

# Information Systems/Technology Employer Needs Survey: Analysis by Curriculum Topic

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## ABSTRACT

As the demand for Information Systems (IS) and Information Technology (IT) graduates grows, it is imperative that the curriculum in IS and IT programs meet employer needs. At the same time it is important that these programs do not become 'training' programs but rather teach skills enabling students to learn new technologies as they evolve. IS and IT educators encounter a continuing challenge to insure that their courses and curriculum stay up to date with the technological changes in the field as well as being relevant to the business community. This research summarizes the results of an employer survey conducted at four different universities and their service areas. It is similar to other employer surveys in querying job-hiring expectations, but unique in that it queries the detailed job skills required for specific occupations. The paper also compares the results of a similar survey conducted in 2002/2003. Survey results indicated that Help Desk and Software Development occupations have the highest anticipated hiring levels in the surveyed areas for the 2007-2008 period.

Keywords: ACM curriculum, IS curriculum, IS education, IT employment, IT skills

## 1. INTRODUCTION

The United States Bureau of Labor Statistics reports that in the 2004-2014 period Information Systems (IS) and Information Tech-

nology(IT) jobs have the second highest growth rate and demand in the United States (US Bureau of Labor Statistics, 2005). Fortune Magazine also reports that IT occupations comprise six of the top twen-

ty (Fortune Magazine, March 2005) growth jobs. This demand for IT professionals is coming at a time of decreasing IS enrollments (Lomerson and Pollacia, 2006 and Deloitte 2007).

Luftman and Kempaiah (2007) report that the demand for IS workers in the United States are on the verge of exceeding the available workers.

A challenge for any computer information systems' faculty member is to stay relevant and up to date with the evolving technologies demanded by employers. Lee, Koh, Yen and Tang (2002) note that in a dynamically changing industry (Information Technology) information systems' academics have a hard time coping with this rapid change in their course content. Many higher education universities follow either the IS 2002 Model Curriculum or the ABET model curriculum. These model curricula provide suggestions for course content for graduate and undergraduate IS and IT courses. However a limitation of any models is that they have difficulty in staying abreast of technological changes. The moment they are published technology and business needs change.

Many business schools that are accredited by the AACSB (Association to Advance Collegiate Schools of Business) have restrictions placed on the number of courses required within the business school and often results in restrictions on the number of courses required in a major, like information systems. While AACSB has made some adjustments in the new guidelines (January 2007) to provide some flexibility and relief, it is only available to those who can prove the need based upon their mission. IS content in major courses must be designed efficiently in order to effectively cover the growing knowledge and skill set within limited course offerings.

Many IS programs report decreased enrollments over the peak in 2000-2001. (Janicki et. al., 2004) Reasons quoted are that IS enrollment has dropped as the lure of high salaries in the IS industry has faded. The second reason quoted is that the IT job market is tighter, requiring new graduates to do more to compete with seasoned professionals. It behooves IS programs to take an objective look at how curriculum matches

market needs. A better understanding of the market may improve placement, and thus draw more students into the programs.

Technology is rapidly changing and it is important that IS curriculum is relevant to employer needs (Lee et al., 2002, Woratschek and Lenox, 2002, Scott, Alger, Pequeño, and Sessions. 2002) . There are several problem areas for developers of IS programs that need to evolve as technology and industry needs change. These problem areas are:

- How to balance the common body of knowledge for graduates of business schools versus technology skills desired;
- How to balance training and certification desires of students with in depth knowledge of a topic area;
- How to incorporate more and more recent advances in technology into the same number of courses;
- How to meet employer needs for entry-level and above entry-level employees in the IT profession; and
- How to determine what knowledge should be included in basic Information Systems courses?

This research was designed to address some of these issues as they relate to the continuing improvement of an undergraduate program in information systems and the development of a proposed graduate program. The primary objective was to identify and profile IS positions anticipated in the near future by employers in the service areas of the participating institutions. In addition, we obtained feedback from those employers about those positions in order to identify different combinations of knowledge and skill sets expected for the successful candidate at both entry and advanced levels. This information is to be used to help guide IS faculty in the design and development of pertinent curriculum. These objectives address the last two "problem areas" identified above in detail.

This research is a follow up study of a similar survey conducted in 2003 (Janicki, et. al. 2004). This paper also details changes in

occupations and skills demanded by industry since the initial survey.

