

Getting an Education in Computer Information Systems (CIS)

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Abstract:

A degree in Computer Information Systems (CIS) is not well understood by many. Many think about it as a “softer” computer science degree, that is, if students cannot do well in computer science, then they could get a degree in CIS. Many confuse it with information systems, business information systems, and information science. Some others, who have done their undergraduate in fields not related to computing, think that it is a good way of getting into the field of computing.

An undergraduate education in CIS is a very valuable degree that stands on its own merit, and serves the community and the region. In this paper, the answer to the question “What does a degree in CIS mean?” is presented. The differences between CIS and related fields such as Computer Science (CS), Business Information Systems (BIS), Information Systems (IS) or Information Science are presented. The various educational curricula features of these programs are presented and the value of the CIS curriculum to the community and the region is presented. Finally, a CIS degree program that meets the current need of a metro community and the characteristics of this program are discussed.

Introduction:

A degree in Computer Information Systems (CIS) is considered by many as a “weaker” computer science degree – both from a student perspective as well as the administrative perspective. A student may register for a degree program in Computer Science (CS), but then find out that he/she is struggling with the math courses. So he/she drops out and joins the CIS program because (a) it does not have the math requirements and (b) most of the credits taken up to the sophomore year will transfer. Administrators within the college may keep the program for the same reason – to provide a lower net to catch the student unsuccessful in the CS program by keep them within the department or college. In many schools, that do not have the CS program, the assumption is that it is easier to start a CIS program because you do not need the faculty to teach the hard math or CS junior/senior level courses.

In fact, the contrary is true. It is harder to get faculty to teach a true CIS program. It takes more money to maintain the CIS program, and more resources to run the program effectively. CIS graduates are more in demand than CS graduates because they understand the business needs very well and are able to align quickly with the goals of the business organization.

Differences between the various programs:

This section presents the differences between the various programs in simple non-technical terms. The purpose of this is to enable incoming students to understand what they are getting into and for administrators and counselors to explain these programs unambiguously.

Computer Science (CS): By getting a degree in Computer Science, a student learns how to build computer software. The focus is on learning how to build the software, and not necessarily on applications that use the software. For example, most students have used Excel. While a business major may use the Excel spreadsheet to maintain an account balance, a computer scientist is interested in creating a program (say SpreadSoft) similar to Excel that provides the same functionality. In computer science, one learns how to create software that shows the rows and columns on the screen, provide the functionality that draws the various types of graphs using the data in the rows and columns, etc. So, a computer scientist is interested in questions such as: How can I make SpreadSoft show animated graphs (a functionality not provided by Excel)? Or how can I get the current stock price of a company from Wall Street into the SpreadSoft?

Computer Information Systems (CIS): By getting a degree in Computer Information Systems, a student learns how to apply or modify the current software to make it more useful for the business he/she is doing. Taking the same example of Excel, while maintaining the account balance, if the user needs to average the monthly balance from several spreadsheets, she may not be able to do it directly using Excel. But Excel provides the feature of writing “macros”, so that one can customize Excel using the macros to get it to do something that you need. A CIS major is a person who would be well suited to do that. The CIS major is not interested in creating new software (such as SpreadSoft) with that feature. Instead he/she is interested in understanding what the current business need is (of averaging across multiple sheets) and writing (“programming”) a macro in Excel to enable the user to get the job done. Similarly all computer applications, such as databases, web programs (Internet Explorer), etc have to be “programmed” to make them useful for a particular business situation and CIS majors are well-suited to do such programming.

Business Information Systems (BIS): By getting a degree in Business Information Systems, a student learns how to develop a business process of using an information system to solve the business need. Continuing on the Excel example, if a business is using handwritten logs to keep track of daily sales, then a business information system major will be able to show how the process can be made “better”, “faster”, “accurate” by using an Excel spreadsheet. The BIS major will lay out the exact steps (create the process) that one executes in Excel to enter the data and to show the daily balances. Out in the business world, there are thousands of applications and just to know which application to select, and how to use an application (without any changes to it) to meet the business needs is the job of the BIS major.

Management Information Systems (MIS): By getting a degree in Management Information Systems (MIS), a student learns the use of information systems in managing a business. Whereas a BIS major concentrates on all aspects of a business, MIS is concentrated more on software systems used by management. Continuing on the Excel example, how do I know which aspect of my business – such as reducing inventory, or faster delivery will help me increase my profits?

