1. Educate and train students with the required skills as professionals and prepare them for positions of leadership in industry;
2. Conduct and publicize research in IS to improve the management and application of IS in organizations and to enhance IS pedagogy; and
3. Provide service that responds to the needs of the institution, enterprises, professional societies, governmental agencies, and other organizations that may benefit from the expertise of its faculty and students.

Beginning from the 1980s to the late 1990s, the competitiveness of US business has been eroding. Hayes and Abernathy's 1980 *Harvard Business Review* article, "Are We Managing Our Way to Economic Decline?" signaled the growing awareness in the U.S. that effective management of technological innovation was becoming a high-priority concern of U.S. business. Organizations have begun the great migration to adopt the Internet as a vehicle to deliver various services including electronic commerce, web-based collaboration, web-based surveys, assessment and evaluation, web data mining, distance education, intelligent agents, electronic data interchange, patient and health informatics. The rapid adoption by businesses not only of the Internet, but also the Intranet and Extranet has pushed the fringes of information systems towards a new frontier. Development in information systems has been driven by these technological trends. The digital revolution is here. As the world continues to adopt distributed, network centric systems, the dawn of the networked economy grows brighter. There has been much advancement in technology and innovation in organizations especially this past decade. In the early 2000s, Intel's Chairman Andy Grove predicted that by 2005 only companies that have adopted the Internet as a mission critical technology would survive. His prediction seems to be correct; this means that all companies have to address technology as a critical element in their strategic management. It is of critical importance that organizations manage its resources and keep in pace with the advances so as not to lose its competitive advantage. In accordance with these trends, the IS curriculum needs to be brought up-to-date to reflect current technology trends and industry's

skill requirements of IS graduates; and also to meet accreditation requirements. The Association for Information Systems over the past 3 decades has developed a model graduate curriculum based on technology trends and industry's needs. The latest version of the model curriculum is the MSIS2000 model curriculum. The US Bureau of Labor Statistics has published data for the projected occupation needs of industry from 2006-2016. The occupation (job title) provides the information for the skills in demand. This paper describes a career skills oriented approach based on recent studies on career skills in demand (Luftman, 2006) and (Prabhakar, et al, 2005), current data from the Bureau of Labor Statistics (BLS), MSIS 2000 model curriculum recommendation, current demand for information security professionals, professional certification in demand (Hilbink, 2004), (IDC, 1999), and (Ray & McCoy, 2000), and the resources required. While the BLS projected occupational data, the current demand for information security professionals, the demand for various professional certifications and recent studies provided the basis for determining the career skills required by industry; the IS model curriculum provided the structure that supported the proposed curriculum. This paper is divided into 4 main sections. Section 1 provides an overview of how the proposed curriculum is derived. Section 2 presents the proposed graduate curriculum. Section 3 discusses certification and recommends the relevant professional certificate (based on the skill set) that is needed in industry. The final section reviews the current status of the IT skills requirements in industry and assesses some possible future trends.

OVERVIEW

There has been a consistent trend of increasing demand for IT professionals.¹ The “Numeric Change in Total Employment, 2006-2016” projection data from BLS shows annual job openings from 9,000 (Computer and Information Systems Managers), 9,000 (Programmers), 24,000 (Computer Support Specialists), 28,000 (Computer Systems Analysts) to 30,000 (Computer Software Applications Engineer). The “Fastest Growing Occupations, 2006-2016” projection data shows number of job increases from 34,000 (Database Administrators), 140,000 (Network Systems and Data Communications Analysts), 146,000 (Computer Systems Analysts), to 226,000 (Computer Software Applications Engineer). (This data is extracted from the BLS website at <http://data.bls.gov>) The demand for IT professionals has also resulted in significant salary increases.

A recent paper (Luftman & Kempaiah, 2007) stated that between 2006 and 2012, 1 out of every 4 new jobs will be IT related. Also, as the baby boomers of the dot-com era retire over the next 5 years, the shortage of IT professionals is expected to increase. A 2006 Society of Information Management (SIM) survey (Luftman, 2006) shows the top 10 skills employers are looking for when hiring mid-level employees (See Table 1).

Table 1: Top 10 skills employers are looking for when hiring mid-level employees

1.	Communication
2.	Project Leadership
3.	Functional Area Knowledge
4.	Business Process Design/Reengineering*
5.	Managing Expectations*
6.	Change Management*
7.	Systems Analysis*
8.	IT Architecture/Standards
9.	User Relationship Management
10.	Project Integration/Program Management

* Ties

An earlier IT skills study conducted by (Prabhakar, et al, 2005) found that web programming has the highest demand (in 42.6% of job ads). In Web programming, C++ programming has the highest demand while Java

¹ The term “IT Professionals” is used synonymously with “IS professionals.” There is little difference in training and job skills between them.

and/or SQL programming is demanded in more than 20% of the job ads and the demand continues to grow stronger. .NET skills represented about 13% of the skills sought by IT employers. The demand for database, Enterprise Resource Planning (ERP) and e-commerce server skills are: for database skill, over 22% of all positions require Oracle while SQL server skills accounted for 16% of all IT jobs; the demand for ERP skills (such as SAP, Oracle and PeopleSoft) is slightly over 13%; the demand for e-commerce server skills is under 9% but is expected to increase with the e-commerce market. It was also found that an average of 5% of all positions advertised required vendor or industry certifications. There is indication that in a tight job market, a candidate with certification has an edge over another without certification. In summary, Web programming, C++, Java, SQL programming and Oracle database skills seems to be the top skills in demand.