Surveys of employers' technological needs are commonly performed to support the curriculum development process. However this survey is different in three manners. First it attempts to "drill-down" to understand the employer needs for an occupation. For example, it is helpful to identify the mix of knowledge and skills needed for database professionals, not just that a database course is necessary in the curriculum. Secondly, this survey was built from an employer perspective (of job skills needed) versus many surveys that are built from the academic side (what courses should be delivered). Thirdly, the survey queried not only entry-level positions (undergraduate degrees) but also two to three levels above entry positions to represent needs for graduate programs.

## 2. LITERATURE REVIEW

There are numerous research efforts in the area of matching employer needs to curriculum. Lee et al. (2002) surveyed IS practitioners and IS academicians and made the following conclusion: IS academicians' understanding of the required knowledge and skills for the IT profession is not in line with the demands of industry. Specifically they noted that IS practitioners rated interpersonal, team, and communication skills higher than technical knowledge and skill sets. They also noted that practitioners rated software tool skills as less important than academicians. In general academics saw technical skills more valuable for IS graduates, while business professionals saw a need for more "managerial skills."

An interesting observation of Lee et al. (2002) is that the traditional career path for IS professionals (from programmer, to analyst to project manager, to IS manager) is being replaced by many diverse career paths as one can not be a technical expert in all areas of IS operations.

Woratschek and Lenox (2002) also reported that non-technical skills were as important as technical skills. In addition their survey of 30 plus employers noted that knowledge of the systems development life cycle remains a key component of IS graduate knowledge

with less emphasis on programming languages. Investigating the certification needs of employers, their study reported that professional certifications were not important for entry-level positions. Cappel (2002) did a similar study of employer needs and also found the ability to utilize the systems development life cycle to be a key skill desired by employers.

The findings of Lee et al. (1995) also support the need for a well rounded IS graduate. They identified in their survey of business professionals a need for skills in technology, business operations, management and interpersonal skills. In addition they noted that lower level IS jobs (primarily programming) were disappearing to overseas markets and IS graduates need to have skills in multiple areas beyond technology. The 2002 IS model curriculum stresses the need for IS professionals to have a broad business and real world perspective, as well as strong analytical and interpersonal communication skills.

Scott et al. (2002) recently completed a similar study where they contrasted employer expectation with student skills. Their overall conclusion was that there were significant gaps in the knowledge expected by employers in the following areas: database, CASE modeling tools, and programming. Bentley, Lowry, and Sandy (1999) found a need for institutions to stress problem-based learning approaches in their courses.

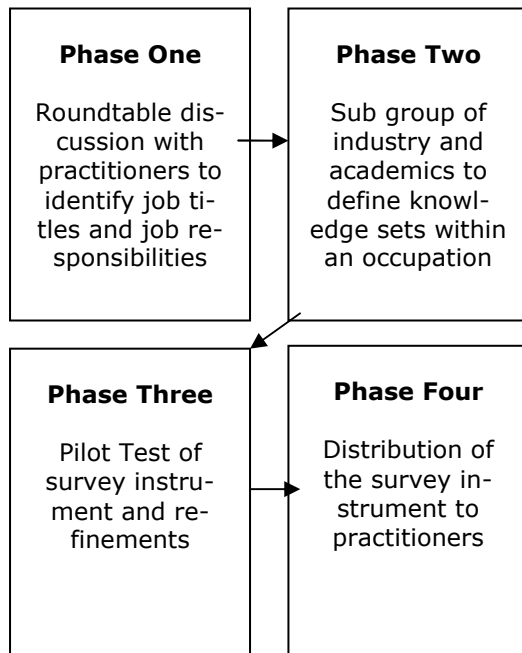
To build on the results of previous research, we built our survey to provide a more detailed examination of the job skills and knowledge needed for indicated current or anticipated "hot" jobs for both undergraduate and graduate degree students. We sought to answer four key questions: a) what are the technologies currently in use and projected to be in use in the near future by corporations?; b) what entry and above entry jobs will have the highest new hiring in the near future?; c) what is the common set of business skills required by employers of IS graduates?; and, d) what are the IS skills required for specific jobs as well as what IS skills are needed by all graduates?

## 3. METHODOLOGY

The development of the survey instrument was in four phases as shown in Figure 1.

