SUNY | The State University of New York

New Program Proposal:
Graduate Degree Program

This form should be used to seek SUNY's approval and New York State Education Department's (SED) registration of a proposed new academic program leading to master's or doctoral degree. Approval and registration are both required before a proposed program can be promoted or advertised or can enroll students. The campus Chief Executive or Chief Academic Officer should send a signed cover letter and this completed form (unless a different form applies[1]), which should include appended items that may be required for Sections 1 through 6, 9 and 10 and MPA-1 of this form, to the SUNY Provost at *program.review@suny.edu*. The completed form and appended items should be sent as a single, continuously paginated document.[2] If Sections 7 and 8 of this form apply, External Evaluation Reports and a single Institutional Response should also be sent, but in a separate electronic document. Guidance on academic program planning is available here.

Table of Contents
NOTE: Please update this Table of Contents automatically after the form has been completed. To do this, put the cursor anywhere over the Table of Contents, right click, and, on the pop-up menus, select "Update Field" and then "Update Page Numbers Only." The last item in the Table of Contents is the List of Appended and/or Accompanying Items, but the actual appended items should continue the pagination.

---

[1]Use a different form if the proposed new program will lead to a graduate degree or any credit-bearing certificate; be a combination of existing registered programs (i.e. for a multi-award or multi-institution program); be a breakout of a registered track or option in an existing registered program; or **lead to certification as a classroom teacher, school or district leader, or pupil personnel services professional** (e.g., school counselor).

[2]This email address limits attachments to 25 MB. If a file with the proposal and appended materials exceeds that limit, it should be emailed in parts.

Section 1. General Information		
a) **Institutional** **Information**	Date of Proposal:	November 26, 2019
	Institution's 6-digit SED Code:	211000
	Institution's Name:	Binghamton University
	Address:	-4400 Vestal Parkway East, Binghamton NY 13902
	Dept of Labor/Regent's Region:	Southern Tier
b) **Program** **Locations**	List each campus where the entire program will be offered (with each institutional or branch campus	
	List the name and address of off-campus locations (i.e., extension sites or extension centers) where courses will offered, **or check here [X] if not applicable**:	
c) Proposed **Program** **Information**	Program	Information Systems
	Award(s) (e.g., M.A., Ph.D.):	M.S.
	Number of Required Credits:	Minimum [30] If tracks or options, largest minimum [36]
	Proposed HEGIS Code:	[0702.00]
	Proposed 6-digit CIP 2010 Code:	[11.0103]
	If the program will be accredited, list the accrediting agency and expected date of accreditation:	
	If applicable, list the SED professional licensure title(s)[3] to which the program leads:	
d) **Campus** **Contact**	Name and title: Aondover Tarhule, Vice Provost and Dean of the Graduate School Telephone: 607-777-2073 E-mail: atarhule@binghamton.edu	
e) **Chief Executive** **or Chief** **Academic** **Officer** **Approval**	**Signature affirms that the proposal has met all applicable campus administrative and shared governance procedures for consultation, and the institution's commitment to support the proposed program.** ***E-signatures are acceptable.*** Name and title: Signature and	
	If the program will be registered jointly[4] with one or more other institutions, provide the following information for each institution:	
	Partner institution's name and 6-digit SED Code:	
	Name, title, and signature of partner institution's CEO (or **append** a signed letter indicating approval of this proposal):	

---

[3] If the proposed program leads to a professional license, a specialized form for the specific profession may need to accompany this proposal.
[4] If the partner institution is non-degree-granting, see SED's CEO Memo 94-04.

Attestation and Assurances

On behalf of the institution, I hereby attest to the following:

That all educational activities offered as part of this proposed curriculum are aligned with the institutions' goals and objectives and meet all statutory and regulatory requirements, including but not limited to Parts 50, 52, 53 and 54 of the Rules of the Board of Regents and the following specific requirements:

That credit for study in the proposed program will be granted consistent with the requirements in §50.1(o).

That, consistent with §52.1(b)(3), a reviewing system has been devised to estimate the success of students and faculty in achieving the goals and objectives of the program, including the use of data to inform program improvements.[5]

That, consistent with §52.2(a), the institution possesses the financial resources necessary to accomplish its mission and the purposes of each registered program, provides classrooms and other necessary facilities and equipment as described in §52.2(a)(2) and (3), sufficient for the programs dependent on their use, and provides libraries and library resources and maintains collections sufficient to support the institution and each registered curriculum as provided in §52.2(a)(4), including for the program proposed in this application.

That, consistent with 52.2(b), the information provided in this application demonstrates that the institution is in compliance with the requirements of §52.2(b), relating to faculty.

That all curriculum and courses are offered and all credits are awarded, consistent with the requirements of §52.2(c).

That admissions decisions are made consistent with the requirements of §52.2(d)(1) and (2) of the Regulations of the Commissioner of Education.

That, consistent with §52.2(e) of the Regulations of the Commissioner of Education: overall educational policy and its implementation are the responsibility of the institution's faculty and academic officers, that the institution establishes, publishes and enforces explicit policies as required by §52.2(e)(3), that academic policies applicable to each course as required by §52.2(e)(4), including learning objectives and methods of assessing student achievement, are made explicit by the instructor at the beginning of each term; that the institution provides academic advice to students as required by §52.2(e)(5), that the institution maintains and provides student records as required by §52.2(e)(6).

That, consistent with §52.2(f)(2) of the Regulations of the Commissioner of Education, the institution provides adequate academic support services and that all educational activities offered as part of a registered curriculum meet the requirements established by state, the Rules of the Board of Regents and Part 52 of the Commissioner's regulations.

CHIEF ADMINISTRATIVE or ACADEMIC OFFICER/ PROVOST	
Signature	Date
Type or print the name and title of signatory	Phone Number

---

[5] The NY State Education Department reserves the right to request this data at any time and to use such data as part of its evaluation of future program registration applications submitted by the institution.

Section 2. Program Information

2.1. Program Format

Check all SED-defined formats, mode and other program features that apply to the **entire program**.

a) Format(s): [X]Day [X]Evening [X]Weekend [ ]Evening/Weekend [ ]Not Full-Time

b) Modes: [X]Standard [ ]Independent Study [ ]External [ ]Accelerated [X]Distance Education
   NOTE: If the program is designed to enable students to complete 50% or more of the course requirements through distance education, check Distance Education, see Section 10, and append a Distance Education Format Proposal.

c) Other: [ ] Bilingual [ ] Language Other Than English [ ] Upper Division [ ] Cooperative [ ] 4.5 year [ ] 5 year

2.2. Related Degree Program

NOTE: This section is not applicable to a program leading to a graduate degree.

2.3. Program Description, Purposes and Planning

   a) What is the description of the program as it will appear in the institution's catalog?

   The planned MS program in Information Systems (IS) is a graduate-level offering in Information Systems that is geared towards professionals and undergraduates who have an interest in computer systems strictly from the user/application-perspective and whose career paths are focused on computer hardware and software systems operations and maintenance. The program is designed to accommodate undergraduates from liberal arts, science and engineering disciplines via a series of bridge courses or some of the undergraduate courses currently available to CS minors. We expect the master's program in Information Systems to be of value to BS and MS graduates from a variety of majors on this campus, as it empowers them to pursue a wider job market.