Since the 9/11 attacks on US soil, there have been a tremendous amount of effort spent on improving and strengthening the infrastructure of the US. A principal component of the infrastructure is the information infrastructure. Each day millions of dollars of business transactions and many communication channels are conducted through the information infrastructure via the Internet. Organizations of all types (business, academia, government, etc.) are facing risks resulting from their ever-increasing reliance on the information infrastructure. Business, government, and non-profit institutions have expressed difficulty finding personnel with appropriate training in cyber security tools. Such training requires hands-on experience with secure systems work, yet many institutions of higher learning lack the resources to provide that experience. As a consequence of this, the government, through the Department of Defense issued Directive 8570.1M officially in 2006. This directive requires both technical staff and managers with privileged system access performing Information Assurance (IA) functions at computing, networking or enclave positions be trained and hold appropriate certifications accredited by the American National Standards Institute (ANSI). It also requires that all users be trained by 2010. The government has allocated funding in the millions for this purpose. The list of approved certifications is as follows:

Table 2: Table of approved security certificates by level

Technical Level I	Technical Level 2	Technical Level 3
A+	GSEC	CISA
Network+	Security+	CISSP
SSCP	SCNP	GSE
	SSCP	SCNA
Management Level I	Management Level 2	Management Level 3
GISF	GSLC	GSLC
GSLC	CISM	CISM
Security+	CISSP	CISSP

* There is a glossary of the abbreviations in Appendix 1.

According to Lynn McNulty, CISSP, director of government affairs for (ISC)² (news release January 9, 2006):

The initiative represents a commitment by DoD officials to create and maintain a world class IA workforce that can meet the challenges of the digital battlefield and indicates a clear confidence in professional certification as a key component in improving the education, management and continued evolution of that workforce.

In an earlier presidential directive, the National Security Agency (NSA) in the spirit of Presidential Decision Directive 63, National Policy on Critical Infrastructure Protection, May 1998, designed and operated the National Centers of Academic Excellence in Information Assurance Education (CAEIAE) and the CAE-Research (CAE-R) outreach programs. Currently the NSA and the Department of Homeland Security (DHS) in support of the President's National Strategy to Secure Cyberspace, February 2003, jointly sponsor the program. From the NSA website:

The goal of the program is to reduce vulnerability in our national information infrastructure by promoting higher education in information assurance (IA), and producing a growing number of professionals with IA expertise in various disciplines.

Under the CAEIAE program, 4-year colleges and graduate-level universities are eligible to apply to be designated as a National Center of Academic Excellence in IA Education. Institutions meeting the Carnegie Foundation's classifications of Research University/Very High (RU/VH), Research University/High (RU/H) and Doctoral Research University (DRU) are eligible to apply for CAE-R. CAEIAEs and CAE-Rs receive formal recognition from the U.S. government, as well as opportunities for prestige and publicity, for their role in securing our nation's information systems.

Institutions awarded the designation are eligible to apply for scholarships and grants through several Information Assurance Scholarship Programs offered by the federal government. In addition, such institutions are encouraged to conduct research in information assurance and may become focal points of recruiting by federal departments and agencies seeking individuals with information assurance expertise.

As it is an involved process for institutions aspiring to be Centers of Excellence in Information Assurance, this paper will only propose a few security skills based courses instead of outlining the complete process. For more information on the application process and the criteria, see the NSA web page at <http://www.nsa.gov/ia/academia/caeiae.cfm> The proposed IS graduate curriculum will include two security courses. In addition, a module of security concepts is recommended to be integrated into other IS courses.

(Prabhakar, et al, 2005) provided demand information for specific IT skills based on his analysis of job ads between 2002 and 2005 while (Luftman, 2006) provided information for IT skills based on his survey of SIM members. From these two studies (and other reliable sources such as business journals or newspaper reports, government bulletins, etc), academicians can harness the information provided to update and enhance the IS curriculum just-in-time to educate and train undergraduates in the skills that industry needs. Thus, the IS curriculum should be developed to meet the demands of industry based on IT skills studies, BLS employment statistics (using the job titles and its job description) and on the skills that are in demand (for example, information assurance/security) as mandated by the government through the provision of grants for training, research and development. Skills requirement has typically been updated into the IS model curriculum.

This paper will use the career skills information to propose a IS curriculum that integrates these career skills into various courses. The proposed IS curriculum is structured based on the MSIS2000 model curriculum and enhanced by these career skills based courses. The proposed IS courses are mapped to the Common Body of Knowledge (CBOK) of the model curricula and content of the professional certification, if applicable.

Each IS program need to find a niche to fully exploit its expertise and attract students. From recent studies and the unique resources of each IS program, it is possible to focus on information assurance/security, systems analysis and design, IS project management, ecommerce, web application development, application software development or global information technology management.

