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IS Programs become Accredited: COBOL in Crisis

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Abstract

The crisis in college and university COBOL education is becoming more acute as time passes. The reduction and total elimination of COBOL courses, declining interest by both faculty and students, and low visibility of new commercial applications being developed using COBOL are commonplace. Yet many practitioners are well aware of the billions of lines of existing, operational, revenue-producing lines of COBOL code that continue to provide the mainstay of many commercial enterprises. This paper presents the case for arresting the decay of COBOL expertise by citing current and future needs, while providing alarming new evidence of the continuing downward spiral in COBOL instruction as evidenced by the seven newly accredited information systems programs in the first full information systems accreditation cycle undertaken by the Computing Accreditation Commission of ABET.

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1. COBOL DOMINANCE IN THE CORPORATE IT WORLD

The Y2K transition has concluded, and the business community is now faced with a reassessment (and perhaps retrenchment) of its COBOL dependency. While the corporate world may look to the recent past to remind themselves of the successful remediation of billions of lines of operational COBOL code into Y2K compliance, many business IT managers and faculty curriculum planners must carefully reconcile the role that COBOL will play for the next ten or

more years. Ed Arranga (Arranga, 2000) cites a Gartner Group estimate that between 150 and 175 billion lines of COBOL are currently in production worldwide and that this base continues to grow. Stern, Stern and Ley (Stern, 2003), authors of one of the most widely used COBOL textbooks estimate there are up to 200 billion lines of production COBOL code worldwide. They further state that for the U.S. Department of Defense, 59% of information systems applications use COBOL, that applications that manage about 85% of the world's business data are written in COBOL, and

that it has been further estimated some 35% of all new business application development is written in COBOL. Even CICS transaction volume (such as COBOL-based ATM transactions) grew 50% in only four years from 20 billion a day in 1998 to 30 billion a day in 2002. (Legacy Reserves, 2003) It does not appear that COBOL is experiencing its last gasp.

2. PREDICTIONS FOR COBOL'S FUTURE

From the landmark *IEEE Software Vol 17 No 2* (published in 2000), consider a few additional facts: the COBOL community invested between \$300 billion and \$600 billion dollars in the Y2K remediation effort. (Arranga, 2000) This exercise revealed that COBOL assets were much more complex than previously imagined, and that corporate dependency upon these assets was also much higher than previously speculated. (Bradley, 2000) suggested that 75% of all production transactions on mainframes are done using COBOL programming support, over 60% of all web-access data resides on mainframes, that COBOL mainframes process more than 83% of all transactions worldwide, and that over 95% of finance-insurance data is processed with COBOL. Ankrum cites that 50% growth has largely been driven by web-based applications that access back-end COBOL applications. (Ankrum, 2001) "That philosophy of [COBOL] extinction has been replaced with one of extension and inclusion. COBOL applications are, by and large, too critical and too valuable to consider replacing en masse." (Arranga and Price, 2000) Y2K, while a few years old, pointed out ever so clearly that COBOL is alive, well, and will persist for a number of years into the new millennium.

(Carr, 2000) conducted extensive research that provided interesting statistics regarding the feelings of business and academic leaders relating to the future role of COBOL. Approximately 3,000 CIS and IS programs and 5,000 businesses were surveyed. Carr cites that "In surveying business and academic leaders, the authors found that almost 95% of academic respondents and 90% of IT managers still want IS curricula to include COBOL instruction." They further discovered that nearly 90% of IT managers want both object-oriented and web-based

features integrated into COBOL instruction in college curricula." The percentage is quite significant and is further reflected by other sources: "Integration with Legacies is the number one concern of IT managers in 2003;" and, "The most highly paid programmers in the next ten years are going to be COBOL programmers who know the Internet." (Legacy Reserves, 2003) This need for integrating COBOL capabilities with web-based applications is very pervasive in the literature.

One might ask, "Will COBOL continue as a major implementation language for business solutions?" To answer these and related questions, Carr and Kizior surveyed business leaders to discover that "over 87% currently develop and maintain code written in COBOL – over 50% of effort solely in maintaining current legacy COBOL applications; 20% of effort developing new applications using COBOL; and 30% of the programming resources expended in a mixture of new application development and maintenance." (Carr, 2000) Stern, Stern, and Ley claim that the annual growth of COBOL code over the next four years is projected to be five billion lines. (Stern, 2003)

That maintenance is a large percentage of effort expended on legacy applications is neither surprising nor revealing. But anticipated annual growth in applications supported by COBOL is indeed revealing and provides additional insight as to modern skill sets IT managers need from future Information System graduates