   The Information Systems program focuses on developing skills to: (a) configure and integrate various IS components such as networking and software systems, databases, data analytics and web-based systems and software packages; (b) develop programming and scripting skills, including software testing skills - starting from basic programming principles to the use of packages and utilities for larger applications. This differs from the Computer Science (CS) programs, which tend to emphasize software and hardware theoretical foundations, design and formal analysis techniques for assessment of performance, cost, and functional tradeoffs.

   The program includes multiple courses in different focus areas, allowing students to place an emphasis on material they find particularly relevant. The initial design of the program includes tracks for cybersecurity, applied data science, and web-based information systems. We anticipate these tracks will evolve over time to match changes in student interest and changes in the needs of potential employers.

   The curriculum includes bridge courses, designed to enable students from other disciplines to transition smoothly into the program. It also allows students who have the preparation and interest to optionally take existing CS courses as electives. The program proposes to use a combination of in-class lectures and remote delivery of program materials with live assistance for the students.

   The proposed program requires 30 credit hours (equivalence of 10 courses). Among them, 9 come from required courses, 18 from electives and 3 from a termination project. Students are expected to complete the degree requirements in 1.5 to 2 years. Two optional practicum courses will be offered to provide coverage of fundamental concepts in information systems to students with less background in computing; the home department will advise incoming students appropriately.

   b) What are the program's educational and, if appropriate, career objectives, and the program's primary student
      learning outcomes (SLOs)? *NOTE: SLOs are defined by the Middle States Commission on Higher Education in the*

4

[Characteristics of Excellence in Higher Education](#) *(2006) as "clearly articulated written statements, expressed in observable terms, of key learning outcomes: the knowledge, skills and competencies that students are expected to exhibit upon completion of the program."*

Successful graduates of the program will be able to:
- Deploy and maintain computing systems and software for in-house computing needs, and to access and configure computing resources available from commercial cloud service providers.
- Utilize computing systems and sophisticated software to gather, process and analyze data.
- Implement small software projects to integrate software and hardware systems.
- Assess security and privacy needs for information processing and storage systems and develop solutions to address these needs.
- Work both independently and on a team with diverse educational backgrounds to solve complex real data analytics problems provided by corporate and organizational partners.
- Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Present and communicate the findings to leaders and policymakers of client organizations.

c) How does the program relate to the institution's and SUNY's mission and strategic goals and priorities? What is the program's importance to the institution, and its relationship to existing and/or projected programs and its expected impact on them? As applicable, how does the program reflect diversity and/or international perspectives? For doctoral programs, what is this program's potential to achieve national and/or international prominence and distinction?

Binghamton University's mission combines academic excellence and public service. This role is embodied in the university's *Road Map to Premier* strategy plan as the following statement: "Binghamton University is a premier public university dedicated to enriching the lives of people in the region, state, nation and world through discovery and education and to being enriched by partnerships with those communities." The proposed program will advance our mission in academic excellence and community partnership by training the next generation of information systems professionals.

Information systems in general and cybersecurity, data science, and web-based services in particular, have become integral parts of almost every area of activity; from finance, to business systems, research, and healthcare. Professionals trained in those areas also gather, organize and process vast amounts of data to produce meaningful results. Information systems graduates thus serve as the interface between specialized domains, and provide the computing solutions that empower the domain experts and end-users.

Binghamton University's plan to increase graduate enrollments has been approved by SUNY system administration and the governor's office. This new program will constitute part of that growth, while creating a vital new resource for graduate students for meeting the workforce demands of the state and the nation.

Diversity is important at Binghamton University. The Faculty Senate passed a resolution in 2016 to ensure that proposals include a plan for recruiting and retaining faculty and students from underrepresented groups. This issue is especially important in the current proposal as the proposed degree is a STEM degree, and the undergraduate students will potentially come from STEM related backgrounds, which historically have much lower participation rates of underrepresented groups. The proposal provides further details later on how we plan to address this issue. But broadly, we will use the expertise available on campus (e.g. in the Office of Diversity and Inclusion, Graduate School, and the Watson School) to cooperate with and use programs that already exist and develop new ideas and programs on how to attract and retain both faculty and students from diverse and underrepresented groups. All hiring will be in accordance with the diversity initiatives at Binghamton University.

Within the undergraduate program in Computer Science, the number of students identifying as Black or Hispanic has doubled from 2014 to 2018. These students comprise 4.7% and 11.7% of the student body, respectively – this is above the national averages of 3.1% and 7.7%, as reported by the 2018 Taulbee Survey. The graduate program in Computer Science is dominated by international students, who comprise 90% of this group. While it is anticipated that many students attracted to the MSIS program will be international, the department will still seek to maximize diversity and will encourage students from underrepresented minority (URM) groups to enroll. To recruit students

from historically URM groups into the proposed MSIS program, we plan to take the following measures. We will publicize this program at institutions that have a large number of URM undergraduate students and seek help from computing/IT organizations for women and URM groups such as AWC (Association for Women in Computing), ACM-W (ACM Committee on Women in Computing), CWIT (Center for Women and Information Technology), IAAMCS (Institute for African-American Mentoring in Computing Sciences) and Hispanics in Computing, for recruiting women and URM students. We will also attend, make presentations, and recruit from events organized by the Anita Borg Institute for Women and Technology such as the annual Grace Hopper Celebration (GHC) for women in computing. GHC 2019 had more than 25,000 attendees, including students from our department. We will continue to work with Monica Majors, Director of Diversity Programs & Initiatives of the Watson School, as we have done before, on inviting promising URM undergraduate students to visit the department to increase application and enrollment. We will work with the graduate recruiting team in the Thomas J. Watson School of Engineering and Applied Science to organize events on campus, such as open house and informational presentations, to get students from diverse background interested. We will continue to utilize scholarship programs such as the Clifford D. Clark Fellowship program and the GEM fellowship program to encourage qualified URM undergraduate students to apply and enroll. We will also work with the Division of Diversity, Equity and Inclusion to help recruit URM students.

With personnel searches for the MSIS program, the Computer Science Department will encourage applications from women and underrepresented minorities, to build a diverse and vibrant faculty. Women currently comprise roughly 15% of the tenured and tenure-track faculty; one senior female faculty member recently retired, lowering the average for the time being. The 2018 Taulbee survey indicates that 20% of new PhD graduates are female, making the department comparable to other peer institutions. Two thirds of the current faculty of the Computer Science Department identify as Asian, with many having ancestry from China, India, and Korea. This is comparable to national averages: the 2018 Taulbee survey has 64.4% of new PhDs in Computer Science being for nonresident aliens. The remainder of the Computer Science faculty are identified as White; this is also in line with national averages. Attracting new faculty from underrepresented minority groups is a challenge in the field: only 1.4% of new PhD graduates identify as Black or African-American, and 1.8% identify as Hispanic. The department has been actively working to recruit faculty members from women and URM groups. To enhance our effort, a subcommittee in future search committees will be formed to focus on identifying candidates from women and URM groups. The initial goals will be on exploring the CRA (Computing Research Association) database, identifying women and URM senior researchers and postdoctoral candidates at other institutions and directly encouraging them to apply, and developing guidelines to evaluate the diversity statements of all applicants to open faculty positions. We will seek help from computing/IT organizations for women and URM groups such as AWC, ACM-W, CWIT, IAAMCS and Hispanics in Computing, for recruiting women and URM faculty members. Some of these organizations have successfully helped women and URM students get tenure-track faculty positions.