The IS model curricula is important as it defines a CBOK that IS graduates should possess. This is well expended by the foreword to the MSIS2000 model graduate curriculum:

University-level Information Systems (IS) curricula need frequent updating to remain effective. Model curricula developed by task groups from professional societies aid universities in their curricula development and updating efforts by providing four inputs:

- The common body of knowledge that graduates are expected to know. This helps counter local requirements bias and helps graduates to be prepared for positions in a large geographic area.
- A program structure with suggested courses and course sequences.
- Rationale for the program and the resources required for it.
- Rationale for investment in faculty development to keep faculty members up to date with rapidly changing technology.

The value of model curricula such as MSIS 2000 are also based on a strong, increasing demand for university-trained graduates who can meet the changing needs of the information economy. A degree program in information systems cannot teach every fact or every process that will be needed by the graduate; its objective is to provide the fundamentals that support productive employment and provide a basis for lifelong learning.

The proposed graduate IS curriculum will adapt from the CBOK from the MSIS2000 model graduate curriculum which was developed over 3 decades based on the skills demand in industry. Detailed specifications can be found from the MSIS2000 document listed in the Reference section. See Figure 1 below.

FOUNDATION

IS Foundations (Technical Prerequisites)

- IS'97.1 – Fundamentals of Information Systems
- IS'97.4 – Information Technology Hardware and Software
- IS'97.5 – Programming, Data and Object Structures

Business Foundations (Business Prerequisites)

- Financial Accounting
- Organizational Behavior
- Marketing

IS CORE

- MSIS2000.1 – Data Management
- MSIS2000.2 – Analysis, Modeling and Design
- MSIS2000.3 – Data Communications and Networking
- MSIS2000.4 – Project and Change Management
- MSIS2000.5 – IS Policy and Strategy
- MSIS2000.6 – Integration. One of the following:
 - MSIS2000.6.1 – Integrating the Enterprise
 - MSIS2000.6.2 – Integrating the IS Function
 - MSIS2000.6.3 – Integrating IS Technologies
 - MSIS2000.6.4 – Integrating the Enterprise, IS Function and IS Technologies

CAREER ELECTIVES

Four career-oriented courses — may include a practicum. See Table 3 (page 13) for representative lists.

Figure 1: Summary of Curriculum Course Requirements

The IS Foundations and Core areas from the MSIS2000 model graduate curriculum are as shown next:

Table 3: MSIS2000 IS Foundations and Core Areas

MSIS2000 IS Foundations
IS'97.1 – Fundamentals of Information Systems
IS'97.4 – Information Technology Hardware and Software
IS'97.5 – Programming, Data and Object Structures
MSIS2000 IS Core
MSIS2000.1 – Data Management
MSIS2000.2 – Analysis, Modeling and Design
MSIS2000.3 – Data Communications & Networking
MSIS2000.4 – Project and Change Management
MSIS2000.5 – IS Policy and Strategy
MSIS2000.6 – IS Integration

The proposed IS courses are mapped to the IS Foundations and Core areas of the MSIS2000 model graduate curriculum (see Table 4). The proposed career track will each have 4 courses that are relevant to the local context instead of the recommended course electives. Also, as a result of the current demand for IS security skills, the proposed IS graduate curriculum will include 2 security courses – IS755 Security Risk Analysis and IS757 Information Security. In addition, a module of security concepts is recommended to be integrated into other courses.

The recent skills in demand studies by (Luftman, 2006) and (Prabhakar, et al, 2005) indicated that there is a substantial demand for application software development (in C++, Java, SQL Programming or .Net languages) and project management (including project leadership, program management and business process re-engineering). It is thus proposed that IS745 Application Software Development and IS747 IS Project Management be added to the IS curriculum.

As the world evolve into a net economy, globalization is now prevalent in all aspects of our lives; this offers the IS program, the unique opportunity to include the study of global IS in its curriculum. It is therefore proposed that a course IS410 Global IT Management be created.

Also, as business research is a critical skill not only in academia but also in the fast-moving IS industry, it is proposed that a course “IS601 Research Methods in Information Systems” be included in the IS core which will strengthen and provide a better balance to the overall IS core courses and also in view of accreditation exercises. The next section will discuss the proposed graduate IS curriculum in more complete details.

PROPOSED GRADUATE CURRICULUM

This section will propose a sample IS option curriculum for the graduate student. A table of the comparison of the model curriculum IS courses with the proposed courses is presented; followed by the proposed course sequence and requirement for the IS option. The career track is introduced to enable beginning graduate students to choose a career then plan their course schedule based on the required courses and electives for that career track. The Career Track Contract lists the courses a student will take and helps track the student’s progress through the program. A sample Information Security Career Track Contract and a sample Expanded Course Outline for IS755 Security Risk Analysis can be found in Appendix 2 and 3 respectively.

Student career track contracts also serve another purpose -- if advisors/schedulers know the courses that students are planning to take, a more definite and concrete class schedule can be planned each term. Also, when students choose career tracks they specialize in a set of skills that enable them to complete projects, for example, create an impressive website, create an impressive information system design or use some state of the art computer tools. Students can showcase their projects during open houses for student recruitment and also aid retention of students. Students’ projects can also be entered for competitions. It is also possible to organize competitions in the IS program’s career niche areas.

