

Undergraduate Business Analytics and the overlap with Information Systems Programs

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Abstract

As companies continue to put data and business analytics as their top priority, universities will need to supply students with the appropriate skill sets that meet this demand and offer future opportunities to their graduates. Although business analytics is a new field, many of the required competencies stem from already established areas such as Information/Computer Technology or Information Systems. Using a sample of 225 randomly selected AACSB accredited business schools this study examined the new developments in Business Analytics undergraduate academic programs, and determined the amount of overlap between the Business Analytics and the Information/Computer Technology degree programs. Our findings reveal that approximately 36 percent of the Business Analytics programs overlap with the Information/Computer Technology programs. In addition, the top three required courses in most Business Analytics programs include a Database course, predictive analytics course, and Introduction to Business Analytics. This research provides valuable insight for schools that haven't adopted a Business Analytics degree yet or are looking to improve their existing curriculum. In addition, colleges and universities can now utilize the appropriate Information Systems courses and include them as important foundation and part of their Business Analytics programs.

Keywords: Data Analytics, Business Analytics, Business Intelligence, Business Analytics program,

1. INTRODUCTION

Holsapple et al. (2014) defined Business Analytics

as "evidence-based problem recognition and solving that happen within the context of business situations" (p. 134). Although business analytics

is a fairly new term, it originates from the decision support systems that were introduced in the late 1960s, followed by Business Intelligence systems in the late 1980s (Watson, 2011). Many of these traditional techniques, however, used and analyzed structured data to support their business decisions. The evolution of the Internet in 1970s and wide adoption of the World Wide Web, mobile devices, as well as sensor technology, have allowed companies to generate and collect more data than ever before (Chen et al. 2012). Furthermore, this data comes in a new format such as audio, video, text, which is no longer structured. Therefore, the availability of ubiquitous and unstructured data, has created a demand for novel techniques and data analysis skills. As stated by Holsapple et al. (2014) "modern-day BA [Business Analytics] is rooted in the ongoing advances of systems to support decision making. These advances include increasingly powerful mechanisms for acquiring, generating, assimilating, selecting, and emitting knowledge relevant to making decisions."

Subsequently the skills required for today's business decision making have evolved as well. Chiang et al. (2012) identified three categories of skills required for effective Business Analytics professionals, presented in Figure 1:

1. Analytical skills such as statistical analyses, data and text mining, optimization and simulation.
2. Information Technology (IT) Knowledge and Skills including relational databases, data warehousing, visualization and dashboard design, semi structured and unstructured data management and manipulation, and more.
3. Business Knowledge and Communication Skills focusing on business domain knowledge and ability to propose analytical solutions as well as articulate findings.

From the origin of business analytics, the definition, as well as the skills model, it is evident that there is an overlap between the analytical skills and Information Technology. More specifically, Information Technology knowledge and skills appear to play a fundamental role in developing Business Analytics professionals.

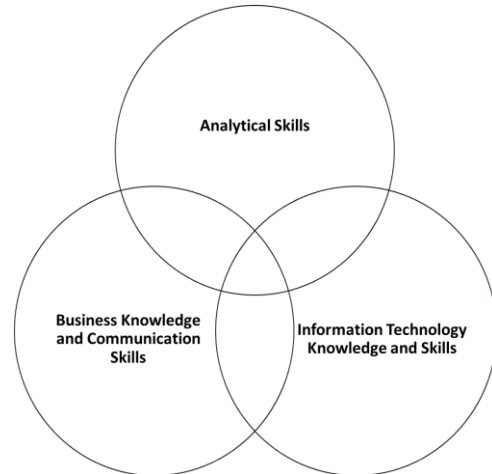


Figure 1. Business Analytics Skills Model

The Demand for Business Analytics Majors

Students with a degree in Business Analytics have a variety of different job opportunities. A few of the careers for Business Analytics graduates include: Business Analyst, Quantitative Analyst, Market Research Analyst, Financial Analyst, and Operations Research Analyst. The demand for professional in business analytics is increasing. (Univ Wash, 2018)