To improve faculty retention, and to maximize the chance that newly hired faculty members meet tenure criteria, the department provides support in a number of ways. Each junior faculty member has two senior faculty members as mentors. Faculty mentors as well as other senior faculty members of the department provide assistance to junior faculty in many areas, including teaching, guidance on research directions, identification of funding opportunities, proposal reviews, and PhD student recruiting. For faculty with special needs such as the need to care for young children or manage disabilities, the department gives careful consideration to teaching schedules and committee assignments. The department also helps with the two-body problem of some faculty members. Once we have URM faculty members, we plan to organize a workshop on best practices in helping them succeed with tenure and retaining them.

Binghamton University's CS Department received roughly 1,000 graduate applications per year over the past three years, with approximately 250 of these applications better suited for the proposed program than for the current graduate offerings in CS. Many of the graduate applications to CS come from students with undergraduate degrees in other disciplines -- these students appear to be seeking, and well-suited for, a program much like the one we propose.

We believe that one of the drivers for the increasing number of applications is the industry demand for professionals with Information Systems training; there are jobs available, and students who wish to become qualified for them. The proposed program should be a "better fit" for the needs of many of the students who apply.

There is modest overlap with other SUNY campuses. For example, SUNY Albany's MS in Information Systems

program is focused primarily on library applications and SUNY Stony Brook only offers a BS in Information Systems. Based on the number of applicants to our program, and the strong industry demand for professionals in the area, we do not expect that the added capacity at Binghamton will negatively impact other SUNY programs. We believe the program will be synergistic with the Binghamton School of Management programs.

d) How were faculty involved in the program's design? Describe input by external partners, if any (e.g., employers and institutions offering further education).

The current and past chairs of the CS Department have been considering the proposed program for several years and have had informal discussions with faculty members during this period. A rough outline was formulated and presented to the department during a Spring 2017 faculty retreat and the consensus of the department was to move forward with planning.

The School of Management has been consulted. The proposed program will provide a natural transition to graduate program for students who complete their undergraduate MIS program. We envision deeper collaboration in the future, as the program grows; a joint program is one possible evolution.

e) How did input, if any, from external partners (e.g., educational institutions and employers) or standards influence the program's design? If the program is designed to meet specialized accreditation or other external standards, such as the educational requirements in Commissioner's Regulations for the profession, append a side-by-side chart to show how the program's components meet those external standards. If SED's Office of the Professions requires a specialized form for the profession to which the proposed program leads, append a completed form at the end of this document.

We will follow the Middle States accreditation assessment. The proposed program is modeled in part by similar programs at other major universities. The proposed program was presented to the Department IAB (Industrial Advisory Board) in a November 2019 IAB meeting and the IAB was very supportive of this program.

f) Enter anticipated enrollments for Years 1 through 5 in the table below. How were they determined, and what assumptions were used? What contingencies exist if anticipated enrollments are not achieved?

Year	Anticipated Headcount Enrollment			Estimated FTE
	Full-time	Part-time	Total	
1	40	2	42	
2	90 (50 new)	5	95	
3	110 (60 new)	7	117	
4	130 (70 new)	9	139	
5	150 (80 new)	10	160	

We plan to start the program with 42 students (40 full-time and 2 part-time) and increase the enrollment by about 11 (10 full-time and 1 part-time) in each subsequent year (total for the second year will be 42+42+11=95). By Year 5, the enrollment is expected to reach 160. With students typically spending two years in the program, there would be approximately 75 students continuing, with 85 new admits, in the fifth year. The number of students enrolled when the program reaches "steady state" could be close to 200 students – as the program progresses, we expect to continually balance the number of admitted students against overall demand and available resources. The proposed program can make a major contribution to the university's strategic goal of significantly expanding its graduate enrollment.

The enrollment of master's students in CS has been high – over 320 in each of the past 3 years (the number is 366 for Fall 2019); we anticipate that a portion of the students who would normally pursue a traditional program in CS would opt for the Information Systems focus, with the net overall growth within CS to be somewhat less than the expected "new" Information Systems students. As the traditional MS CS program and the proposed MS IS program have distinct features, we do not expect the new program to have a significant negative impact on the enrollment of our MS CS program.

For the past three years, the CS Department has received approximately 1,000 MS applications each year. Out of these applicants, 25% did not have the necessary background for the MS in CS program. However, their background matches the requirements for the proposed IS program. So, we expect to have an initial pool of 200-250 applications per year for the proposed program. The applicant pool is also expected to grow once the program is instituted and advertised. If the acceptance and yield rates for the applications to the new program are similar to those of the MS CS program, the above pool of applications will initially yield 40 students. Therefore, a large application pool will be available for the first two cohorts of the proposed program. The CS Department also has a joint dual-diploma bachelor's degree program in Information Systems with Istanbul Technical University. This program has about 80 students. Each year about 20 students successfully graduate from this program. Some of these students had expressed interest in continuing with the proposed MS IS program, if it were offered. In addition, a significant number of applications are expected from other programs on this campus. The balance between internal and external student acceptance would be evaluated as the proposed program develops.

Part-time students would mostly come from local hi-tech companies or hospitals such as Lockheed Martin, BAE Systems, UHS (United Health Services) and NYSEG, but we do not anticipate a big number.

g) Outline all curricular requirements for the proposed program, including prerequisite, core, specialization (track, concentration), internship, capstone, and any other relevant component requirements, but do not list each General Education course.

The proposed program requires 30 credit hours, with 9 coming from required courses, 18 from electives and 3 from a termination project. The proposed curriculum includes several new courses, many of which should ideally be taught by new faculty members hired for this program. To keep the delivery cost of the program reasonable and to make effective use of existing faculty resources, at least initially, some new courses could be team-taught, with modules within each of several courses assigned to separate participating faculty, possibly as extra service. When a course is team-taught, one faculty member will be designated as the instructor of record and the coordinator for that course. Existing electives will be taught by current faculty as part of their regular teaching load. The program also relies on a full-time lecturer to supervise termination projects (the need will increase as the enrollment of the program increases).

Three tracks of emphasis are proposed for the program: cybersecurity, applied data science, and web-based information systems. The three required courses build a strong foundation for these three areas and students can select electives to build depth in areas that match their interests.