How can I use Excel to monitor these two aspects of my business? How can I get reports from Excel showing this information in various graphical formats? A student learns analytical skills to identify which business management function has to be optimized and how to use information system to help in the identification and management of this function. These programs are **not** focused on teaching how to manage information systems (such as data centers, databases etc) – that is they do not teach the management of information systems. The word management is used as an adjective qualifying the term information systems, and it is not used as a verb.

Very few universities offer an MIS at the undergraduate level (Wichita State, Keiser). Most offer them at the graduate level in which case it is a blend of management courses and IS courses.

Information Systems (IS): Programs that offer Information Systems in the Computer Science Department offer the CIS degree. They just omit the word Computer because it is in the same department. Hence, their IS degree is a CIS degree. Similarly Information Systems programs in College of Business are generally the same as the BIS degree.

Computer and Information Sciences: Several programs offer a degree in Computer and Information Science. Most of these programs have requirements similar to a CS program.

The effect of these programs:

The basic knowledge gained by the graduate from each of the above programs is quite different. Each is valuable, and generally lucrative, if the student understands it and is able to apply to it very well.

There are more jobs for BIS majors, than CIS majors and hence starting salaries may be governed by supply and demand. However, if a student acquires a particular skill in one set of software, then they raise their marketability and value considerably. For example, if a BIS major learns how to use a Human Resources software package, and/ or a Customer Management software package while in school or at an internship, then he/she will considerably increase his/her marketability. Similarly CIS majors can increase their marketability by getting the experience of “programming” popular databases (SQL Server, Oracle, etc), or enterprise software (such as SAP modules, or PeopleSoft modules). For CS majors, in addition to learning the foundation of building various types of applications (such as graphics, databases, etc) it is necessary for them to be experienced in current software development tools such as .Net, java, web application tools, etc., CS majors are not very familiar with business software such as SAP or PeopleSoft, etc., Their skills are towards developing software “from scratch”. Hence their salaries depend on showing employers the kind of things they have built from scratch – especially in their senior courses or project courses.

The biggest criterion that employers are looking for students is their technical problem solving skills. A second criterion, these days, is their soft skills – communication, time management, attitude, etc. Since most CS programs require a good set of math courses (Discrete, Calculus), employers equate that if a student can get through these math courses and the computing courses, then he/she has good problem solving skills. Hence they look to employ

majors in CS, even though what they really need are CIS majors. Many CS majors employed by large business corporations have indicated that they do command good salaries, are moving up the organization, and are happy. However, they have very rarely written code from scratch; nor have they worked on building a custom system. What they have been doing is to maintain and enhance various systems such as web-based systems, databases, internal applications, etc. A good CIS undergraduate program, where a student learns the appropriate problem solving and application skills would produce the necessary graduates needed by the industry.

Educational features of these programs:

In this section, the general course requirements for each of the four programs is discussed.

	<i>CS</i>	<i>CIS</i>	<i>BIS</i>	<i>MIS</i>
<i>Math</i>	Calculus II Prob&Stats Discrete, Linear	Modern Algebra	Modern Algebra	Probability and Stats
<i>Computing</i>	Algorithms, SoftwareEngg Networks, Db, OS	Data Structures, (.Net/Java), Softw Engg/ Analysis	CS 1 (.Net/Java)	CS 1 (.Net/Java)
<i>Business</i>		Mrkt, Fin, Acct, Mgmt	Econ, Mrkt, Fin, Acct, Mgmt	Econ, Mrkt, Fin, Acct, Mgmt
<i>Science</i>	Two or three courses with lab	One or two courses	One course (core curriculum)	One course (Core curriculum)
<i>Software Application</i>	.Net, Java, Db, Web	Db, Web		
<i>Business Applications</i>		Project mgmt	ECommerce, Database	Enterprise, Database, Operations
<i>Special Applications</i>	Graphics, Security, etc	GIS, DSS, etc		Supply Chain, DSS
<i>Located in College of</i>	Science/Engg Some in Business, Arts	Business / Science. Some in Engineering	Business	Business

The table above shows a generalized set of courses for each of the degree program types in the categories of math, computing, business, science, and application courses in software, business and special purposes.