Phase I

In phase one, 20 professionals from various IT professions and responsibilities (members of a corporate advisory board), met with faculty to develop topic areas of importance to IT professionals when hiring entry-level or above entry-level professionals.



**Figure 1: Survey Methodologies Stages**

This group was not given the job titles from the 2002 survey, but rather they were asked to determine what would be the common job titles for 2007. The professionals brought full job descriptions to the meetings so that the survey could 'group' similar job titles into one generic title. Appendix B details the job areas and definitions that were agreed for the survey.

Phase II

A sub group of these professionals worked to define the job knowledge areas required for each occupation. These job skills went through several iterations and 'pilot testing' with other industry professionals to insure the proper job skills were defined. See Appendix B for a list of jobs and job categories defined by the advisory board group.

The sub group of academics and industry professionals developed fourteen potential knowledge areas that IS professionals may (or may not) need a basic understanding. as shown in Table 1.

Application Services	Security
Computer Architecture	Software Development / Programming
IT Management	Systems Analysis
Networking & Communications	System Design
Project Management	Systems Implementation Methodologies
Rapid Application Development	System Release, Delivery, Compliance
Relational Database	Web Development

**Table 1:**  
**Potential Knowledge Areas that an IS employer may expect a basic level of understanding by new job hires**

To help 'drill down' for each knowledge area and occupation the items shown in Table 1 were further defined to help with course development. This drill down capability enables faculty to design their syllabi around specific topics needed by industry.

To illustrate this 'drill down' by knowledge area the following details the drill down questions for the Relational Database knowledge area. The respondents were asked to indicate the level of knowledge desired as 'none, fundamental, working or expert' for the following sub categories:

- SQL
- Query by Example
- Specific DB Product Knowledge
- Data Modeling
- Specific Data Modeling Language
- Data Warehousing
- Data Cleansing
- Data Integration
- Database Administration

To minimize the length of the survey the respondents would only be asked 'sub category' questions if they indicated some knowledge of the category (Table 1) was desired. In addition respondents were asked to detail only up to two positions when there was an anticipated opening in the next eighteen months.

Phase III

To insure that the survey would be clear to the participants and also within a ten minute response limit, the survey request was emailed to twenty industry professionals. These individuals were directed to a web site to complete the survey. They were asked to record the time to complete the survey and to print any pages that were misleading and fax back any suggestions.

Following completion of this pilot test, the survey instrument was revised and ready for distribution.

#### Phase IV

The request to complete the survey was emailed to 1002 individuals either in the IS/IT field or known to potentially hire IS/IT professionals. We had 308 respondents or 30%. All respondents did not complete the entire survey.

The survey's mailing list was developed by lists from four different institutions. Two of the institutions were state affiliated universities and two were private institutions. The schools were from North Carolina, Ohio and Pennsylvania.

The survey's mailing list was developed based on the following criteria:

- a. members of the IS/IT advisory boards from each participating school
- b. each school provided a list of IS/IT professionals in their service area
- c. alumni from each participating institution

The survey instrument had two major branches. The branch each participant received was based on if they managed or hired IT professionals versus if they did not, but did work in the field. Respondents to both branches were asked the sample demographics (age, gender, location, company size, industry, job title) and if they were responsible for hiring or supervising IS/IT professionals. Based on the answer to the hiring/supervising questions the survey's major branches were:

#### Branch A: Hired or Supervised IS/IT professionals:

- Anticipated Hiring for IT professionals in the next 24 months (Figure 2)
- Knowledge areas expected for one to two of the areas in which hiring is expected (See Table 1)
- Detailed expectations within each knowledge area
- Basic business skills expected for this occupation

#### Branch B: Work as an IT professional

- Knowledge areas expected for their job area (See Table 1)
- Detailed expectations within each knowledge area
- Technology knowledge areas expected for this occupation
- Basic business skills expected for this occupation

Note that those hiring or supervising were asked to respond to up to two occupations they supervise (to limit time of completion) those who did not supervise were asked to complete an additional page on the technologies employed in their occupation (languages, operating systems, databases etc.) See the Appendices for sample questions in each section.

## 4. Results

As reported the survey was emailed to 1002 IT managers, IT professionals or those individuals who hire IT professionals with 308 responses. Table 2 details the functional area within the organization the respondents worked. Please note the respondent was not required to complete all questions.