Required	Credits	Electives	Credits
IS501 Information Systems I: Python and Data Mining (New)	3	IS505 Software Project Management (New)	3
IS502 Information Systems II: Management of Systems (New)	3	IS531 Enterprise Network Security (New)	3
IS532 Database Systems (from MSDA program)	3	IS533 Web Based Information Retrieval and Search (New)	3
		IS535 Applied Data Mining (New)	3
IS595 Termination Project	3	IS536 Applied Machine Learning (New)	3
		IS537 Tools for Data Science (New)	3
		IS541 Mobile Applications for Social Networks (New)	3
		IS542 OO Design in Java + Design Patterns (New)	3
		IS544 Web-based Programming (New)	3
		IS553 Blockchain and Beyond (New)	3
		IS554 Data Analytics for Security (New)	3
		IS558 Web and Database Security (New)	3

		IS559 Information Systems Security (New)	3
		MIS523 Information Systems Analysis and Specification (from SOM)	3
		CS Electives (based on standing)	3
		IS500A Information Systems Practicum I (not counted towards degree requirement)	3*
		IS500B Information Systems Practicum II (not counted towards degree requirement)	3*
Total required credits: 30			

h) Program Impact on SUNY and New York State

(1) *Need:* What is the need for the proposed program in terms of the clientele it will serve and the educational and/or economic needs of the area and New York State? How was need determined? Why are similar programs, if any, not meeting the need?

The US Dept. of Labor has recently (as of 9/4/2019) predicted growing demand for professionals in Information Systems. Positions in computer and information technology are projected to grow 12% from 2018 to 2028, much faster than the average for all occupations (the average is about 5.2%), with 2018 median salaries of $86,320. For positions in computer and information management, the growth rate is projected to be 1% from 2018 to 2028, with 2018 median salaries of $142,530. Positions in network and computer systems administration are projected to grow at 5% from 2018 to 2028, with 2018 median salaries of $82,050. As a graduate degree, the proposed program would prepare students for the higher growth rate managerial and leadership positions. Specializations within the program will start with cybersecurity (of broad interest, especially to the financial sector based in NYC), applied data science, and web-based information systems.

Within the Binghamton area, we would expect graduates of the program to be of interest to employers such as Lockheed-Martin and UHS. Within New York State, many financial services companies would likely have great interest. Because of the growing demand, we anticipate many employment opportunities at several companies nationally.

(2) *Employment:* For programs designed to prepare graduates for immediate employment, use the table below to list potential employers of graduates that have requested establishment of the program and state their specific number of positions needed. If letters from employers support the program, they may be **appended** at the end of this form.

	Need: Projected positions	
Employer	**In initial year**	**In fifth year**

(3) *Similar Programs:* Use the table below to list similar programs at other institutions, public and independent, in the service area, region and state, as appropriate. Expand the table as needed. *NOTE: Detailed program-level information for SUNY institutions is available in the Academic Program Enterprise System (APES) or Academic Program Dashboards. Institutional research and information security officers at your campus should be able to help provide access to these password-protected sites. For non-SUNY programs, program titles and degree information – but no enrollment data – is available from SED's Inventory of Registered Programs.*

Institution	**Program Title**	**Degree**	**Enrollment**
SUNY Albany	Information Systems	MS	
RIT	Information Science & Technology	MS	100
Syracuse University	Information Management	MS	

Northeastern	Information Systems	MS	267/yr
UMBC	Information Systems	MS	172 (online)
George Mason University	Applied Information Technology	MS	64
U. Pennsylvania	Computer and Info. Technology	MCIT	46
NY Inst. Technology	Info. Network, & Computer Security	MS	40
Johns Hopkins	Information Systems Engineering	MS	36

(4) **C*ollaboration:*** Did this program's design benefit from consultation with other SUNY campuses? If so, what was that consultation and its result?

Other campuses have not been consulted; we anticipate coordinating with others (in particular SUNY Albany and Stony Brook) as planning for the program moves forward.

(5) ***Concerns or Objections:*** If concerns and/or objections were raised by other SUNY campuses, how were they resolved?

n.a

.

2.4. Admissions

a) What are all admission requirements for students in this program? Please note those that differ from the institution's minimum admissions requirements and explain why they differ.

In setting the standards for admission, the faculty committee will strive for both academic excellence and diversity (of race/ethnicity, gender, undergraduate major, field of professional interest, etc.) Binghamton University's rigorous graduate admissions criteria will be followed for the proposed program. The proposed program broadens the pool of applicants, compared to the graduate CS program that requires a CS or closely related background, as we would encourage students with undergraduate degrees in other fields to consider the Information Systems program.

Applicants with a less extensive background in programming and CS topics will be advised to take two additional Programming Practicum courses, which will run concurrently with the required courses. These additional courses are designed to provide necessary skills for students to be successful in the proposed program. Program advisors will work with admitted students to decide on an appropriate sequence of courses.

b) What is the process for evaluating exceptions to those requirements?

No exceptions will be made.

c) How will the institution encourage enrollment in this program by persons from groups historically underrepresented in the institution, discipline or occupation?

The Graduate School and the Watson School currently recruit applicants to all programs from historically underrepresented groups by attending recruitment fairs dedicated to minority students, by visiting colleges and universities where underrepresented students attend in large numbers, and by emphasizing the affordability of a Binghamton education and the availability of scholarships for historically underrepresented students. Additionally, many Binghamton undergraduate students come from historically underrepresented groups, and we anticipate a high level of interest in this program from our own graduates.

Recruiting for the Information Systems program will involve both Graduate School/Watson School staff recruiters as well as faculty and staff of the Computer Science Department. We will also seek help from Division of Diversity, Equity and Inclusion.

The program director will work closely with the Director of Diversity Programs and Initiatives in the Watson School to increase the number of women and historically underrepresented minority faculty and students. The Watson School recruits STEM students at historically black colleges and universities (e.g., Bennett College and North Carolina A&T) and at meetings of underrepresented groups in engineering (e.g., Society of Women Engineers). We will identify similar venues to recruit. In addition, we plan to elicit donations to support some tuition scholarships to encourage these students to apply. The CS Department may provide support to students and faculty members who participate in outreach efforts.

d) What is the expected student body in terms of geographic origins (i.e., same county, same Regents Region, New York State, and out-of-state); academic origins; proportions of women and minority group members; and students for whom English is a second language?

We anticipate that most students will be from the areas where Binghamton University's engineering programs get its graduate students – viz. New York State and internationally. Since a large number of alumni as well as potential firms that need the graduates are in the greater New York city area, we anticipate many students will come from this region. The online component of the program may be attractive to students in NY state, as well as throughout the US and from abroad. To foster diversity, our goal is to have about 30 percent of the students from underrepresented groups. The department is

committed to improving the diversity of our student body, and in particular expanding the participation of underrepresented groups. Outreach and recruiting efforts will be distributed across the department.

2.5. Academic and Other Support Services

a) Summarize the academic advising and support services available to help students succeed in the program.

Students enrolled in the program will be assigned an academic advisor from the faculty teaching in the program. Students will be required to meet with their faculty advisors each semester to review their progress in courses, field placements, and discuss their short- and long-term academic and career goals. A student progress evaluation form will be developed to track their progress each semester. The Director of the program will also meet with each student once a semester to monitor their progress. Online students not resident in the geographic area will have the option to consult with their faculty advisors online via video conferencing tools such as Skype or GoTo Meeting.

The program will incorporate efforts to support distance students in their utilization of the virtual learning environment. Orientation to online learning through B-online (Binghamton University's tutorial for students taking online courses), community building activities at the onset of each course, and video conferencing for academic advising and office hours will be provided to students to foster a personally engaging and supportive environment.

b) Describe types, amounts and sources of student financial support anticipated. Indicate the proportion of the student body receiving each type of support, including those receiving no support.