By 2022, 85% of companies are expected to adopt data analytics (Bytyci, 2019). Careers in business and data analytics are in demand right now (Labbe, 2018). Therefore, more graduates with data and business analytic skills are needed. Business analytics utilizes data (collecting, storing, and analyzing) from business intelligence and customers in order to generate plans for business enhancements in efficiency and revenue (Gorman and Klimberg, 2014; Wilder and Ozgur, 2015). Traditionally business analysts focused on core business, with knowledge in all business principles, and primarily sought to understand and develop requirements for an information system project. Now business analysts are focused on collecting, storing, and analyzing data they "help guide businesses in improving processes, products, services and software through data analysis. workers straddle the line between IT and the business to help bridge the gap and improve efficiency" (pg 1, Pratt & White, 2019). According to IBM, by 2020 business analyst positions will increase from 364,000 to 2,720,000 openings (Arora, 2018; Bytyci, 2019), as companies have revealed the need for analysis to determine valuable business insights. With the increasing demand for better business and customer knowledge, organizations are increasingly relying on business analytics.

While some business roles are set to decline in demand because of technology, such as auditors and banking clerks, business analyst jobs will advance with technology. Therefore, there could be more overlap between information system degrees and business analytics degrees. In 2015-16, Cleary (2019) examined business analysis job postings. She found five top degree types employers requested for entry-level business analysts – general administration and management, computer science, finance, information systems, and accounting. Further analysis and discussions found that business analysts need a mix of both information technology and business skills, which has been echoed by other authors (Noodle Editorial Staff, 2019). Gorman and Klimberg (2014) found business analytics to combine statistics with information systems as well as quantitative methods. However, traditional business schools are struggling to produce graduates that can effectively meet the growing industry demands (LeClaire, 2016). Many business schools are offering master degrees in business analytics or data analytics (UNC Institute for Advanced Analytics, 2019; Labbe, 2018), but these schools are slower to offer programs at the undergraduate level.

The purpose of this paper is to examine the offerings of business analytics or data analytics majors and minors at the undergraduate, business school level to determine what, if any, overlap might exist with the information system programs. Findings of this study will provide important insight for universities that are looking to start a Business Analytics program or want to strengthen their existing BA curriculum. More specifically this study will identify which courses converge between the two fields of Business Analytics and Information Systems, helping schools create balanced curriculum for a Business/Data Analytics program that is and will continue to be in high demand for years to come.

2. RESEARCH METHODOLOGY

Data was collected from 225 randomly selected AACSB accredited business schools. This accounts for approximately 39.8% of the total AACSB business schools. Data was collected from the schools' catalog and material available on their website. The schools were first searched to see if they had an analytics program within the school of business. Seventy-four programs (33%) had some type of business analytics program, either major, minor, certificate or concentration. For two of the schools, the program requirements could not be determined

from their websites and the schools were removed from further analysis. Due to varying types of BA requirements within schools, the BA programs were classified as having a "program" and worth further investigation if a school required 15 credits (5 classes) or more. There was a total of 58 schools that were considered as offering BA programs. Each school that had a qualified BA program was then further evaluated to see if the school offered an IS program. Data was collected on the courses for both Business Analytics program and the corresponding IS program.

A classification of courses needed to be created for the data collected to be mapped. Appendices A and B show the list for required courses and elective courses. Once the data was collected, data mapping began. This study followed a similar process used in a prior study which surveyed university IS program curriculum described on their websites (Yang & Wen, 2017). Multiple authors went through the courses and coded them based on the classification item that best described each particular item. If a course did not fit in any of the classifications, a new classification was added to the list and communicated to the other coder. After the authors went through the list and coded the courses, the lists were reconciled against each other. Where there were differences or questions, the authors discussed those until a decision was made.

3. FINDINGS AND DISCUSSION

Of all the schools evaluated, 34 of the programs offered degrees in both IS and Analytics and 3 offered combined degrees. To further clarify, if the program was a specialization, minor or a concentration that required more than 5 courses or 15 credits it was considered as offering a program in BA.

