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# Comparing Two Program Contents with Computing Curricula 2005 Knowledge Areas

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## ABSTRACT

*The purpose of this paper is to compare the content of two computer programs with the different knowledge areas listed in the standard curricula that was published in 2006 and named Computer Curricula 2005 (CC2005). The paper begins by giving some description of CC2005, a brief history of the standard curriculums in the computer area and then explains the content of both programs intended to be discussed here. The two programs being discussed are the Technology Support and Training department (TST) at Eberly College of Business – Indiana University of Pennsylvania (IUP) and the Computer Information Systems (CIS) program at Robert Morris University (RMU). Both of these programs are technology programs but neither name is listed in the five computing areas described in CC2005. Thus a discussion is needed regarding the placement of these two programs within the traditional programs listed in CC2005.*

**Keywords:** Comparing two computer programs with CC2005, Computer programs and standard curriculum, Computer programs and, Model technology curriculum CC2005

## INTRODUCTION

The introduction of the Computing Curricula 2005 (CC2005) is considered the first comprehensive study in a number of years to suggest a

standardized curriculum for multiple technology programs. The CC2005 report is different from prior reports in two ways: First it provides suggestions for knowledge areas for five different technology fields: Software Engineering (SE), Computer Engineering (CE), Computer Science (SC), Information Systems (IS) and Information Technology (IT), and Second, it provides a scoring board for minimum and maximum coverage in the knowledge areas specified.

The knowledge area in CC2005 is a comprehensive list that covers a wide range of computing topics. This list suggests topics in the five computing related fields noted in CC2005. However, there are many other degree names that far exceed the five listed in CC2005. The disposition of these "other" program names in CC2005 is unknown. In other words, it is not known whether these programs are considered IS, IT or CS. In these cases an examination of their content with CC2005 may be helpful.

This paper compares the content of two computer programs with the knowledge area in listed CC2005: TST program at (IUP and the CIS program at RMU. The paper begins by giving a snapshot of CC2005, a brief description and course content for both programs under consideration. Then the paper compares the content of the two programs with the knowledge areas listed in CC2005.

CC2005 – A Snapshot

Creating a standard curriculum in the technology field is not something new. Instead, publishing standard curriculum dates back to 1968 when the first computer curriculum was published for computer science (CS) by the Association of Computing Machinery [3]. The Association for Computing Machinery followed that by a series of curriculum standards that include in the latest technology fields, such as the information systems (IS2002) and the software engineering (SE2004), and computer engineering (SE2004) [5]. All these volumes were specific to one computer field and none crossed multiple technology fields.

The efforts of establishing guidelines for multiple technology fields started with the creation of a task force for the computing curriculum in 2001 (CC2001). The CC2001 was intended to create a volume that spans multiple

computer disciplines. However, the same task force soon realized that their participants were mostly computer science majors. As a result, the CC2001 task force issued the CC2001 on the basis that it is focused on computer science majors, and recommended establishing another committee to overlook the creation of newer cross-major volume [2]. The CC2005 task force picked up from CC2001 to establish a report and articulated their goal from this report:

> "The foundation of this report is the set of standards that exist for undergraduate degree programs in five major computing-related field …. Each of the specific curricula volumes represents the best judgment of the relevant professional, scientific, and educational association and serves as a definition of what these degrees should be" [1, p. 4).

In order to set the standards for these different computer-related fields, the CC2005 listed a "knowledge area" that lists the "core" of knowledge that the different computer programs may provide in their curriculum. 40 knowledge areas were listed in this report. Table 1 below lists the 40 different knowledge areas listed in CC2005.

The 40 knowledge areas are supposed to be the "Input" that each program provides into the curriculum. However, the list is not intended to be covered by each of the 5 majors. Instead, CC2005 established a scoring guideline that establishes the minimum and maximum coverage that each program is suppose to provide within the 40 knowledge area listed. The range of score or coverage areas are from zero (lowest) to five (highest). Table 2 below shows a partial listing of the knowledge areas in CC2005. It shows also the suggested scoring (both min and max) for each of the knowledge areas.

While the establishment of the knowledge areas constitutes the input into the program, CC2005 went a step further to create Relative Performance Capabilities of Computing Graduates by Discipline. Table 3 below shows a partially displayed list of the performance capabilities. The table suggests the "output" from the different program or the suggested skills that graduate from each major is supposes to have. As a matter of further explanation, this table groups the knowledge areas together into logical units so that they can be further categorized and compared.