Computer Science (CS) programs have the highest level of math, science and computing courses required. They have the strongest software development skills using programming environments (such as .Net or Java). While they are familiar with using commercial software applications such as SQL, and graphics packages, they are not expected to write applications using these because they are more focused on developing applications from scratch. CS students are expected to learn many application software packages on their own. The elective courses are

also hard-core CS courses. While they get a good education in math, science, and computing, they have little or no exposure to business courses and commercial applications such as decision support systems, supply chain systems, and enterprise applications.

Computer Information Systems (CIS) programs have a combination of computing and business requirements. While they do not require an algorithms course, most programs do require a student to take at least two levels of programming courses (data structures) with a third application programming course (such as Web programming). Most require a course in databases (where they work with commercial systems such as Access, SQL or Oracle), a network course (Cisco based), Web programming (Java), and at least one project management course. Elective courses are from computing and business disciplines. We see that CIS majors have a well rounded business and computing background. Their math and science skills are generally weaker than those of a CS major.

Most BIS and MIS programs do not require Math beyond College Algebra. Also, they do not require programming beyond one course in programming. The students are exposed to more courses in the Business curriculum, and MIS majors get an exposure to management courses such as decision support systems, and operations management courses.

CS majors have a lot more math and computing in their curriculum and hence employers equate that to readiness in problem solving skills. However, they have little to no business background and their soft skills may not be all that polished. CIS majors on the other hand, have a well rounded computing, business, and math background. They also have application programming experience in specific commercial applications, and they have opportunities to polish their soft skills using the project management related courses. They do have some work to do in the interviews to demonstrate problem solving capabilities. This could be done by demonstrating projects they may have completed and also by demonstrating that they were able to optimize a business objective through their projects. BIS and MIS majors have a lot of business courses and not as many computing and math courses in their programs. They may have the hardest time in figuring out how to demonstrate their problem solving skills in an interview.

Recommendation for an undergraduate CIS curriculum:

In this section, a sample undergraduate CIS curriculum is presented, based on what a student should know to be competitive in this market. This curriculum is based on 120 semester hours required for graduation in four years at the average load of 15 semester hours per semester.

<i>Course</i>	<i>Year Taken</i>	<i>Sem Hrs</i>
<i>University Core Curriculum</i>	Freshman to Senior	42
<i>Mathematics (3 courses)</i>		10
Calculus I	Freshman	4
Linear Algebra	Sophomore	3
Probability & Statistics	Junior	3
<i>Two course Science sequence with Lab</i>	Freshman	8

Technical Communication (oral and written)	Sophomore	3
<i>Business Core (6 courses)</i>		<i>18</i>
Managerial Accounting	Sophomore	3
Principles of Finance	Junior	3
Principles of Marketing	Sophomore	3
Principles of Management	Junior	3
Management Methods	Senior	3
Business Law and Ethics	Junior	3
<i>Computing Core (9 courses)</i>		<i>30</i>
CS1 & CS2 Programming courses with Lab	Freshman	8
Software Design & Development	Sophomore	3
Web Design and Programming with Lab	Sophomore	4
Networks	Junior	3
Graphics and multimedia	Junior	3
Multi-Tier Databases	Junior	3
Web Design and Databases	Senior	3
Senior Project (To be taken in the last semester)	Senior	3
<i>Electives (3 courses selected from list):</i>		<i>9</i>
Project Management and Leadership	Junior	3
Decision Support Systems	Senior	3
Enterprise Systems	Senior	3
Customer Relationship Systems	Senior	3
Financial Accounting Systems	Junior	3
Ecommerce Systems	Junior	3
Mobile Computing Technologies	Senior	3
Total		120

The above curriculum assumes a University Core of 42 semester hours which include all the English and Speech requirements.

Math requirement is kept to three courses, including a four hour Calculus I class. The university core generally requires one math course, which could be a preparatory course for Calculus I, in case that is needed for incoming students. This level of math is sufficient for the remaining curriculum, and it demonstrates sufficient problem solving skills that employers are looking for. A science sequence (Physics, Chemistry, Biology, etc) is included to ensure a well rounded curriculum. Generally the Core includes one science course with a lab. In such a case, the above curriculum would provide the student an exposure to two science fields – one science core curriculum course, and one set of science courses in same discipline. A course in oral and written technical communications is included to ensure that students have sufficient soft skills to enter the workplace.