Student financial support may be available based on need from the Office of Financial Aid. We anticipate receiving some modest scholarships from firms that may potentially employ our graduates.

2.6. Prior Learning Assessment

If this program will grant credit based on Prior Learning Assessment, describe the methods of evaluating the learning and the maximum number of credits allowed, **or check here [X] if not applicable**.

2.7. Program Assessment and Improvement

Describe how this program's achievement of its objectives will be assessed, in accordance with *SUNY policy*, including the date of the program's initial assessment and the length (in years) of the assessment cycle. Explain plans for assessing achievement of students learning outcomes during the program and success after completion of the program. **Append** at the end of this form, **a plan or curriculum map** showing the courses in which the program's educational and, if appropriate, career objectives – from Item 2.3(b) of this form – will be taught and assessed. *NOTE: The University Faculty Senate's Guide for the Evaluation of Undergraduate Programs is a helpful reference.*

Program assessment will include the following components.
a) Each course will be assessed by students using the Binghamton University (or a variant) SOOT (Student Opinion of Teaching) form. This form assesses the course and faculty on ten items. There is also a place for extensive comments. The form will be administered through our Learning Management System, MyCourses. These assessments will be shared with the program director.
b) Each course will also be assessed in accordance with the general Middle States process. Each learning outcome will be assessed, weaknesses will be identified, and when applicable, actions to address each weakness will be proposed and followed up.
c) A program outcome survey of all graduating students will be administered. This survey will be given to the students before they graduate and will ask them to provide program-level feedback – program content, its coordination across courses, program management, placement services, technology, etc.
d) Program learning goal outcome will be assessed in courses as outlined in the curricular map. The

proportion of students who are at, below and above expectations will be documented. The faculty evaluation committee will meet annually to assess the measures and take steps in various courses to improve the performance.

e) Informal feedback from employers after placement of students will be requested about one year after the completion of the program.

f) Survey of alumni from this program will be conducted biennially to get their feedback on the effectiveness of the curriculum and course offerings.

In the spirit of Total Quality Management, the director and the faculty review committee will review all feedback annually and take corrective actions to improve the program. The findings of these assessments will be shared with the deans and the program faculty.

Section 3. Program Schedule and Curriculum

Complete the **SUNY Graduate Program Schedule** to show how a typical student may progress through the program. This is the registered curriculum, so please be precise. Enter required courses where applicable, and enter generic course types for electives or options. Either complete the blank Schedule that appears in this section, or complete an Excel equivalent that computes all sums for you, found here. Rows for terms that are not required can be deleted.

*NOTES: The **Graduate Schedule** must include all curriculum requirements and demonstrate that expectations from in*
Regulation 52.2 http://www.highered.nysed.gov/ocue/lrp/rules.htm are met.

Special Cases for the Program Schedules:
- *For a program with multiple tracks, or with multiple schedule options (such as full-time and part-time options), use one Program Schedule for each track or schedule option. Note that licensure qualifying and non-licensure qualifying options cannot be tracks; they must be separate programs.*
- *When this form is used for a multi-award and/or multi-institution program that is not based entirely on existing programs, use the schedule to show how a sample student can complete the proposed program. NOTE: Form 3A, Changes to an Existing Program, should be used for new multi-award and/or multi-institution programs that are based entirely on existing programs. SUNY policy governs the awarding of two degrees at the same level.*

a) If the program will be offered through a nontraditional schedule (i.e., not on a semester calendar), what is the schedule and how does it impact financial aid eligibility? *NOTE: Consult with your campus financial aid administrator for information about nontraditional schedules and financial aid eligibility.*

   The program will follow a typical semester schedule.

b) For each existing course that is part of the proposed graduate program, **append** a catalog description at the end of this document.

c) For each new course in the graduate program, **append** a syllabus at the end of this document. *NOTE: Syllabi for all courses should be available upon request. Each syllabus should show that all work for credit is graduate level and of the appropriate rigor. Syllabi generally include a course description, prerequisites and corequisites, the number of lecture and/or other contact hours per week, credits allocated (consistent with SUNY policy on credit/contact hours), general course requirements, and expected student learning outcomes.*

d) If the program requires external instruction, such as clinical or field experience, agency placement, an internship, fieldwork, or cooperative education, **append** a completed External Instruction form at the end of this document

SUNY Graduate Program Schedule (*OPTION:* *You can insert an Excel version of this schedule AFTER this line, and delete the rest of this page.*)
Program/Track Title and Award: MS in Information Systems – without specific track

a) Indicate **academic calendar** type: [X] Semester   [ ] Quarter   [ ] Trimester   [ ] Other (describe):
b) **Label each term in sequence**, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)
c) Use the table to show **how a typical student may progress through the program**; copy/expand the table as needed.
d) Complete the last row to show program totals and comprehensive, culminating elements. **Complete all columns that apply to a course.**

Program for students with requisite background. For students who do not wish to select a specific track option, and who have adequate preparation, there are no restrictions on the electives that can be selected. Any courses in the C, D, and W categories may be selected. While we anticipate that most students will complete the program in four semesters (with the final semester having a light course load to allow students to focus on the termination project), it is possible to complete the program in three semesters.

Term 1: Fall 1				Term 2: Spring 1			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
IS501 Information Systems I: Python and Data Mining	3	X		IS532 Database Systems	3		IS502
IS502 Information Systems II: Management of Systems	3	X		Elective	3		
Elective	3			Elective	3		
Term credit	9			Term credit	9		
Term 3: Fall 2				**Term 4: Spring 2**			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
Elective	3			IS595 Termination Project	3	X	
Elective	3						
Elective	3						
Term credit	9			Term credit	3		
Program Total:	**Total Credits: 30**		**Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable:** IS595 Termination Project				

New: X if new course   **Prerequisite(s)**: list prerequisite(s) for the listed courses

SUNY Graduate Program Schedule (*OPTION:* *You can insert an Excel version of this schedule AFTER this line, and delete the rest of this page.*)
Program/Track Title and Award: MS in Information Systems – without specific track, with practicum courses
a) Indicate **academic calendar** type: [X] Semester   [ ] Quarter   [ ] Trimester   [ ] Other (describe):
b) **Label each term in sequence**, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)
c) Use the table to show **how a typical student may progress through the program**; copy/expand the table as needed.
d) Complete the last row to show program totals and comprehensive, culminating elements. **Complete all columns that apply to a course.**

An alternate program, with optional practicum courses, is also possible; this program is for students who do not wish to select a specific track option. The practicum courses focus on building computing skills, and will feature exercises and practice problems that support material presented in IS501, IS502, and IS532.