#### Demographics

Table 3 details the size of the organizations represented while table 4 details the type of organization for the respondents. Table 5 indicates where the respondents company was located. The state distribution centered in NC, PA and OH is to be expected as this is where the participating institutions are located.

Functional Area	#	%
Accounting	17	5.5
Corporate Administration	6	1.9
Corporate Management	19	6.1

Finance	12	3.9
Information Systems	177	57.3
Marketing	4	1.3
Operations	17	5.5
Research	11	3.6
Sales	14	4.5
Other	32	10.4

**Table 2: Functional Area of Respondents  
(Number and % of Respondents)**

Number of Employees	# of Respondents	% of Respondents
< 11	40	12.9
11 - 20	19	6.1
21-100	59	19.1
101-499	32	10.4
500-999	79	25.6
1000-9999	73	23.6
>10000	7	2.3

**Table 3: Size of the organizations**

Organization Type	Number of Resp.	% of Resp.
Corporation	180	58.3
Education	31	10.0
Government	38	12.3
LLC	26	8.4
Non or Not for Profit	18	5.8
Sole Proprietor or Partnership	16	5.2

**Table 4: Organization Type**

Other demographics include the following:

- Gender: 68% Male; 31% Female
- Age: < 30: 29%; 30 - 39: 23%; 40-49:26%; 50-59: 16%
- Time with company – over 50% had been with their company less than two years while 12% had been with their firm over 10 years.

Company Location	Number of Respondents
NC	140
PA	46
OH	35
MI	25

VA	17
NY	6
CA	5
MD	5

**Table 5: Company Location**

#### Hiring Expectations

To assist students' preparation for the job market, a section of the survey concerned future hiring expectations by position. Table 6 summarizes hiring expectations for the 2007-2008 period. Above entry level hiring was defined as two to three levels above entry-level employment

Title	Current Employees	Entry level hiring	Above entry hiring	Rank in 2002 survey (entry)
Help Desk	325	169	62	3
Software Development	810	78	65	1
Networking	194	69	41	2
Systems Analysis	708	48	52	4
Technical	215	32	35	5
IT Auditing	271	31	32	*
Server Mgt	169	13	32	*
Web Development	59	13	11	6
IT Management	237	8	55	*
Database	91	7	14	7
Graphic Design	70	6	5	8
IT Security	41	6	4	*
Tech Sales	34	1	6	*
Other	308	30	23	

**Table 6:  
Occupations and hiring expectations  
(\*new category for 2007 survey)**

Table 6 details the occupations in descending order by hiring expectation. The table indicates that the Help Desk occupations will lead the 'entry level' position for many firms, followed by Software Development and Networking. At the advanced hiring level (potential master level student) Software Development, Help Desk, and System Analysis are at the top of the demand list. A "\*" indi-

cates this occupation was not identified in the 2002 survey.

Common Body of Business Knowledge

Previous employer surveys have stressed the importance of interpersonal and general business skills. Similar results were found in this survey.

Table 7 details courses commonly found in the business core at many institutions. The respondents indicated that graduates should possess a **working knowledge** of the following areas:

- Information Systems Topics
- Written Communication Skills
- Oral Communications Skills

In addition entry level hires should have **fundamental knowledge** of the following areas (in order of importance):

- Operations
- Management
- Accounting
- Finance
- Statistics

Contrasting the 2002 survey results to the 2007 very little change in the importance of the business core occurred. New to the 2007 survey were the communication skills questions which scored in the 'working knowledge' area.

Common Body of Business Knowledge Desired	Help Desk	Software Development	Networking	All IS/IT Jobs	2002 Survey
Accounting	1.5	1.7	1.7	1.9	1.9
Business Law	1.4	1.3	1.3	1.5	1.6
Economics	1.5	1.4	1.4	1.6	1.6
Finance	1.5	1.7	1.7	1.8	1.7
International	1/5	1.2	1.4	1.5	*
IS	3.0	3.0	3.0	3.0	2.9
Management	1.8	2.0	2.2	2.1	2.2
Marketing	1.5	1.6	1.6	1.7	1.9
Operations	2.3	2.0	2.1	2.2	2.3
Statistics	1.5	1.8	1.8	1.8	2.0
Oral	2.6	2.6	2.6	2.7	*