The curriculum includes six core courses in Business. It includes one foundation course in each major discipline. Generally a course in Economics is included in the core curriculum, and hence it is not included in the Business core. A course in management methods emphasizing

software management is included. Also, a course in Business Law and ethics is included to cover the need for ethics training.

The curriculum includes the standard CS1 and CS2 programming courses which would be implemented using an objected oriented environment (.Net or similar technology). Following that are the seven core courses in computing. The first course is the Software Design and Development course which covers concepts and tools for object-oriented design and development using agile methodologies. Students would then take the Web design course with lab in the following semester to get a foundation on Web technologies (scripting languages). In the Junior year they would complete the foundation networks course (using Cisco or similar technologies), multi-tier database course (using SQLServer, Oracle technologies), and Graphics and Multimedia (using gaming and similar technologies). The Web design and Database course is an advanced course in Web programming and Databases. The Senior Project is a capstone course which allows the student to develop their own project using technologies they have learned, and some that they have to learn on their own. This further demonstrates problem solving skills, and life-long learning capabilities.

The curriculum includes three electives that may be chosen from a set of six to seven courses. These courses have either a business concentration or a computing concentration. The courses are designed to reflect the current needs in the market.

Characteristics of the proposed program:

The above recommended program develops a student in four major education and skill areas: math (problem solving), science (understanding of basic systems), computing (application of problem solving using computing) and business (understanding the implication of the business applications of computing). It also prepares them in enhancing several of their soft skills capabilities, such as oral and written communication, team leadership (through the senior design course), and continuous learning (through electives). A graduate will have a well-rounded combination of education, technical skills, and soft-skills to be marketable immediately (because of their knowledge of current tools) as well as have the foundation for future growth in the computing industry (because of their foundation knowledge in math, science, computing, and business). Medium (revenues > 50 million) and large (revenues > 1 billion) sized industries (such as oil companies – Exxon, Shell, defense contractors – Raytheon, Lockheed Martin, consulting, banking, hospitals, etc), are looking for graduates with such combination of education and skills. This is because such graduates provide immediate value as well as long-term value to the organization. While they will have a high marketability in the job market, they will also be prepared to pursue graduate education in the fields of CIS, MIS – and with a couple of pre-requisite courses, will be able to pursue graduate courses in computer science or the MBA.

Teaching courses in this program will require different skills than teaching in the computer science fields. Faculty members have to be trained to view courses from an application perspective. For example, in a database course, the instructor should have experience in using database systems such as SQL server, and Oracle, to ensure that the database concept being taught is implemented through these “industrial strength” systems and not with smaller systems

such as MS Access. The instructor has to ensure that the students get enough hands-on experience using these tools.

To run and maintain some of these industrial strength computing systems for the various courses, especially for the electives, requires resources such as money, infrastructure, and personnel. Faculty and lab managers will have to remain trained, licenses for the software must be renewed, and the hardware infrastructure of computers, networks and peripheral devices must be maintained. Newer applications have to be purchased and installed on a continuing basis. Education institutions do have a relief in license cost due to academic pricing, and for many applications using the SAAS (software as a service model) will reduce the cost of purchase and maintenance. In addition, many competitive systems are available for applications (such as enterprise systems, CRM systems, etc.) and selecting a low-cost system is sufficient to give students an exposure to the usage and programming of the various modules.

Conclusion:

An undergraduate degree program in CIS is a very valuable degree program and stands on its own merit and it should not be perceived as a “weaker” computing program. It is necessary to understand the differences between a CIS and a CS program. CS graduates and CIS graduates meet two distinct needs of the community. In most metro communities, there will be a greater need for CIS majors than CS majors because most organizations run application systems that need customization and maintenance. The proposed 4 year CIS program has features which will satisfy the immediate and long-term computing needs of most organizations.

References:

Many CS, CIS, BIS, MIS programs have been studied by visiting their websites. Some are listed below:

- [1] <http://www.tarleton.edu>
- [2] <http://www.ccu.edu>
- [3] <http://www.ferris.edu>
- [4] <http://www.famu.edu>
- [5] <http://www.udmercy.edu>
- [6] <http://www.cis.udel.edu>
- [7] <http://webs.wichita.edu/freds/MISAcad.asp>
- [8] <http://www.keiseruniversity.edu/mis-BA.php>