3. PROBLEMS AND TRENDS FOR COBOL IN ACADEMIA

Waning COBOL Perceived Importance. Consider the following statistics: The percentage of IS/CIS academic programs teaching COBOL is steadily decreasing, while instruction in languages such as Java and Visual Basic is increasing. According to Hardgrave and Doke (Hardgrave, 2000), COBOL was offered in 90% of undergraduate IS programs in 1995 but has fallen to 53% in 1998, while instruction in C++ has fallen from 60% in 1995 to 53% in 1998. OO COBOL, very slow to gain attention, has risen from 0% in 1995 to 7% in 1998; Java instruction has skyrocketed from 0% in 1995 to 43% in 1998 and instruction in Visual

Basic has risen from 59% in 1995 to 70% in 1998.

There are many factors contributing to these figures. Faculty (and students) enjoy teaching and learning the latest technologies. While modern COBOL versions have enjoyed a significant improvement over earlier standards, COBOL itself is not a glamorous language and is often considered cumbersome and lacking in "elegance." According to Rod Newing (Newing, 2003), we are in an "...era when COBOL programming is about as 'uncool' as a graduate can get." One interesting theory that mentions the perceived death of COBOL and rise of languages such as Java is "...simply because things like C and Java are so convoluted that they require lots of books and magazines and web sites dedicated to explaining and supporting them, so they have a high perceived use, where COBOL 'just runs' and doesn't really need that kind of infrastructure associated with it. Your business logic is likely solid, you just spent a lot of time and money on Y2K upgrades, [and] there's no reason to throw out that code to chase some phantom." (Gordon, 2003)

Until recently in Australian universities, the trend was to slowly phase out COBOL and COBOL-related subjects to emphasize the more popular web-based, networking and e-commerce subjects. In Australia, most universities teach C++, Java, and/or Visual Basic. COBOL, when available, addressed batch reports running under Unix or limited versions of commercial compilers. This trend has reversed over the last 18 months as far as Acucorp is concerned. (Acucorp has an Academic outreach program) (Turk, 2002) Examples such as this one, however, are not often reported.

While some attempts at COBOL course modernization have been made, these efforts are presenting very serious challenges to educators. In many cases, requirements for courses such as Visual Basic, Internet Programming, Java, C++, e-commerce, client-server computing, and other "newer" courses are replacing some (or all) of the COBOL instruction, despite the fact that there appears to be no language that is more suited to business logic and transaction processing than COBOL. In

courses where the maximum number of hours is tightly constrained, programs are forced to reduce the role of COBOL in favor of the modern technologies that appear to be responsive to industry's immediate demands. As hard decisions are made as to the allocation of language courses to the number of hours available for programming instruction, COBOL continues to lose favor.

Future Trends for COBOL Instruction.

Thus, when considering what is taking place within IS/CIS programs, cause for alarm is readily apparent. Instruction in COBOL is rapidly becoming less prominent in the vast number of IS/CIS programs. Modern features in the COBOL 2002 standard are not being taught to any extent. Leveraging COBOL for internet applications are minimally (if at all) communicated. Faculty interest in teaching COBOL continues to wane, generally in favor of instruction in the more exciting and newer technologies. At this time, there is little evidence that this trend for reduced/eliminated COBOL instruction in most programs will slow down.

4. INSTRUCTION AND ACCREDITATION ISSUES

The Computing Accreditation Commission (CAC), one of the commissions of ABET, has this past year started accrediting IS programs nationally. The *Criteria*, which took over four years to produce and refine, have been developed by the entire global IS community. The draft IS *Criteria* have been presented at many conferences including SIGCSE, FIE, AMCIS, IAIM, ICIS, ISECON, ICIS, and IACIS which include several, if not all of the IS organizations. Additionally, a web survey with over 300 respondents was undertaken to gain additional buy-in and feedback. All steps were completed to create the current IS Criteria and to gather agreement within the IS community.

During the 2001-2002 accreditation cycle, one pilot institution was visited, and during the 2002-2003 accreditation cycle, six additional institutions were visited. At this time, the first full IS accreditation cycle has been completed and a total of seven institutions have ABET/CAC accredited IS programs. As both educators and practitioners, it is informative to examine the characteristics of these newly-accredited

programs, and, for the purposes of this paper, to see the role that COBOL plays in each of them particularly as it pertains to the theme of this paper (see Table 1 below).