Term 1: Fall 1				Term 2: Spring 1			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
IS501 Information Systems I: Python and Data Mining	3	X		IS532 Database Systems	3		IS502
IS502 Information Systems II: Management of Systems	3	X		Elective	3		
IS500A Information Systems Practicum I	3	X		Elective	3		
Elective	3			IS500B Information Systems Practicum II	3	X	
Term credit total:	12			Term credit total:	12		
Term 3: Fall 2				**Term 4: Spring 2**			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
Elective	3			IS595 Termination Project	3	X	
Elective	3						
Elective	3						
Term credit total:	9			Term credit total:	3		

Program Total:	**Total Credits: 36**	**Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable:** IS595 Termination Project

New: X if new course   **Prerequisite(s)**: list prerequisite(s) for the listed courses

SUNY Graduate Program Schedule (*OPTION: **You can insert an *Excel version* of this schedule AFTER this line, and delete the rest of this page.***)
Program/Track Title and Award: <u>MS in Information Systems – Cybersecurity track</u>
a) Indicate **academic calendar** type: [X] Semester   [ ] Quarter   [ ] Trimester   [ ] Other (describe):
b) **Label each term in sequence**, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)
c) Use the table to show **how a typical student may progress through the program**; copy/expand the table as needed.
d) Complete the last row to show program totals and comprehensive, culminating elements. **Complete all columns that apply to a course.**

Program for students with requisite background. Students in this track must select at least three courses from the "C" category, beyond the required MSIS core courses. While we anticipate that most students will complete the program in four semesters (with the final semester having a light course load to allow students to focus on the termination project), it is possible to complete the program in three semesters.

Term 1: Fall 1				Term 2: Spring 1			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
IS501 Information Systems I: Python and Data Mining	3	X		IS532 Database Systems	3		IS502
IS502 Information Systems II: Management of Systems	3	X		Elective ("C" course)	3		
Elective ("C" course)	3			Elective	3		
Term credit	9			Term credit	9		

Term 3: Fall 2				Term 4: Spring 2			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
Elective ("C" course)	3			IS595 Termination Project	3	X	
Elective	3						
Elective	3						
Term credit	9			Term credit	3		

Program Total:	Total Credits: 30	Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable: IS595 Termination Project

New: X if new course   **Prerequisite(s)**: list prerequisite(s) for the listed courses

SUNY Graduate Program Schedule (*OPTION: You can insert an Excel version of this schedule AFTER this line, and delete the rest of this page.*)
Program/Track Title and Award: MS in Information Systems – Cybersecurity track, with practicum courses

a) Indicate **academic calendar** type: [X] Semester   [ ] Quarter   [ ] Trimester   [ ] Other (describe):
b) **Label each term in sequence**, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)
c) Use the table to show **how a typical student may progress through the program**; copy/expand the table as needed.
d) Complete the last row to show program totals and comprehensive, culminating elements. **Complete all columns that apply to a course.**

An alternate program, with optional practicum courses, is also possible. The practicum courses focus on building computing skills, and will feature exercises and practice problems that support material presented in IS501, IS502, and IS532. Students in this track must select at least three courses from the "C" category, beyond the required MSIS core courses.

Term 1: Fall 1				Term 2: Spring 1			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
IS501 Information Systems I: Python and Data Mining	3	X		IS532 Database Systems	3		IS502
IS502 Information Systems II: Management of Systems	3	X		Elective ("C" course)	3		
IS500A Information Systems Practicum I	3	X		Elective	3		
Elective ("C" course)	3			IS500B Information Systems Practicum II	3	X	
Term credit total:	12			Term credit total:	12		
Term 3: Fall 2				**Term 4: Spring 2**			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
Elective ("C" course)	3			IS595 Termination Project	3	X	
Elective	3						
Elective	3						
Term credit total:	9			Term credit total:	3		

Program Total:	**Total Credits: 36**	**Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable:** IS595 Termination Project

New: X if new course   **Prerequisite(s)**: list prerequisite(s) for the listed courses

SUNY Graduate Program Schedule (*OPTION: You can insert an Excel version of this schedule AFTER this line, and delete the rest of this page.*)
Program/Track Title and Award: MS in Information Systems – Applied Data Science track

a) Indicate **academic calendar** type: [X] Semester   [ ] Quarter   [ ] Trimester   [ ] Other (describe):
b) **Label each term in sequence**, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)
c) Use the table to show **how a typical student may progress through the program**; copy/expand the table as needed.
d) Complete the last row to show program totals and comprehensive, culminating elements. **Complete all columns that apply to a course.**

Program for students with requisite background. Students in this track must select at least three courses from the "D" category, beyond the required MSIS core courses. While we anticipate that most students will complete the program in four semesters (with the final semester having a light course load to allow students to focus on the termination project), it is possible to complete the program in three semesters.

Term 1: Fall 1				Term 2: Spring 1			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
IS501 Information Systems I: Python and Data Mining	3	X		IS532 Database Systems	3		IS502
IS502 Information Systems II: Management of Systems	3	X		Elective ("D" course)	3		
Elective ("D" course)	3			Elective	3		
Term credit	9			Term credit	9		

Term 3: Fall 2				Term 4: Spring 2			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
Elective ("D" course)	3			IS595 Termination Project	3	X	
Elective	3						
Elective	3						
Term credit	9			Term credit	3		

Program Total:	Total Credits: 30	**Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable:** IS595 Termination Project

New: X if new course   Prerequisite(s): list prerequisite(s) for the listed courses

SUNY Graduate Program Schedule (*OPTION: You can insert an Excel version of this schedule AFTER this line, and delete the rest of this page.*)
Program/Track Title and Award: MS in Information Systems – Applied Data Science track, with practicum courses

a) Indicate **academic calendar** type: [X] Semester [ ] Quarter [ ] Trimester [ ] Other (describe):
b) **Label each term in sequence**, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)
c) Use the table to show **how a typical student may progress through the program**; copy/expand the table as needed.
d) Complete the last row to show program totals and comprehensive, culminating elements. **Complete all columns that apply to a course.**

An alternate program, with optional practicum courses, is also possible. The practicum courses focus on building computing skills, and will feature exercises and practice problems that support material presented in IS501, IS502, and IS532. Students in this track must select at least three courses from the "D" category, beyond the required MSIS core courses.

Term 1: Fall 1					Term 2: Spring 1			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**		**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
IS501 Information Systems I: Python and Data Mining	3	X			IS532 Database Systems	3		IS502
IS502 Information Systems II: Management of Systems	3	X			Elective ("D" course)	3		
IS500A Information Systems Practicum I	3	X			Elective	3		
Elective ("D" course)	3				IS500B Information Systems Practicum II	3	X	
Term credit total:	12				Term credit total:	12		
Term 3: Fall 2					**Term 4: Spring 2**			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**		**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
Elective ("D" course)	3				IS595 Termination Project	3	X	
Elective	3							
Elective	3							
Term credit total:	9				Term credit total:	3		

Program Total:	**Total Credits: 36**	**Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable:** IS595 Termination Project

New: X if new course   **Prerequisite(s)**: list prerequisite(s) for the listed courses

SUNY Graduate Program Schedule (*OPTION:* ***You can insert an*** *Excel version* ***of this schedule AFTER this line, and delete the rest of this page.***)

Program/Track Title and Award: **MS in Information Systems – Web-Based Information Systems track**

a) Indicate **academic calendar** type: [X] Semester [ ] Quarter [ ] Trimester [ ] Other (describe):

b) **Label each term in sequence**, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)

c) Use the table to show **how a typical student may progress through the program**; copy/expand the table as needed.

d) Complete the last row to show program totals and comprehensive, culminating elements. **Complete all columns that apply to a course.**

Program for students with requisite background. Students in this track must select at least three courses from the "W" category, beyond the required MSIS core courses. While we anticipate that most students will complete the program in four semesters (with the final semester having a light course load to allow students to focus on the termination project), it is possible to complete the program in three semesters.