**Table 1: Knowledge Areas in Computing Curricula 2005 – Source CC2005**

| Knowledge Area | Knowledge Area | Knowledge Area | Knowledge Area |
|---|---|---|---|
| Programming Fundamentals | Integrative Programming | Algorithms and Complexity | Computer Architecture and Organization |
| Operating Systems Principles & Design | Operating Systems Configuration & Use | Net Centric Principles and Design | Net Centric Use and Configuration |
| Platform Technologies | Theory of Programming Languages | Human-Computer Interaction | Graphics and Visualization |
| Intelligent Systems | Information Management (DB) Theory | Information Management (DB) Practice | Scientific Computing (numerical Methods) |
| Legal / professional / Ethics / Society | Information Systems Development | Analysis of Business Requirements | E-Business |
| Analysis of Technical Requirements | Engineering Foundation for SW | Engineering Economics for SW | Software Modeling and Analysis |
| Software Design | Software Verification and Validation | Software Evolution (maintenance) | Software Process |
| Software Quality | Comp Systems Engineering | Digital Logic | Embedded Systems |
| Distributed Systems | Security Issues and Principles | Security implementation and Management | Systems Administration |
| Management of Info Systems Org | Systems Integration | Digital Media Development | Technical Support |

**Table 2 – Scores of Knowledge Area Coverage in CC2005 – Partial List**

| Knowledge Area | CE | | CS | | IS | | IT | | SE | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max |
| Programming fundamentals | 4 | 4 | 4 | 5 | 2 | 4 | 2 | 4 | 5 | 5 |
| Interactive Programming | 0 | 2 | 1 | 3 | 2 | 4 | 3 | 5 | 1 | 3 |
| Algorithms and Complexity | 2 | 4 | 4 | 5 | 1 | 2 | 1 | 2 | 3 | 4 |
| Computer Architecture and Organization | 5 | 5 | 2 | 4 | 1 | 2 | 1 | 2 | 2 | 4 |
| Operating Systems Principles & Design | 2 | 5 | 3 | 5 | 1 | 1 | 1 | 2 | 3 | 4 |

**Table 3 - Partial Relative Performance Capabilities (1st two rows) - Source CC2005**

| Area | Performance Capability | CE | CS | IS | IT | SE |
|---|---|---|---|---|---|---|
| Algorithms | Prove theoretical results | 3 | 5 | 1 | 0 | 3 |
| | Develop solutions to programming Problems | 3 | 5 | 1 | 1 | 3 |
| | Develop proof-of-concept programs | 3 | 5 | 3 | 1 | 3 |
| | Determine if faster solutions possible | 3 | 5 | 1 | 1 | 3 |
| Application Programs | Design a word processor program | 3 | 4 | 1 | 0 | 4 |
| | Use Word Processor Features Well | 3 | 3 | 5 | 5 | 3 |
| | Train and Support Word Processor Users | 3 | 4 | 1 | 0 | 4 |
| | Design a spreadsheet program (e.g. Excel) | 3 | 4 | 1 | 0 | 3 |
| | Use spreadsheet features well | 2 | 2 | 5 | 5 | 3 |
| | Train and support spreadsheet users | 2 | 2 | 4 | 5 | 2 |

The TST Program at IUP

The Technology Support and Training (TST) program at Eberly College of Business – Indiana University of Pennsylvania offers a Bachelor of Science degree in Business Technology Support. Students are required to take a total of 120 credits in order to complete the requirements for this degree. As the case with many other degrees, the students are required to take university required courses, college required and the remaining courses in the major field. However, the knowledge areas in CC2005 shown in Table 1-3 above lists only the technology related areas. Thus, this section emphasizes only the required technology courses so they will be compared with CC2005 knowledge area. Table 4 below shows the required technology courses for the students to take at the TST program at IUP.

**Table 4 - List of technology courses for the for the TST program at IUP**

| | |
|---|---|
| IFMG 300 | Information Systems: Theory and Practice |
| BTST 273 | Hardware Support Solutions |
| BTST 310 | Telecommunications |
| BTST 311 | Training Methods in Business and Information Technology Support |
| BTST 383 | Microcomputer Software Solutions |
| BTST 411 | Technology Support Development |
| BTST 413 | Enterprise Technology Support |
| BTST 480 | Seminar in Business Technology Support |
| COSC/IFMG 352 | LAN Design and Installation |
| **Controlled Electives:** Two courses from the following: | |
| BTED 201 | Internet and Multimedia |
| BTST 401 | Web Design |
| BTST 402 | Website Development and Administration |
| BTST 493 | Internship |
| COSC 110 | Problem Solving and Structured Programming |
| COSC 304 | Interactive Internet Programming with Java |

### The CIS Program at RMU

The department of Computer and Information Systems at the College of Communication and Information Systems – Robert Morris University offers a Bachelor of Science degree in Computer Information Systems. This degree requires different courses that are specific to the general requirements for the university and for the college. It also requires different technology courses. Table 5 lists the technology courses required by this program:

**Table 5 Technology Courses for the CIS degree at RMU**

| | |
|---|---|
| INFS1050 | Fund Of Information Systems |
| Two Courses in the Same Programming Language | |
| INFS2210 | Operating Systems Concepts |
| INFS3150 | Intro Web Dev & E-Commerce Technology |
| INFS3220 | Systems Analysis and Design |
| INFS3221 | Advanced Sys Analysis/Design |
| INFS3231 | Network Technology & Mgt (N+) |
| INFS4240 | Database Management Systems |
| INFS4810 | Project Management |
| **TRACK CONCENTRATION 12 Credits Required** | |
| 4 INFS courses relevant to one of the tracks: Software Development, Health Care Systems, Network Administration, Office Information Systems, Web Development | |

### Comparing the Two Programs

In this section we compare the courses listed in table 4 and 5 above with CC2005 knowledge areas listed in table 1. In comparing the two, we took the course name, studied the description for the courses and then compared them with the knowledge areas listed in table1. In cases where the description does not give a clear clew about what knowledge area it belongs to, we examined this further by looking at the relative performance of knowledge areas listed in table 3 above. In all cases we relied also on our experience and knowledge of the courses when things did not seem to match up.

In cases we found out that there are courses that belong to more than one knowledge area. In these cases we listed the course under one knowledge area to avoid redundancy. At the same time we found one knowledge area span more than one course. In these cases we listed each course under one knowledge area. We also noticed that both programs offer elective courses that students may not take. This will not fulfill the "input" that the knowledge area listed for the programs. We nevertheless listed the courses in the table because the program offers this knowledge; though some students may not take them.

A further note can be said about our comparison is that we did not assign numeric values to each topic as is the case in CC2005. We feel that such numeric values is beyond the scope of one conference paper and need to further analyze the contents and the knowledge areas before making a judgment on the numeric value for each course content. After further contemplating the course contents and the knowledge area, we came up with a list of courses as they match each of the knowledge areas. Table 6 below list the knowledge areas and the courses that are listed in the two programs: The TST program at IUP and the CIS program at RMU.

**Table 6 – Comparing TST and CIS Programs with CC2005 Knowledge Area**

| Knowledge Area | TST Courses at IUP | CIS Courses at RMU |
|---|---|---|
| Integrative Programming | | INFS4150 |
| Algorithm and Complexity | | INFS3185 |
| Computer Architecture and Organization | | INFS2210 |
| Operating Systems Principles and Design | | |
| Operating Systems Configurations & Use | BTST383 | INFS2211 |
| Net Centric Principles and Design | | INFS3230 |
| Net Centric Use and Configuration | | INFS3231 |
| Platform Technologies | BTST273 | INFS3236 |
| Theory of Programming Languages | COSC110 | INFS2110 |
| Human-Computer Interaction | BTST310, BTST311 | INFS3160 |
| Graphics and Visualization | | |
| Intelligent Systems (AI) | | |
| Information Management (DB) Theory | | |
| Information Management (DB) Practice | | INFS4240 |
| Scientific Computing (Numerical Methods) | | |
| Legal/Professional/Ethics/Society | | INFS4170 |
| Information Systems Development | | INFS3221 |
| Analysis of Business Requirements | BTST480 | INFS3220 |
| Engineering Foundation for SW | | |
| Engineering Economics for SW | | |
| Software Modeling and Analysis | | |
| Software Design | COSC304 | |
| Software Verification and Validation | | |
| Software Evolution (Maintenance) | | |
| Software Process | | |
| Software Quality | | |
| Comp System Engineering | | |
| Digital Logic | | |
| Embedded Systems | | |
| Distributed Systems | COSC352 | |
| Security Issues and Principles | | INFS3235 |
| Security Implementation and Management | | |
| Systems Administration | | |
| Management of Information Systems Organization | | |
| Systems Integration | BTST402 | |
| Digital Media Development | BTST401 | |
| Technical Support | BTST411, BTST413 | |

## Conclusion and Future Plan

From the last table we can notice that there are a number of knowledge areas that are neither covered in the TST program nor the CIS program. We also notice that some of the knowledge areas are covered in more than one course. However, it is apparent that both curricula lack coverage in the areas of software validation, intelligent systems, graphics and visualization, information management theory, software engineering evolution and process as well as security implementation and management.

Except for the security implementation and management, most of the course content not covered in the two programs involves the domain of software and electrical engineering in the CC2005 knowledge areas. Thus our recommendation for both programs is to include coverage of information security and assurance and eliminate the redundancy of courses within each knowledge area.

Near the completion of writing this paper, we learned of a new standard curriculum being developed for the information technology (IT)

field. A draft copy of the IT2005 has been published [3] and we are in process of reviewing it to see their applicability to each of the programs. In is worthy to note that in both IUP and RMU, another program in IS exists. At IUP there is another program under the name Management Information Systems and in RMU there is another degree by the name Information Systems Management. In our opinion, all four programs need to be evaluated in the context of the latest standard curriculum. It is our intention that we conduct another study to compare the courses that are offered at the TST and CIS programs with IT2005 (or IT2006). This comparison will be conducted at different course levels and the number of hours assigned for each topic.

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