The size of the schools based upon undergraduate enrollment and the programs that are offered are given in Table 1. Small universities were categorized as small if undergraduate enrollment was less than 10,000 students. Medium size schools had enrollment between 10,000 and less than 20,000. Large schools had enrollment greater than or equal to 20,000. The size of the school had no effect on whether the school offered a BA program. Seventy-three percent of all the schools did not offer any BA program and 16% offered both a BA and IS program.

| Size | No BA Program | BA Program Only | Both BA & IS | Combined Degree |
|-------------|---------------|-----------------|--------------|-----------------|
| Large | 76% | 8% | 14% | 3% |
| Medium | 67% | 13% | 19% | |
| Small | 74% | 9% | 15% | 2% |
| All Schools | 73% | 10% | 16% | 1% |

Table 1. University Size and Program Offerings

Approximately 66% of the schools analyzed were public schools (Table 2). Fourteen percent of the private schools offered both, BA and IS programs and 17% of the public schools offered both.

| Private/Public | No BA Program | BA Program Only | Both BA & IS | Combined Degree |
|----------------|---------------|-----------------|--------------|-----------------|
| Private | 71% | 14% | 14% | 1% |
| Public | 74% | 8% | 17% | 1% |
| All Schools | 73% | 10% | 16% | 1% |

Table 2. University Type and Program Offerings

Business Analytics Course Requirements

Figure 2 shows the math requirements for the BA programs. The percentage indicated in orange are those schools that the math class is required as part of the college or school’s core requirements. Fifty-six percent of the schools require at least one statistic course and 45% require at least one calculus course.

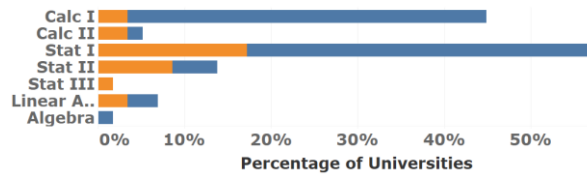


Figure 2. BA Math Requirements

Figure 3 shows the programming requirements for the BA programs. Programming courses are not typically part of the core but an introductory programming course is required by 36% of the BA programs. Twelve percent require a statistical programming course.

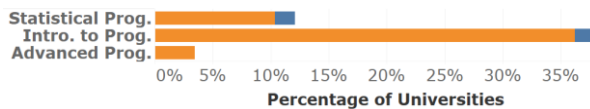


Figure 3. BA Programming Requirements

Appendix A shows the different required courses offered by the BA programs. A course in database management is the most frequently required course and is required by 67% of all BA programs. Fifty-six of the classifications were found to be required courses in at least one of the BA programs. The top 20% of the required courses, excluding courses in the business or university

core are found in Table 3. This large list of courses shows that there is no agreed upon set of skills that should be obtained when completing a BA program. Without that consistency, it is difficult to know which concepts a student has been exposed to without knowing the program he/she completed. For example, thirty-three percent of the programs do not require a database course. However, this does not necessarily mean those students are not being exposed to these concepts. Perhaps database skills are being taught in another course being offered. The Intro to BA course may be a course which covers these skills.

| Course | Univ. Count | Percentage |
|-------------------------|-------------|------------|
| Database | 39 | 67% |
| Predictive Analytics 1 | 29 | 50% |
| Intro to BA | 28 | 48% |
| Dec. Models 1 | 23 | 40% |
| Intro to Programming | 21 | 36% |
| Capstone | 16 | 28% |
| Predictive Analytics II | 14 | 24% |
| Data Viz | 14 | 24% |
| Data Warehousing | 13 | 22% |
| Big Data | 11 | 19% |
| Stat I | 10 | 17% |

Table 3. BA Required Courses

Business Analytics Course Electives

Appendix B lists all the different electives offered by the BA programs. Some schools have statistics as an elective and not a required course. The list shows the vast array of different offerings among programs. Among the elective list are many of the courses that are considered required courses for other BA programs. This further illustrates the fact that there is still no single set of agreed upon courses in a BA program. Electives are where a BA program can easily incorporate other disciplines. Courses in areas such as Sports Analytics, Healthcare Analytics, Supply Chain/Logistics, Human Resource Management Data, etc., can be developed with faculty from those areas. Or perhaps, these courses already existed prior to the creation of the BA program? This can help to tap into a new group of students interested in analytics for that particular industry/area.