The proposed IS graduate courses are based on the recommended IS Foundations and Core courses in the MSIS2000 model graduate curriculum and adapted to fit the unique context of the IS program. The career electives section of the MSIS2000 model curriculum recommended 4 courses for each career track. The 4 courses for each career track can be chosen to reflect the unique resources of each IS program. The IS Foundations and Core areas from the MSIS2000 model graduate curriculum can be mapped to the proposed IS courses as follows:

Table 4: MSIS2000 IS Foundations and Core Areas Mapped to IS Courses

MSIS2000 IS Foundations	Proposed Graduate IS courses
IS*97.1 – Fundamentals of Information Systems	IS595 Information Systems for Management
IS*97.4 – Information Technology Hardware and Software	IS710 Systems Hardware and Software
IS*97.5 – Programming, Data and Object Structures	
MSIS2000 IS Core	Proposed IS courses
MSIS2000.1 – Data Management	IS720 Database Management Systems
MSIS2000.2 – Analysis, Modeling and Design	IS715 Systems Analysis and Design
MSIS2000.3 – Data Communications & Networking	IS750 Data Communications and Networks
MSIS2000.4 – Project and Change Management	IS747 IS Project Management
MSIS2000.5 – IS Policy and Strategy	IS765 Information Systems Strategy and Management
MSIS2000.6 – IS Integration	

A complete list of all the proposed graduate IS courses can be found on Table 5. The additional courses (highlighted in Table 5) are career track courses for the 4 career track options.

Table 5: List of Proposed Graduate IS Courses

	Proposed Graduate IS Courses	Credit
1	IS595 Information Systems for Management	3
2	IS601 Research Methods in Business Information Systems	3
3	IS705 Electronic Business	3
4	IS706 Cyber Law, Policy and Ethics	
5	IS710 Systems Hardware & Software	3
6	IS715 Systems Analysis and Design	3
7	IS720 Database Management System	3
8	IS735 Global Information Technology Management	3
9	IS740 Decision Support Systems	3
10	IS745 Application Software Development	3
11	IS747 IS Project Management	3
12	IS750 Data Communication & Networks	3
13	IS755 Security Risk Analysis	3
14	IS757 Information Security	3
15	IS760 Current Topics in IS	3
16	IS765 Information Systems Strategy and Management	3

NOTE:

1. It is possible that the course “IS601 Research Methods in Business Information Systems” to be the IS core course for the IS option.
2. The proposed course IS755 is updated to include the CBOK for the Certified Information Systems Auditor (CISA). See Section 3 for more details.
3. The proposed course IS715 is updated to include the CBOK for the IBM Certified Solution Designer (Object Oriented Analysis and Design, vUML 2). See Section 3 for more details.

The proposed graduate IS courses are developed and mapped to the CBOK of MSIS2000 model curriculum as shown in Table 4. The following illustration shows the proposed graduate IS course sequence.

Proposed Graduate IS Option Course Sequence

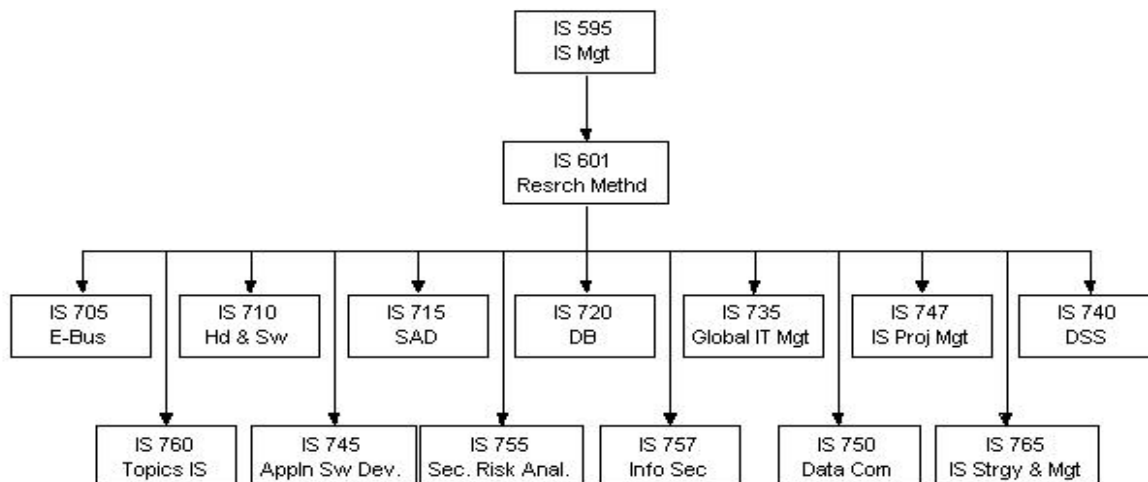


Figure 2: Proposed Graduate IS Course Sequence

Mapping the proposed IS curriculum to the MSIS2000 model curriculum, the required IS courses are illustrated in the following table.