Communications					
Written Communications	2.9	2.9	2.7	3.0	*

**Table 7:**  
**Desired business knowledge desired**  
**Scale: 1=None; 2=Fundamental;**  
**3=Working; 4=Expert**

Productivity Software Desired Knowledge	Help Desk	Software Development	Networking	All IS/IT Jobs	2002 Survey
MS Access	2.6	2.1	2.4	2.4	2.9
MS Excel	3.2	2.8	3.0	3.0	2.8
MS PowerPoint	2.8	2.5	2.7	2.8	2.6
MS Project	2.2	2.1	2.3	2.2	2.2
MS Word	3.3	2.9	3.0	3.0	2.8

**Table 8:**  
**Desired knowledge of productivity software desired**  
**Scale: 1=None; 2=Fundamental;**  
**3=Working; 4=Expert**

The level of knowledge for common office productivity applications desired is shown in Table 8. Graduates should possess working knowledge of spreadsheets and word processing (both increasing in desired knowledge since the last survey). Interesting desired knowledge of MS Access decreased, perhaps as employers are seeking more MS SQL, mySQL knowledge.

Knowledge desired by occupation

A goal of the survey was to provide faculty the drill down capability within an occupation. Tables 9 and 10 detail the drill down capability for the top two occupations by knowledge set (Help Desk and Software Development). The tables only reflect those items 2.5 or greater (fundamental to working knowledge)

IS knowledge set – Help Desk (only shown > 2.5)		
Application Servers		
Various OS		2.8
Configure Software		2.5
Network Software		2.8

	Performance monitoring	2.5
	Problem Identification	2.6
<b>IT Management</b>		
	IT Ethics/Privacy Policies	2.7
<b>Networking</b>		
	Network Administration	2.5
	Windows Administration	2.8
<b>Relational Database</b>		
	SQL	2.8
<b>Systems Release / Delivery</b>		
	Quality Control	2.5
	Systems Integration	2.5
<b>Web Development</b>		
	Web Services	2.6

**Table 9:**  
**Desired knowledge**  
**of IS topics for a 'Help Desk' new hire.**  
**Scale: 1=None; 2=Fundamental;**  
**3=Working; 4=Expert**

The goal of the drill down by knowledge set is to help provide developers of curriculum an understanding of the current needs of industry and to offer a wide range of knowledge sets in the curriculum. As shown in Table 10 a System Developer needs more than language expertise, the survey indicates the software developer needs skills in IT Management, Database, Application Servers, System Delivery and web knowledge sets as well as programming knowledge.

Overall the knowledge sets most in demand for all occupations are shown in Table 11 in order of importance.

<b>IS knowledge set – Software Developer</b> (only shown > 2.5)		
<b>Application Servers</b>		
	Problem Identification	2.6
<b>IT Management</b>		
	IT Ethics/Privacy Policies	2.7
	Project Management	2.8
	Planning and Scheduling	2.7
<b>Rapid Application Development</b>		
	At least one specific language	3.2
	GUI Design	2.9
	Prototyping	2.5
<b>Relational Database</b>		
	SQL	3.1
	At least one specific product	2.6
<b>Software Development</b>		
	Data Structures	2.9
	Object Oriented Programming	2.6
	Structured Programming	3.1
	Documentation	2.9
<b>Systems Analysis</b>		
	Process Modeling	2.9
	Requirements Analysis	2.9
	Data Modeling	2.5
	Structured Modeling	2.8
<b>Systems Release / Delivery</b>		
	Quality Control	2.9
	Release / Compliance Mgt	2.7
	Testing	3.0
<b>Web Development</b>		
	CSS	2.7
	HTML	3.1
	Java Script	2.7
	Session Management	2.6
	Web Services	2.7
	XML	2.7

**Table 10:**  
**Desired knowledge of IS topics for a**  
**'Software Developer' new hire.**  
**Scale: 1=None; 2=Fundamental;**  
**3=Working; 4=Expert**

The goal of the drill down by knowledge set is to help provide developers of curriculum an understanding of the current needs of industry and to offer a wide range of knowl-



edge sets in the curriculum. As shown in Table 10 a System Developer needs more than language expertise, the survey indicates the software developer needs skills in IT Management, Database, Application Servers, System Delivery and web knowledge sets as well as programming knowledge.