Term 1: Fall 1				Term 2: Spring 1			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
IS501 Information Systems I: Python and Data Mining	3	X		IS532 Database Systems	3		IS502
IS502 Information Systems II: Management of Systems	3	X		Elective ("W" course)	3		
Elective ("W" course)	3			Elective	3		
Term credit	9			Term credit	9		
Term 3: Fall 2				**Term 4: Spring 2**			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
Elective ("W" course)	3			IS595 Termination Project	3	X	
Elective	3						
Elective	3						
Term credit	9			Term credit	3		

Program Total:	**Total Credits: 30**	**Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable:** IS595 Termination Project

New: X if new course   **Prerequisite(s)**: list prerequisite(s) for the listed courses

SUNY Graduate Program Schedule (*OPTION: You can insert an Excel version of this schedule AFTER this line, and delete the rest of this page.*)
Program/Track Title and Award: MS in Information Systems – Web-Based Information Systems track, with practicum courses

a) Indicate **academic calendar** type: [X] Semester   [ ] Quarter   [ ] Trimester   [ ] Other (describe):
b) **Label each term in sequence**, consistent with the institution's academic calendar (e.g., Fall 1, Spring 1, Fall 2)
c) Use the table to show **how a typical student may progress through the program**; copy/expand the table as needed.
d) Complete the last row to show program totals and comprehensive, culminating elements. **Complete all columns that apply to a course.**

An alternate program, with optional practicum courses, is also possible. The practicum courses focus on building computing skills, and will feature exercises and practice problems that support material presented in IS501, IS502, and IS532. Students in this track must select at least three courses from the "W" category, beyond the required MSIS core courses.

Term 1: Fall 1				Term 2: Spring 1			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
IS501 Information Systems I: Python and Data Mining	3	X		IS532 Database Systems	3		IS502
IS502 Information Systems II: Management of Systems	3	X		Elective ("W" course)	3		
IS500A Information Systems Practicum I	3	X		Elective	3		
Elective ("W" course)	3			IS500B Information Systems Practicum II	3	X	
Term credit total:	12			Term credit total:	12		
Term 3: Fall 2				**Term 4: Spring 2**			
Course Number & Title	**Credits**	**New**	**Co/Prerequisites**	**Course Number & Title**	**Credits**	**New**	**Co/Prerequisites**
Elective ("W" course)	3			IS595 Termination Project	3	X	
Elective	3						
Elective	3						
Term credit total:	9			Term credit total:	3		
Program Total:	**Total Credits: 36**	**Identify the required comprehensive, culminating element(s), such as a thesis or examination, including course number(s), if applicable:** IS595 Termination Project					

New: X if new course   **Prerequisite(s)**: list prerequisite(s) for the listed courses

Program Staff Plan

Tracks: C – Cybersecurity, D – Applied Data Science, W – Web Based Information Systems

Course Title (Required Courses)	Track	Credits	Potential Faculty
IS501 Information Systems I: Python and Data Mining (New)	C,D,W	3	**New Lecturer(s)**; backups: Madhusudhan Govindaraju, Les Lander, Michael Lewis
IS502 Information Systems II: Management of Systems (New)	C,D,W	3	**New Lecturer(s)**; backups: Patrick Madden, Kenneth Chiu
IS532 Database Systems (from MSDA program)	C,D,W	3	**New Tenure-track faculty**; backups: K.D. Kang, Weiyi Meng
Course Title (Elective Courses)	**Track**	**Credits**	**Potential Faculty**
IS505 Software Project Management (New)	C,D,W	3	**New Lecturer(s);** backup: Merwyn Jones
IS531 Enterprise Network Security	C	3	**New Tenure-track faculty**; backups: Guanhua Yan
IS533 Web Based Information Retrieval and Search	W, D	3	**New Tenure-track faculty**; backups: K.D. Kang, Weiyi Meng
IS535 Applied Data Mining (New)	D	3	**New Tenure-track faculty**; backups: Zhongfei (Mark) Zhang, Lei Yu
IS536 Applied Machine Learning (New)	D	3	**New Tenure-track faculty**; backups: Lei Yu, Arti Ramesh
IS537 Tools for Data Science (New)	D	3	**New Tenure-track faculty;** backups: Jeremy Blackburn
IS541 Mobile Applications for Social Networks (New)	C,W	3	**New Lecturer(s)**; backup: Patrick Madden
IS542 OO Design in Java + Design Patterns	W	3	**New Lecturer(s);** backup: Les Lander
IS544 Web-based Programming (New)	W	3	**New Lecturer(s)**; backups: Zerksis Umrigar
IS553 Blockchain and Beyond (new)	C	3	**New Lecturer(s);** backups: Ping Yang
IS554 Data Analytics for Security (New)	C, D	3	**New Tenure-track faculty;** backups: Aravind Prakash
IS558 Web and Database Security (New)	C,D,W	3	**New Tenure-track faculty**; backups: Ping Yang, Guanhua Yan
IS559 Information Systems Security (New)	C,D	3	**New Tenure-track faculty**; backups: Ping Yang, Guanhua Yan
MIS523 Information Systems Analysis and Specification (from SOM)	D	3	SOM faculty
CS Electives (based on standing & advisement)		3	CS faculty
Course Title (Project Courses)		**Credits**	**Potential Faculty**
IS595 Termination Project	C,D,W	3	**New Lecturers**

Section 4. Faculty

a) Complete the **SUNY Faculty Table** on the next page to describe current faculty and to-be-hired (TBH) faculty.

b) **Append** at the end of this document position descriptions or announcements for each to-be-hired faculty member.

NOTE: CVs for all faculty should be available upon request. Faculty CVs should include rank and employment status, educational and employment background, professional affiliations and activities, important awards and recognition, publications (noting refereed journal articles), and brief descriptions of research and other externally funded projects. New York State's requirements for faculty qualifications are in in Regulation 52.2 http://www.highered.nysed.gov/ocue/lrp/rules.htm

c) What is the institution's definition of "full-time" faculty?

SUNY Faculty Table

Provide information on current and prospective faculty members (identifying those at off-campus locations) who will be expected to teach any course in the graduate program. Expand the table as needed. Use a separate Faculty Table for each institution if the program is a multi-institution program.