Table 6: Table of Required Graduate IS courses

	Proposed Required Graduate IS Courses
1	IS595 Information Systems for Management
2	IS601 Research Methods in Information Systems
3	IS710 Systems Hardware and Software
4	IS720 Database Management Systems
5	IS715 Systems Analysis and Design
6	IS750 Data Communications and Networks
7	IS745 Information Systems Strategy and Management
8	IS747 IS Project Management
	plus 3 Career Track Courses

From the skills in demand by employers (Luftman, 2006) and (Prabhakar, et al, 2005), the demand for information security mandated by the government, the demand for professional certification (Hilbink, 2004), (IDC, 1999), and (Ray & McCoy, 2000), the recommended MSIS2000 model graduate curriculum (as illustrated in Table 4) and the unique resources of the IS program, it is possible that career tracks be focused at, for example, Business Systems Analysis, Electronic Business (or Web-based Business), Information Assurance/Security, or Management Information Systems. Each career track has 2 required courses and students have to choose an additional 1 out of 2 courses from the electives in the track. The career tracks with their required courses and elective courses are:

1. Business Systems Analysis

1. **IS 745** **Application Software Development (Required)**
2. **IS 747** **IS Project Management (Required)**
3. IS 755 Security Risk Analysis OR
4. IS 705 Electronic Business.

2. Electronic Business

1. **IS 705** **Electronic Business (Required)**
2. **IS 735** **Global IT Management (Required)**
3. IS 740 Decision Support Systems OR
4. IS 757 Information Security.

3. Information Systems Security

1. **IS 755** **Security Risk Analysis (Required)**
2. **IS 757** **Information Security (Required)**
3. IS 706 Cyber Law, Policy and Ethics OR
4. IS 705 Electronic Business.

4. Management Information Systems

1. **IS 735** **Global IT Management (Required)**
2. **IS 740** **Decision Support Systems (Required)**
3. IS 757 Information Security OR
4. IS 760 Current Topics in IS.

The content of the courses in the career tracks can include CBOK from its professional certification. For example, courses from the Information Systems Security career track can include CBOK from the Information Systems Audit and Control Associate (ISACA) Certified Information Systems Auditor (CISA) certification. Also courses from the Business Systems Analysis career track can include CBOK from the IBM Certified Solution Designer - Object Oriented Analysis and Design (UML 2) certification or the International Institute of Business

Analysis (IIBA) Business Analyst certification. In addition, the IS Project Management course can include CBOOK from the Project Management Institute (PMI) Project Management Professional (PMP) certification. A sample Information Systems Security Career Track Contract can be found in Appendix 2. The next section will discuss professional certification.

PROPOSED CERTIFICATION PREPARATION CURRICULUM

Employers are increasingly demanding that potential and existing employees be professionally qualified in the skills required. According to the paper by (Ray, et al, 2000), a study conducted by IDC, Incorporated (1999), found that 92% of the managers surveyed stated that they realized all or some of the benefits they expected from their certified employees. The top 5 benefits expected are: greater knowledge and increased productivity, a certain level of expertise and skill, improved support quality, reduced training costs and higher morale and commitment. The paper also reported that employees with certification commanded higher salary. A whitepaper by (Hilbink, 2004) stated that industry studies show that certified employees demonstrate higher productivity, make fewer errors and possess more skills valued by the customers. Certification can also differentiate a company and create a competitive advantage. A Gartner survey found that companies offering a strong training and education program often attracted the strongest job candidates and that certification is a cost-effective way of rewarding valued employees while investing in the future of the company. Industry research shows that smaller companies average 30-90% return on investment over a one year period, while larger companies with more certified employees see returns of 65-200%. The return is measured by reduction in downtime, an increase in productivity or sales and a decrease in costs due to mistakes or inefficiencies.

From (Luftman, 2006) and (Prabhakar, 2005), skills in high demand include systems analysis and design, project management, Web programming (or development), Java programming and information security (based on the emphasis by the US government). Professional certifications are available for each of these skills. Each certification has a CBOOK. Professional certifications are earned from a professional society and, generally, need to be renewed periodically, or may be valid for a specific period of time. A professional body or professional organization, also known as a professional association or professional society, is an organization, usually non-profit, that exists to further a particular profession, to protect both the public interest and the interests of professionals (from http://en.wikipedia.org/wiki/Professional_society). As a part of a complete renewal of an individual's certification, it is common for the individual to show evidence of continual learning - often termed continuing education or earning continuing education units (CEU)(from [http://en.wikipedia.org/wiki/ Professional certification](http://en.wikipedia.org/wiki/Professional_certification)).

As a result of the existing and continuing demand for professional certification, it is recommended that proposed courses in the IS curriculum cover part or if possible, the whole of the CBOOK. The School of Management through the IS program can also work towards being an academic partner for some of these professional certification, for example, IBM (Systems Analysis & Design certification), Sun Micro System (Java certification), Project Management Institute (PMI) (Project Management Professional certification), Information Systems Audit and Control Association (ISACA) (Information Systems Auditor or Information Security Manager certifications), International Institute of Business Analysis for Systems Analysis & Design (IIBA) (Business Analyst certification) or Microsoft (Microsoft Computer Professional certification). Typically, each certification requires a few courses to adequately cover its CBOOK.