Overall the knowledge sets most in demand for all occupations are shown in Table 11 in order of importance.

System Documentation	2.9
Data Security	2.8
HTML	2.8
IT Ethics/Privacy	2.8
Problem Identification	2.8
Project Management	2.8
Process Analysis	2.8
Systems Analysis	2.8
Systems Delivery / Testing	2.8
Specific Programming Lang	2.8
Desktop Support/Knowledge	2.7
Structured Programming	2.7

**Table 11:**  
**Desired knowledge of IS topics for a 'all IS new hires.**  
**Scale: 1=None; 2=Fundamental;**  
**3=Working; 4=Expert**

Appendix A contains the full list of knowledge sets and their scores.

## 5. CONCLUSIONS

The respondents indicated that graduates at both entry and above entry-level should possess fundamental knowledge of information systems as well as both oral and written communication skills. In addition management (motivation, team building) and operations topics are important for an IS/IT graduate to have at between a fundamental to working knowledge of these topics.

Fundamental knowledge of accounting, finance and marketing was expected of all graduates. At above entry-level, project management and statistics as well as proficiency in personal productivity software were relevant. Another important consideration for the curriculum developer is to drill-down to the individual job skills indicated by occupation.

The highest level of new hires is anticipated in help desk as many firms use the Help Desk position as an entry gateway to access the knowledge and communication skill sets of the new hire. Following Help Desk entry position were software developer, network specialist, system analysts and technical experts. This is a change from our earlier survey in which networking was the highest occupation.

The survey indicates that regardless of the occupation, the employers expected a working knowledge of system documentation, security, IT ethics and privacy, problem identification, specific programming language and process analysis.

Our survey found some interesting results that differ from previous employer surveys. The Woratschek and Lenox (2002) and Cappel (2002) studies found that the top skill set desired by employers was systems development life cycle knowledge, while our study found help desk and software development skills most desirable for new hires.

Another difference compared to previous surveys was that we investigated the common body of business knowledge desired by employers. Only the Lee et al. (1995) study had previously investigated the common body of business knowledge. However, their study did not include the detail and drill-down analysis of this exploratory study. Finally the survey attempted to define the different skill sets required for a new hire versus a hire two to three levels above new entry.

## 6. FUTURE RESEARCH

Future research includes expanding the survey to additional employers outside the four institutions' service area. Our current survey results cannot necessarily be generalized beyond the participating institutions' geographic regions. This region is primarily on the east coast. Furthermore, a larger sample would certainly give us a clearer view of the data, and allow us to make more powerful statements.

A limitation of the survey is that at several of the institutions the mailing lists of participants were primarily alumni from those institutions. This could be a 'self reporting'

problem in which alumni report the same knowledge sets they were taught.

We would also like to delve deeper into the skill-sets needed for particular jobs. For instance, our survey results indicate a curriculum designed to develop a successful programmer is not accomplished by simply adding more programming courses, but by blending a combination of courses that satisfies the skill-set required. More investigation on each job would help us create tracks in curriculum that closely match the required skill-sets.

Finally, we would like to report in the future how we adjusted our curriculum to better match the job market. This is a non-trivial exercise, since a market that demands programmers does not necessarily mean that relational database expertise is not in demand. Furthermore, it touches on the question of what role should higher education play in IS skills. Should we move towards specific products and certifications, because of their high perceived value on graduates' resumes? Or do we focus on fundamental skills that are not product-specific and let organizations train graduates in the products that they use?

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**APPENDIX A****Summary of knowledge sets and sub sets (all occupations) expected for IS new hires****Scale: 1=None; 2=Fundamental; 3=Working; 4=Expert**