	Robert Morris University	University of South Alabama	University of North Florida	Illinois State University	Virginia Commonwealth Univ.	Pace University	Drexel University
School	Communications and Information Systems	Computer and Information Sciences	Computing Sciences and Engineering	College of Applied Science and Technology	Business	Computer Science and Information Systems	Information Science and Technology
Department	Computer and Information Systems	No department	Computer and Information Sciences	School of Information Technology	Information Systems	No department	No department
Program(s) Accredited	Information Systems Management; Information Sciences	Information Systems	Information Systems	Information Systems	Information Systems	Information Systems	Information Systems
Degree	BS in Computer and Information Sciences	BS in Computer and Information Sciences	BS in Computer and Information Sciences	BS in Information Systems	BS in Business with major in Information Systems	BS in Information Systems	BS in Information Systems
Other tracks/ programs/ specialties	No other undergraduate tracks in department	Computer science (accredited by ABET), Information technology, Computer engineering (joint with College of Engineering)	Computer science (accredited by ABET), information sciences	Bachelor's degree in Applied Computer Science (accredited by ABET), Bachelor's degree in Telecom Mgmt.	BS in Computer Science in School of Engineering (accredited by ABET)	BS in Computer Science, BA in Computer Science, BS in Technology Systems, BS in Professional Computer Studies	BS in Software Engineering (also offered through the College of Engineering – not a joint program)
COBOL	Elective within both programs	Recently removed from curriculum (remains as an elective). Taught with Microfocus - Web Express. Change due to small numbers of interested student.	Intro to COBOL (3 hrs), File Structures (4 hrs)	Advanced Cobol (4 hrs) is required	Never Required. One elective course in curriculum being deleted.	No longer offered as of Fall 2003	Not offered
Other languages	A two course sequence in COBOL, C++, Visual Basic or M is required	Java	Java, Intro. to Object Oriented Programming.; Data Structures using OOP	JCL- required for Systems Devlpmt Analyst sequence and one of four 3 hr. courses (three required) for Web AppDevelopment Sequence. Other programming languages required.	Students program almost exclusively in Java. C++ was required until 2000.	C++ for procedural; Java for object oriented.	C++; Java
Web address	www.rmu.edu	www.usouthal.edu	www.unf.edu	www.ilstu.edu	www.vcu.edu	www.pace.edu	www.drexel.edu

Table 1: Characteristics of Recently Accredited Information Systems Programs.

Please note that every attempt has been made to gather accurate information. In several cases, specific languages required within programs of study were not explicitly

specified in catalog course descriptions. But very conscientious inferences were made from available information. In the absence of a personal contact via email, the primary source of program information was the institution's web page. Six of the seven schools responded to email requests. Interestingly, while one or two individuals stated that there was simply no longer any demand for COBOL in their region, one clearly lamented the elimination of COBOL. Most responses were indifferent, and Illinois State University and The University of North Florida indicated a regional need for COBOL.

The Information Systems *Criteria* (ABET, 2003), by design, do not specify any kind of required programming language for IS programs, except that graduates of the program must be proficient in at least one modern programming language. (ABET, 2003) The Computing Accreditation Commission (CAC) is careful in this area (and all areas related to accreditation) to avoid being prescriptive. The Information Systems program belongs to the faculty and the institution, and CAC is vigilant to assert this. Decisions related to program content – objectives and assessment, student matters, curriculum, faculty composition and expertise, laboratories, program delivery, and institutional support and facilities are exclusively the domain of the institution. CAC merely evaluates information system (and other) programs against the set of published criteria referenced earlier in this paragraph. So, the choice of programming language(s) is appropriately a programmatic choice.

5. INFERENCES FROM ACCREDITATION AND THE REAL FUTURE OF COBOL

Let's first begin with a brief analysis of the tabular data. In the seven schools accredited, two schools require COBOL specifically, University of North Florida and Illinois State University. At Robert Morris University, COBOL may be taken as the required programming language, but other languages may be chosen instead. In the remaining four programs at the University of South Alabama, Virginia Commonwealth, Pace University, and Drexel University, COBOL is either unavailable or in the process

of being eliminated from the program (generally the former).

So, if COBOL, long the mainstay of information systems programs, is not the primary supporting programming language, then what language(s) is/are? Java appears to be the favorite followed by C++. But based on the group of accredited programs, the numbers are close. All of these programs also appeared to have strong database components and also SQL is taught in this context. A couple of programs offer artificial intelligence, so Prolog and Lisp are sometimes available, but this is not the norm. Several include Internet programming and Visual Basic. But overall, Java seems to be the established language of choice at this time.