Often mid-level managers do not have the option of taking semester-long courses over months or years. “Crammed” or intensive courses are more viable in such an instance. The IS program should also create such “crash courses” or “boot-camp” type certification classes. The classes can be offered as compressed certificate programs. Typically 4 or 5 classes are required for each certificate. The duration for each class is usually 4-5 full days. However, the classes can be customized as well. These classes can be offered through the professional extension program or through a center of excellence in a School of Management. Faculty will be able to teach these classes without much additional preparation as the class content matches closely to the regular course offered. The classes do not have to be taken immediately one after the other. They can be scheduled.

From the International Institute of Business Analysis (IIBA) certification CBOOK, 2 of the classes for the Business Systems Analysis and Design Certificate can be made up of:

1. Application Program Development, and
2. Information Technology Project Management

The **Application Program Development class** will cover:

1. Enterprise Analysis
Enterprise Analysis describes how we take a business need, refine and clarify the definition of that need, and define a solution scope that can feasibly be implemented by the business. It covers problem definition and analysis, business case development, feasibility studies, and the definition of a solution scope.

Purpose

Identify and propose projects that meet strategic needs and goals.

2. Elicitation
Elicitation describes how we work with stakeholders to find out what their needs are and ensure that we have correctly and completely understood their needs.

Purpose

Explore, identify and document stakeholder needs.

3. Requirement Analysis
Requirements Analysis describes how we progressively elaborate the solution definition in order to enable the project team to design and build a solution that will meet the needs of the business and stakeholders. In order to do that, we have to analyze the stated requirements of our stakeholders to ensure that they are correct, assess the current state of the business to identify and recommend improvements, and ultimately verify and validate the results.

Purpose

1. Progressively elaborate stated requirements to sufficient level of detail that accurately defines the business need within specified scope
2. Validate requirements meet the business need
3. Verify requirements are acceptable quality

4. Solution Assessment and Validation
Solution Assessment and Validation describes how to assess proposed solutions to determine which solution best fits the business need, identify gaps and shortcomings in solutions, and determine necessary workarounds or changes to the solution. It also describes how we assess deployed solutions to see how well they met the original need in order to enable businesses to assess the performance and effectiveness of projects.

Purpose

Assess solutions to ensure that strategic goals are met and requirements are satisfied.

The **Information Technology Project Management class** will cover:

1. Requirements Management and Communication

Requirements Management and Communication describes how we manage conflicts, issues and changes and ensure that stakeholders and the project team remain in agreement on the solution scope. Depending on the complexity and methodology of the project, this may require that we manage formal approvals, baseline and track different versions of requirements documents, and trace requirements from origination to implementation.

Purpose

1. Recognize that communication takes places throughout all knowledge areas and is important for managing requirements
2. Manage the approved solution and requirements scope
3. Ensure stakeholders have access to business analysis work products
4. Prepare and communicate requirements to stakeholders
5. Facilitate enterprise consistency and efficiency by re-using requirements whenever possible

2. Business Analysis Planning and Monitoring

Business Analysis Planning and Monitoring describes how to determine which activities are necessary to perform in order to complete a business analysis effort. It covers identification of stakeholders, selection of business analysis techniques, the process we will use to manage our requirements, and how we assess the progress of the work in order to make necessary changes in work effort. Business analysis planning is a key input to the project plan, and project management responsibilities include organizing and coordinating business analysis activities with the needs of the rest of the project team.

Purpose

1. Plan the execution of business analysis tasks
2. Update or change the approach to business analysis as required
3. Assess effectiveness of and continually improve business analysis practices

3. Business Analysis Techniques

Various business analysis techniques will be discussed (see the International Institute of Business Analysis (IIBA) certification CBOK for specific details).

Other certificate programs in Information Security, Java Programming or Microsoft software products can be designed by covering the CBOK from each of these certification bodies.

Fees

Typically, each 4-5 full-day class will cost a student between \$1,200 and \$3,200 depending on the resources to be provided, for example, lab facilities, computer usage, type of software used in class and class materials provided.

AUTHOR INFORMATION

Benjamin Khoo completed his Ph.D. (Information Systems) at the University of Maryland, Baltimore County. He is a member of two honor societies and was awarded the Phi Kappa Phi Dissertation Research Grant. He has published annually in the major information systems publications. He is interested in both basic and applied research to further the effectiveness, usability, and ultimately the utility of information systems; and also the pedagogical issues related to these areas. Prior to becoming an academician, he was a member of the Technical Staff (Software Engineer) of a large telecommunication corporation.

Peter Harris is a professional accountant and is an Associate Professor of Accounting at The New York Institute of Technology. He completed his MBA degree at Columbia University in New York City. He has served in curriculum committees for the Chartered Financial Analyst Institute, The American College and has introduced registered Certified Financial Planner and Chartered Life Underwriter programs at The New York Institute of Technology. He has also worked for Ernst and Young LLP and is a member of several professional organizations.

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10. Ray, Charles M. and McCoy, Randy (2000). Invited Editorial: Why Certification in Information Systems? *Information Technology, Learning, and Performance Journal*, Vol.18, No.1, Spring 2000.