BA and IS Overlap

As previously stated, there were 34 programs that offered both BA and IS programs. In looking at just these schools, it appears that many of the required BA courses are also required in the CIS

programs or as part of the core business program. Appendix C. looks at those schools that have both a CIS and a BA program and shows the overlap of the required BA courses and how it relates to CIS and the school core. For example, the database course is the most frequently required course in Business Analytics Programs. Out of the 35 schools that offer both CIS and BA programs, 26 of the BA programs require a database course. Out of these 26, 6 schools do not have it as either a CIS elective or a CIS required course; 18 schools have the database listed as a required course in the CIS program and 2 schools have the database course listed as a CIS elective.

Looking at the predictive analytics course, of the 35 schools that offer BA and CIS programs, 19 of the school's BA programs require a predictive analytics course. Out of these 19 schools, 13 do not require the predictive analytics course for the CIS major. One school requires the predictive analytics course for both the CIS and BA major. And 5 schools allow the predictive analytics course to count the predictive analytics course as an elective. Of note, of the top 20% required BA courses, only three were not in at least 20% of the IS programs in the universities reviewed. These three courses were Big Data, Data Warehousing and Capstone.

How much is the overlap? Table 4 shows the percentage of required BA Classes that are also required CIS courses. For example, looking at university id 411 80% of the required BA courses are also required for the CIS major and 33% of all courses required and electives can also be taken for the CIS major.

As industry demands continue to grow with more business analytics positions, well-informed prospective students will be looking for universities that prepare students for these careers. While many universities have begun to build BA programs at the master's level, undergraduate programs in BA are also needed. This research indicates that many schools, with a current IS program, may already have the courses in place to begin a BA program. As stated, it was determined that having five courses (15 credits) was the marker for having a BA program. For many universities, these courses may be found within the IS program itself or in other departments, such as economics or math. This can make it easier to begin the process of starting the BA program.

| Univ. ID | Overlap Required BA & CIS | Overlap of all BA with CIS |
|-----------------|---------------------------|----------------------------|
| 411 | 80.00% | 33.30% |
| 378 | 66.70% | 85.70% |
| 128 | 50.00% | 35.70% |
| 360 | 50.00% | 71.40% |
| 439 | 50.00% | 50.00% |
| 446 | 50.00% | 100.00% |
| 92 | 42.90% | 42.90% |
| 377 | 37.50% | 68.80% |
| 109 | 33.30% | 33.30% |
| 215 | 33.30% | 33.30% |
| 367 | 33.30% | 14.30% |
| 32 | 30.00% | 63.60% |
| 218 | 25.00% | 10.00% |
| 9 | 20.00% | 22.20% |
| 224 | 16.70% | 50.00% |
| 550 | 16.70% | 58.30% |
| 80 | 15.40% | 15.40% |
| 387 | 14.30% | 14.30% |
| 124 | 12.50% | 45.00% |
| 13 | 0.00% | 28.60% |
| 25 | 0.00% | 35.30% |
| 161 | 0.00% | 20.00% |
| 188 | 0.00% | 0.00% |
| 201 | 0.00% | 0.00% |
| 242 | 0.00% | 50.00% |
| 252 | 0.00% | 0.00% |
| 271 | 0.00% | 28.60% |
| 273 | 0.00% | 20.00% |
| 278 | 0.00% | 13.00% |
| 338 | 0.00% | 0.00% |
| 340 | 0.00% | 66.70% |
| 423 | 0.00% | 50.00% |
| 485 | 0.00% | 10.00% |
| 531 | 0.00% | 42.90% |
| Overall Average | 19.90% | 35.70% |

Table 4. Percentage of BA Classes that are also required CIS Courses

The information found in this study can be used by universities to review the courses already offered by their IS program. While there is no one set curriculum followed for a BA program, this Top

20% required list provides guidance as to what is considered important across many of the universities reviewed in this sample. This will allow university IS programs to determine which courses need to be added and perhaps which courses need to be adapted in order to properly offer a BA program. For example, they may wish to change the introduction to programming course to utilize R as the language taught to satisfy both IS and BA programs.

4. CONCLUSION

According to PWC, data scientists, data engineers and business analysts are among the most sought-after positions in America (PWC, 2018). As demand continues to rise for employees with business analytics skills, universities will need to find ways to prepare their students for these opportunities.

This study found that there is quite a bit of overlap in BA and IS programs. Universities who have not yet begun to build a BA program should consider first looking at their existing courses. They may find that they only need to develop a couple of courses to complete the BA program offering. This would be a good time to consider setting the program apart from others by specializing in a particular area, e.g., healthcare.