There are some additional points to be brought up from the table. Illustrating the diversity of these newly accredited programs are the administrative units within which these programs operate. Only one accredited program lies within a College of Engineering, the University of North Florida, and only one is in a School of Business, the program at Virginia Commonwealth. Two IS programs are offered in the same administrative units that also offer computer science. Of those not offering computer science in the same administrative unit as Information Systems, computer science is offered in a different unit. Interestingly, all of these computer science programs except Robert Morris, (which does have a School of Computer Studies that offers Bachelor of Applied Science in a number of computer studies programs) are currently accredited by ABET/CAC.

There also seems to be a trend to locate IS programs in a separate College-level administrative unit dedicated to computing and information systems, such as at the University of South Alabama, Pace University, and Drexel University. The program at The University of North Florida used to be a single department college specializing in computing programs until it expanded and now includes Engineering and Construction programs.

Given this backdrop and brief view of the tabular data related to the recently accredited programs, the questions arise as

to what does IS accreditation have to do with the future of COBOL? Does accreditation cause declining COBOL offerings? What inferences can be drawn, if any, from accredited programs as to the future of COBOL? All are good questions.

There is no causal relationship between accreditation and the decline of COBOL availability in our colleges and universities. Neither the ABET/CAC accreditation process nor the information systems *Criteria* cause programs to reorient their curricula or to suggest (or recommend) a specific programming language. This has been stated. But what accreditation does do – especially a brand new process that has undergone its first full cycle – is to allow one to focus attention on those programs that have become accredited and to examine the publicly available characteristics of these programs. While it clearly cannot be said at this early juncture in IS accreditation activities that this first group of accredited programs will be typical of future programs seeking accreditation, the features of these program are instructive and from a COBOL perspective - ominous. How so?

Schools seeking or planning to seek accreditation of their information systems programs are likely to look at recently accredited programs as examples of successful accreditation efforts. This seems to be quite natural. While self-study documents are definitely private information, they are sometimes shared among institutions. For those programs that may be 'on the bubble' of eliminating COBOL from the curriculum – and it is clear that many programs already done so, seeing data that shows only two of seven accredited programs offer COBOL may lend additional support to any further action in this area. While this in itself is unlikely to be a deciding factor for many programs, the trends appear to be quite clear. Not many years ago, COBOL was the preferred language of information systems programs. Such is no longer the case, and if one can draw inferences from the newly accredited programs (and additional accreditation cycles will present more data), the decline in COBOL's appeal will continue its downward spiral.

6. CONCLUSIONS

The case has been made that COBOL will continue to underpin much of functional business processing for many years to come. IT managers have pointed out the immediate and projected needs for professional COBOL programmers, as they realize that no language can yet match COBOL's transaction processing and file processing capabilities. However, these same managers feel that incorporation of the newer technologies, (e.g., OO programming, COBOL's web-based facilities, and other technologies) might be useful in order to provide a comprehensive technology base to support critical legacy systems for at least another ten years while at the same time supporting infrastructure and modern development paradigms to meet business and consumer demands in areas such as web-based applications and e-commerce.

The trends in information system programs and now the additional features of newly accredited IS programs seem to indicate that academe' is not heeding the needs of many sectors of the business community. Only two of seven accredited programs require COBOL. In one other, it is an option, as the words of many practitioners appear to be going unheeded.

During the next accreditation cycle, ABET/CAC will again visit a number of institutions to accredit IS programs. Given the data in this paper and the features of the accredited IS programs, there is no reason to believe that analysis of those programs will be substantially different.

There may be some help. A number of institutions have programs in the Information Technology area, and to support accreditation in this area ABET is developing and refining *Criteria* that will be used to evaluate these programs. Many of these programs are diverse and different from Information Systems in a number of ways, and they do not neatly fit under an Information Systems umbrella. Many of these programs will likely undergo IT accreditation activities within the next several years. The authors of this paper feel that many of these IT programs may be located in "Applied," "Technology," and

additional Schools / Colleges of Information Systems / Sciences and/or Technology. We suspect that programming practices in these curricula will include more Java, Visual Basic, additional emphasis in Internet Programming, HCI, scripting languages, along with traditional courses in database, and applied systems analysis, design, and implementation. But it is simply not known at this time. As usual, ABET/CAC will not be prescriptive, so it will be interesting to observe the structure of these programs and discover if they alleviate the waning of COBOL interest in any measurable ways.

Just as the Y2K crisis fell with both feet upon the world-wide corporate community, the growing, acute shortage of COBOL programmers – particularly in the next ten years or so (as many from this generation are now retiring) will indeed be the new crisis, as many businesses attempt to extend the lives of their legacy systems into the Internet age. There is substantial evidence that in some places this has already started.

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