APPENDICES

Appendix 1

Glossary:

- A+
- Network+
- Security+
- CISSP Certified Information Systems Security Professional
- SSCP System Security Certified Practitioner
- CISM Certified Information Security Manager
- CISA Certified Information Security Auditor
- SCNP Security Certified Network Professional
- SCNA Security Certified Network Architect
- GSEC GIAC Security Essentials Certification
- GSLC GIAC Security Leadership Certification
- GSE GIAC Security Expert
- GISF GIAC Information Security Fundamentals

Appendix 2

Information Security Career Track Contract

for curriculum years 2008 - 2009 and later

WARNING – THIS CONTRACT CANNOT BE USED
IF YOU ARE ON A CURRICULUM YEAR 2007-2008 OR EARLIER

Curriculum Year

Student Name (print last name, first name)

Student Id

I have selected the **Information Security Career Track**. In fulfillment of the requirements for my chosen career track, I will complete the following courses:

	Required IS Courses	Credits	Completed
1	IS595 Information Systems for Management	3	
2	IS601 Research Methods in Information Systems	3	
3	IS710 Systems Hardware and Software	3	
4	IS720 Database Management Systems	3	
5	IS715 Systems Analysis and Design	3	
6	IS750 Data Communications and Networks	3	
7	IS745 Information Systems Strategy and Management	3	
8	IS747 IS Project Management	3	

I will select 4 career track courses from the following:

Required Courses	Credits	Take	Completed
IS 755 Security Risk Analysis	3	X	
IS 757 Information Security	3	X	
Supplemental Electives			
IS 706 Cyber Law, Policy and Ethics OR	3		
IS 705 Electronic Business.	3		
Total Required Option Courses (3 courses)		9	

Student Signature

Advisor Signature

Date

Advisor Printed Name

Appendix 3

A Sample Expanded Course Outline for IS755

Course title: Security Risk Analysis

Course number: IS755

Date prepared: May 1, 2008

Section A

1. Catalogue description

In this course, we discuss IS audit services in accordance with IS audit standards, guidelines and best practices to assist the organization in ensuring that its information technology and business systems are protected and controlled. A set of analytical tools for quantifying risk, costs and benefits of mitigation methods will be discussed. The feasibility of technical solutions as applied to various cases will also be presented. **Prerequisite:** IS595

2. Required background or experience

1. Prerequisites. IS 595
2. Prerequisites justification. Problems and projects in the course require knowledge of managerial principles used by contemporary business organizations and basic microcomputer skills.
3. General education contribution. The student is expected to learn risk analysis as part of an organization wide information quality assurance program, where supporting business objectives or mission requires
 - Identification of customer requirements
 - Sensitivity of information
 - Availability of the system or application
 - Basic enterprise requirements include
 - Information classification
 - Business Impact Analysis (BIA)
 - Risk analysis
 - Intellectual property safeguards

3. Expected outcomes

It is expected that students will learn to:

1. Analyze Risk by: Identifying the Asset, Ascertaining the Risk, Determining the Vulnerability and Implementing the Corrective Action,
2. Identify potential undesirable or unauthorized events, “RISKS,” that could have a negative impact on the *Integrity, Confidentiality, or Availability* of information by, or flowing through, an application or system, and
3. Identify potential “CONTROLS” to reduce or eliminate the impact of RISK events determined to be of MAJOR concern, so as to:
 - a. Maintain customer, constituent, stockholder, or taxpayer confidence in the organization.
 - b. Protect confidentiality of sensitive information (personal, financial, trade secret, etc.)
 - c. Protect sensitive operational data from inappropriate disclosure
 - d. Avoid third-party liability for illegal or malicious acts committed with the organization’s systems
 - e. Ensure that organization computer, network, and data are not misused or wasted
 - f. Avoid fraud
 - g. Avoid expensive and disruptive incidents
 - h. Comply with pertinent laws and regulations
 - i. Avoid a hostile workplace atmosphere

4. Text and references

Peltier, Thomas R.; *Information Security Risk Analysis*; Auerbach Publishing, Boca Raton, FL, 2001. ISBN: 0-8493-3346-6

5. Special or unique student materials:

Students should have access to a computer with Microsoft Office and with access to the Internet.

- | | | | |
|--------------------------------------|--------------------------------------|---------------------------------------|--|
| <input type="checkbox"/> Zip Disk | <input type="checkbox"/> Calculator | <input type="checkbox"/> Camera | <input checked="" type="checkbox"/> Laptop |
| <input type="checkbox"/> Floppy Disk | <input type="checkbox"/> Graph Paper | <input type="checkbox"/> Video Camera | <input checked="" type="checkbox"/> Computer |
| <input type="checkbox"/> CD-Rom | <input type="checkbox"/> Writing Pad | <input type="checkbox"/> Videotape | <input type="checkbox"/> Other |

6. Special or unique university facilities

Classroom projection facilities for lectures and demonstrating applications. University-supported computer laboratories in which students can work with the application software are very helpful.