This study illustrates that there is no clear curriculum for a basic undergraduate BA program. At this time, no expectation can be made in regard to skills acquired when a student graduates with such a program. This is something that should be considered as the field develops. Future research should propose a model curriculum.

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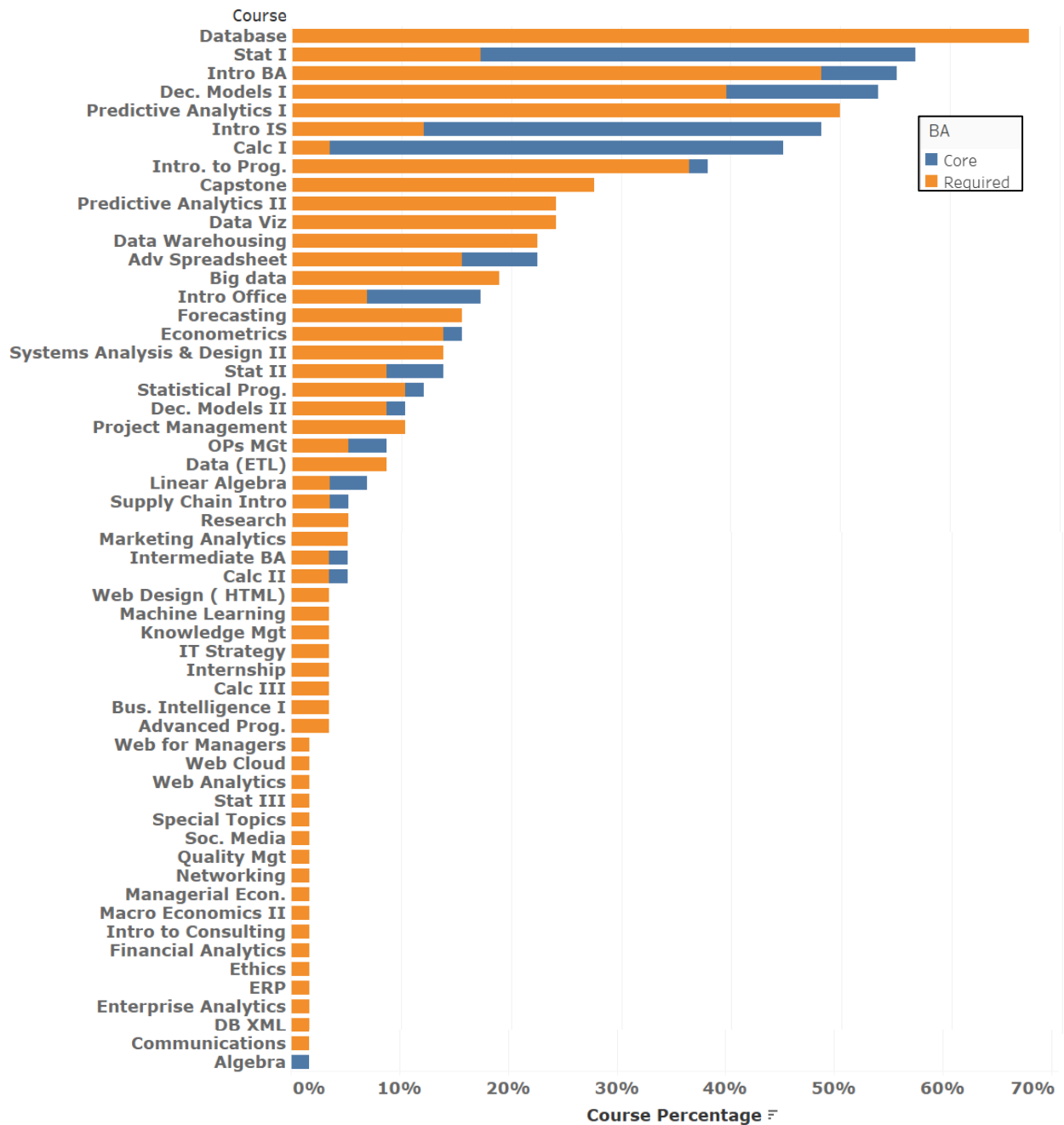
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Appendix A Business Analytics Required Courses