<b>Application Servers</b>		
	Problem Identification, Diagnosis, Resolution	2.8
	Performance monitoring, troubleshooting	2.6
	O/S knowledge (various OS')	2.6
	Networking knowledge	2.5
	Hardware / Software architecture	2.4
	O/S installation	2.4
	Configure software operational parameters	2.3
<b>Computer Architecture</b>		
	Computer System Architecture	2.4
	Parallel Processing	1.9
	Clustering / Virtual Machines	1.8
	CPU Architecture and Design	1.8
	Memory systems architecture	1.5
	Machine level design	1.5
	I/O protocols	1.3
	Digital Circuit Design	1.3
<b>IT Management</b>		
	Project Management	2.8
	IT Ethics/Privacy policies	2.8
	Supervisory skills	2.7
	IT Human resources	2.7
	Negotiation skills	2.7
	Team leadership	2.6
	Presentation skills	2.5
	IT Strategy	2.1
<b>Networking &amp; Communications</b>		
	Data Security	2.8
	Desktop Support	2.7
	Windows Administration	2.5
	Firewall Administration	2.5
	Wireless Network Administration	2.5
	TCP/IP	2.4
	Organization Security Policies	2.4
	Network Design	2.4
	Network Programming	2.2

	Network Administration	2.1
	Network Security	2.0
<b>Project Management</b>		
	Leadership	2.7
	Planning and Scheduling	2.7
	Project Mgt Software	2.6
	Change Management	2.3
<b>Rapid Application Development</b>		
	A Specific Language Knowledge	2.8
	A Specific Product Knowledge	2.6
	GUI Design	2.5
	Prototyping	2.4
	CASE Tools	1.8
<b>Relational Database</b>		
	SQL	2.9
	Specific DB Product Knowledge	2.5
	Database Administration	2.4
	Query by Example	2.3
	Data Modeling	2.3
	Data Integration	2.2
	Specific Data Modeling Language	2.0
	Data Cleansing	2.0
	Data Warehousing	1.9
<b>Security</b>		
	Data Security	2.5
	Security Policies	2.4
	Network Security Policies	2.3
	Firewall Security	2.2
<b>Software Development / Programming</b>		
	Structured Programming	2.7
	Data Structures	2.6
	Object-Oriented Programming	2.5
	Algorithms	2.2
	Specific Platform	2.2
	Specific Framework	2.0
	Graphics/Visualization	2.0
	Design Patterns	2.0
	Artificial Intelligence	1.5

<b>System Analysis</b>		
	Requirements Analysis	2.8
	Process Analysis	2.8
	Data Modeling	2.4
	Process Modeling	2.3
	Software as a Service	2.3
	UML / Object Modeling	2.0
<b>System Design</b>		
	Systems Design	2.8
	Structured Design	2.5
	System Architecture	2.4
	Object Oriented Design	2.3
	Data Modeling	2.3
	Web Services	2.2
	2-Tier	2.2
	3-Tier or n-Tier	2.1
<b>Systems Implementation Methodologies</b>		
	Project Management Tools	2.3
	Prototyping Approach	2.2
	Test Driven Development	2.2
	PERT/GANTT Charts	2.1
	Waterfall	1.8
	Agile	1.7
	Hybrid Approaches	1.6
	Extreme Programming	1.2
<b>Systems Release / Delivery / Compliance</b>		
	Documentation	2.9
	Testing	2.8
	Quality Control	2.7
	Systems Integration	2.7
	Release / Delivery / Compliance Management	2.6
	Migration Approaches	2.6
	User Training	2.5
<b>Web Development</b>		
	HTML	2.8
	CSS	2.5
	Java Script	2.4
	Web Services	2.4
	XML	2.4
	Session Management	2.1

	ASP (family)	2.1
	AJAX	1.9
	JSP (famiy)	1.8

**APPENDIX B**

**Sample Screen Shot,  
Employers who supervise or hire Information Systems professionals are asked to  
enter their expected level of hiring in the 2007-2008 period**

**Hiring Expectations by Job Area**

You indicated that you either supervise or hire employees (or both). Please indicate the number of employees that you currently supervise and the number of employees you anticipate hiring in the next 24 months.

If an individual has responsibilities in more than one area, please enter them in the area that fits best (highest percentage of their time). You may leave a category blank.

Job Area - Employees who:	Current Employees	Expected Entry Level Hires	Expected Hires 1 to 2 Levels Above Entry
Example	3	1	2
Applications - Analyze and Design			
Applications - Develop or Implement			
Databases - Admin or Design or Manage			
Web Sites - Design or Develop or Manage			
Manage IT Employees or Functions			
Networks - Admin or Design or Manage			
Security - Admin or Design or Manage			
Application Servers - Admin or Manage			
Provide Hardware Support			
Provide IT Auditing Services			
Provide Technical Sales			
Work with End Users / Help Desk			
Work with Graphics Applications			
Other IT			