- | | | |
|---|---|--|
| <input checked="" type="checkbox"/> Computer Lab | <input type="checkbox"/> Computer Connection | <input type="checkbox"/> “Smart” Classroom (one workstation) |
| <input type="checkbox"/> File Server | <input checked="" type="checkbox"/> White Board/Markers | <input checked="" type="checkbox"/> Overhead Screen |
| <input type="checkbox"/> Computer Projector | <input type="checkbox"/> VCR | <input type="checkbox"/> Microphone |
| <input type="checkbox"/> Laser Pointer | <input checked="" type="checkbox"/> Printer | <input type="checkbox"/> Moveable Classroom Furniture |
| <input checked="" type="checkbox"/> Internet Connection | <input type="checkbox"/> Laptop Ports | <input type="checkbox"/> Other _____ |

7. Expanded description of the course and instructional methods

- a. Instructional methods used in this course include lectures, class discussions, and in-class demonstrations
 1. Lectures are used to clarify and supplement text readings.
 2. Class discussions and in-class demonstrations are used to facilitate student understanding and provide integration of course material within the business educational domain.
 3. Projects and assignments reinforce students’ understanding of current issues in IS.
- b. Students are expected to assimilate a significant portion of course content through self-study of the readings, textbook and instructor-provided materials.
- c. The research paper allow the students to put into practice what they have learned and exercise the students’ ability to conduct research in IS. The instructor will provide assistance and guidance in the research and writing the paper.
- d. One research paper is required. More detailed discussion of the papers will be done in class. The length of a research paper is typically between 7 to more than 20 pages depending on the publication.

Topic area: Any issue related to IS Security Risk Analysis or Assessment.

The information for the paper should come from current literature -- current means from 2005-2007. Source material should be copied and attached to your paper. You also need to cite your source within the paper. Assistance on “how-to” for a research paper can be found at <http://owl.english.purdue.edu/workshops/hypertext/ResearchW/index.html> and the APA style format guide can be found at <http://owl.english.purdue.edu/owl/resource/560/01/> **Note: Most publications provide their guidelines for formatting the research paper to be published.**

- | | | |
|--|-------------------------------------|---|
| <input checked="" type="checkbox"/> Lecture | <input type="checkbox"/> Cases | <input type="checkbox"/> Individualized Instruction |
| <input checked="" type="checkbox"/> Lecture/Discussion | <input type="checkbox"/> Open Lab | <input type="checkbox"/> Cooperative Learning |
| <input type="checkbox"/> Seminar | <input type="checkbox"/> Videotapes | <input type="checkbox"/> Distance Learning |
| <input checked="" type="checkbox"/> Project | <input type="checkbox"/> Other | |

8. Methods of evaluating outcomes

- 1 Research Paper: 20% of final grade
- Examinations: 20% Mid-term Exam
20% Final Exam
- 2 Assignments: 15% + 15%
- Class Participation: 10% of final grade

Evaluation Tools:

Individual Paper: <u>20</u> %	Tests & Exams <u>40</u> %	Individual Project <u>30</u> %
Group Paper: <u> </u> %	Quizzes <u> </u> %	Team Project <u> </u> %
Individual Presentation <u> </u> %	Peer Evaluation <u> </u> %	Outside/Expert Evaluations <u> </u> %
Group Presentation <u> </u> %	Participation <u> </u> %	Other: <u> </u> Participation <u>10</u> %

9. Independent Work

All work is to represent the student’s own efforts. Students are permitted to seek help in clarifying paper requirements or related concepts, but all materials submitted must represent original work by each student. Students **MUST** not duplicate work done by others. Students not adhering to this policy is subject to disciplinary action (see the University Catalog for specific penalties).

Important Resource Link:

Research & Writing:	http://www.cs.cmu.edu/afs/cs.cmu.edu/user/mleone/web/how-to.html
ISWorld Ph.D. Page:	http://www.isworld.org/phd/phd.htm
Research & Writing: ISWorld Research Resources:	http://www.isworld.org/#research

Section B

Week #	Material Covered	Presentation	Assignment/Paper
Week 1	Introduction to the course & Syllabus Risk Management	Slides1	Research Paper assigned
Week 2	Risk Assessment Process	Slides2	
Week 3	Quantitative vs Qualitative Risk Assessment I	Slides3	
Week 4	Quantitative vs Qualitative Risk Assessment II	Slides4	Assignment 1
Week 5	Other Forms of Qualitative Risk Assessment	Slides5	
Week 6	Software Development Risks	Slides6	ConstructSwRisk_tr14.94.pdf
Week 7	Mid-Term Exam		
Week 8	Facilitated Risk Analysis and Assessment Process (FRAAP) I	Slides7	Assignment 1 due
Week 9	Facilitated Risk Analysis and Assessment Process (FRAP) II	Slides8	
Week 10	Facilitated Risk Analysis and Assessment Process (FRAP) III	Slides9	Assignment 2
Week 11	Variations on the FRAAP	Slides10	
Week 12	Mapping Controls	Slides12	
Week 13	Business Impact Analysis	Slides13	
Week 14	Paper Presentations	Students	Assignment 2 due
Week 15	Risk Assessment Management Summary Report		Research Paper due
Week 16	Final Exam		