Appendix B. Business Analytics Elective Courses

| <i>Course</i> | <i>Percentage</i> | <i>Number</i> |
|---|-------------------|---------------|
| <i>Marketing Analytics</i> | 40% | 23 |
| <i>Special Topics</i> | 29% | 17 |
| <i>Stat II</i> | 22% | 13 |
| <i>Financial Analytics</i> | 22% | 13 |
| <i>Supply Chain Intro</i> | 21% | 12 |
| <i>Acct Info. Sys.</i> | 21% | 12 |
| <i>Intro. to Prog.</i> | 19% | 11 |
| <i>Data Viz</i> | 19% | 11 |
| <i>Project Management</i> | 17% | 10 |
| <i>Dec. Models II</i> | 17% | 10 |
| <i>Dec. Models I</i> | 17% | 10 |
| <i>Database</i> | 17% | 10 |
| <i>Forecasting</i> | 16% | 9 |
| <i>Econometrics</i> | 16% | 9 |
| <i>Systems Analysis & Design II</i> | 14% | 8 |
| <i>Stat I</i> | 14% | 8 |
| <i>Statistical Prog.</i> | 12% | 7 |
| <i>Predictive Analytics II</i> | 12% | 7 |
| <i>Internship</i> | 10% | 6 |
| <i>Logistics</i> | 9% | 5 |
| <i>Intro BA</i> | 9% | 5 |
| <i>Cyber Security I</i> | 9% | 5 |
| <i>Soc. Media</i> | 7% | 4 |
| <i>Predictive Analytics I</i> | 7% | 4 |
| <i>Health Care Anal.</i> | 7% | 4 |
| <i>ERP</i> | 7% | 4 |
| <i>Data Warehousing</i> | 7% | 4 |
| <i>CRM</i> | 7% | 4 |
| <i>Web for Managers</i> | 5% | 3 |
| <i>Web Design (HTML)</i> | 5% | 3 |
| <i>Web Cloud</i> | 5% | 3 |
| <i>Web Analytics</i> | 5% | 3 |
| <i>Sports Analytics</i> | 5% | 3 |
| <i>Quality Mgt</i> | 5% | 3 |
| <i>Pricing Strategy</i> | 5% | 3 |
| <i>Stat III</i> | 3% | 2 |
| <i>Risk Management</i> | 3% | 2 |
| <i>Research</i> | 3% | 2 |
| <i>Real Time</i> | 3% | 2 |
| <i>Planning and Control SCM</i> | 3% | 2 |
| <i>Networking</i> | 3% | 2 |
| <i>Managerial Econ.</i> | 3% | 2 |

| | | |
|--|----|---|
| <i>Knowledge Mgt</i> | 3% | 2 |
| <i>Intro IS</i> | 3% | 2 |
| <i>Human Resource Mgt</i> | 3% | 2 |
| <i>Hardware</i> | 3% | 2 |
| <i>Geographic Info sys</i> | 3% | 2 |
| <i>Game Theory</i> | 3% | 2 |
| <i>Energy Analytics</i> | 3% | 2 |
| <i>Data (ETL)</i> | 3% | 2 |
| <i>Bus. Intelligence I</i> | 3% | 2 |
| <i>Big data</i> | 3% | 2 |
| <i>Web development server side</i> | 2% | 1 |
| <i>Systems Analysis & Design I</i> | 2% | 1 |
| <i>Real Estate</i> | 2% | 1 |
| <i>Operating Systems</i> | 2% | 1 |
| <i>Negotiations</i> | 2% | 1 |
| <i>Machine Learning</i> | 2% | 1 |
| <i>Leadership</i> | 2% | 1 |
| <i>Info. Storage and Mgt</i> | 2% | 1 |
| <i>Graphics</i> | 2% | 1 |
| <i>Forensics</i> | 2% | 1 |
| <i>Ethics</i> | 2% | 1 |
| <i>Dec. Models III</i> | 2% | 1 |
| <i>DB XML</i> | 2% | 1 |
| <i>Contract Theory</i> | 2% | 1 |
| <i>Advanced Prog.</i> | 2% | 1 |
| <i>Adv Spreadsheet 2%</i> | 2% | 1 |

Appendix C. Overlap of BA and CIS courses