(a) Faculty Member Name and Title/Rank (Include and identify Program Director with an asterisk)	(b) % of Time Dedicated to This Program	(c) Program Courses Which May Be Taught (Number and Title)	(Highest and Other Applicable Earned Degrees (include College or University)	(e) Discipline(s) of Highest and Other Applicable Earned Degrees	(f) Additional Qualifications: List related certifications, licenses and professional experience in field
PART 1. Full-Time Faculty					
Patrick Madden, Associate Professor	25%	IS502 (Information Systems II: Management of Systems), IS541 (Mobile Applications for Social Networks)	Ph.D., University of California at Los Angeles	Computer Science	Combinatorial optimization, Algorithms, and VLSI design automation
Kanad Ghose, Professor	25%	Electives	Ph.D., Iowa State University	Computer Science	Computer architecture and parallel processing, power-aware systems, high-performance computing and communication systems
Kenneth Chiu, Associate Professor	25%	IS502 (Information Systems II: Management of Systems), IS531 (Enterprise Network Security)	Ph.D., Indiana University	Computer Science	High-performance computing, Big data, Bioinformatics
Madhusudhan Govindaraju, Professor	25%	IS501 (Information Systems I: Python and Data Mining), IS542 (OO Design in Java + Design Patterns)	Ph.D., Indiana University	Computer Science	Cloud computing, big data, distributed systems, high performance computing, web services, component-based technologies, problem-solving environments
Michael Lewis, Associate Professor	25%	IS501 (Information Systems I: Python and Data Mining), electives	Ph.D., University of Virginia	Computer Science	Grid computing, cloud computing, distributed systems and web services
Kartik Gopalan, Professor	25%	Electives	Ph.D., SUNY Stony Brook	Computer Science	Cloud computing, virtualization, cybersecurity operating systems, distributed systems, and computer networks
Weiyi Meng, Professor	25%	IS532 (Database Systems), electives	Ph.D. University of Illinois	Computer Science	Expertise in database, data analytics, information retrieval

24

Name	%	Courses	Degree	Department	Research Interests
K. D. Kang, Professor	25%	IS532 (Database Systems), electives	Ph.D., University of Virginia	Computer Science	Real-time embedded systems, cyber-physical systems, Internet of things, and security
Dmitry Ponomarev, Professor	25%	Electives	Ph.D., Binghamton University	Computer Science	Computer Architecture, security, energy-aware systems, parallel discrete event simulation
Ping Yang, Associate Professor	25%	IS558 (Web and Database Security), electives	Ph.D., SUNY Stony Brook	Computer Science	Information and systems security, security in virtualized computing infrastructures, access control, privacy, policy analysis, and formal methods
Aravind Prakash, Assistant Professor	25%	Electives	Ph.D., Syracuse University	Electrical and Computer Engineering	Memory forensics, software security, virtualization-based security, and binary reverse engineering
Guanhua Yan, Assistant Professor	25%	IS531 (Enterprise Network Security), IS558 (Web and Database Security)	Ph.D., Dartmouth College	Computer Science	Cyber security and big data
Les Lander, Associate Professor	25%	IS542 (OO Design in Java + Design Patterns), electives	Ph.D., University of Liverpool	Math/Computer Science	Programming languages, programming paradigms, formal aspects of software engineering
Arti Ramesh, Assistant Professor	25%	IS536 (Applied Machine Learning), electives	Ph.D., University of Massachusetts	Computer Science	Machine learning, data mining, data analytics, natural language processing, learning analytics, and social network analysis
Zhongfei (Mark) Zhang, Professor	25%	IS535 (Applied Data Mining), electives	Ph.D., University of Massachusetts	Computer Science	Expertise in data mining, medical imaging and bioinformatics
Lei Yu, Associate Professor	25%	IS535 (Applied Data Mining), IS536 (Applied Machine Learning)	Ph.D., Arizona State University	Computer Science	Machine learning, data mining, and bioinformatics
Zerksis Umrigar, Lecturer	33%	IS544 (Web-based Programming), IS531 (Enterprise Network Security)	Ph.D., Syracuse University	Computer Engineering	Automating courseware development, programming languages, systems programming
Steve Moore, Lecturer	33%	Electives	MS Binghamton University	Computer Science	Web programming and development, mobile programming, and networking
Part 2. Part-Time Faculty					

Merwyn Jones, Adjunct Lecturer	25%	IS505 (Software Project Management)	MS Syracuse University	Computer Engineering	Mainframe virtualization and software project management	
Rose Williams, Lecturer	25%	IS545	MS Binghamton University	Computer Science	Introductory programming and SaaS	**Comment [w1]:** This course is not listed in an earlier table. Remove this row.
Part 3. Faculty To-Be-Hired (List as TBH1, TBH2, etc., and provide title/rank and expected hiring date)						
Senior Lecturer (TBH1)/Program Director (Spring 2021)	100%	IS501 (Information Systems I: Python and Data Mining), IS502 (Information Systems II: Management of Systems), IS595 (Termination Project)	MS/PhD	Information Systems/Computer Science		
Lecturer (TBH2; Fall 2021)	100%	IS553 (Blockchain and Beyond), IS558 (Web and Database Security), IS559 (Information Systems Security), IS595 (Termination Project)	MS/PhD	Information Systems/Computer Science		
Tenure-track Faculty (TBH3; Fall 2021)	100%	IS532 (Database Systems), IS535 (Applied Data Mining), IS536 (Applied Machine Learning)	PhD	Information Systems/Computer Science		
Lecturer (TBH4; Fall 2022)	100%	IS501 (Information Systems I: Python and Data Mining), IS532 (Database Systems), IS544 (Web-based Programming), IS595 (Termination Project)	MS/PhD	Information Systems/Computer Science		
Tenure-track Faculty (TBH5; Fall 2023)	100%	IS501 (Information Systems I: Python and Data Mining), IS535 (Applied Data Mining), IS542 (OO Design in Java + Design Patterns)	PhD	Information Systems/Computer Science		

Lecturer (TBH6; Fall 2024)	100%	IS502 (Information Systems II: Management of Systems), IS505 (Software Project Management), IS541 (Mobile Applications for Social Networks), IS595 (Termination Project)	MS/PhD	Information Systems/Computer Science	
Tenure-track Faculty (TBH7; Fall 2025)	100%	IS502 (Information Systems II: Management of Systems), IS531 (Enterprise Network Security), IS558 (Web and Database Security)	PhD	Information Systems/Computer Science	

Comment [w2]: Not listed in an earlier table.

a) What is the resource plan for ensuring the success of the proposed program over time? Summarize the instructional facilities and equipment committed to ensure the success of the program. Please explain new and/or reallocated resources over the first five years for operations, including faculty and other personnel, the library, equipment, laboratories, and supplies. Also include resources for capital projects and other expenses.

- Before the program starts, the costs include (1) hire of a (senior) lecturer as the Director of the program for Spring 2021 start ($40,000, all estimates not including fringes), (2) hire of an IT staff during Spring 2021 (up to $30,000), (3) expenses for computer servers ($40,000) and software licensing fees ($10,000), and (4) advertisement fees for the new program on select websites and travel expenses of recruiting trips ($20,000).
- In Year 1, we will hire (1) a tenure-track faculty ($100,000), (2) a second full-time lecturer ($68,000), (3) the senior lecturer becomes full-time ($80,000), (4) an IT staff (i.e., continue the IT staff, $60,000), (5) a graduate administrative assistant ($46,000) and three TAs ($83,500, for 2 PhD TAs at $30,250 each and 1 MS TA at $23,000 each); existing faculty/staff will receive a 2% raise. The recruiting cost will be at $15,000 and the software licensing fees at $10,000.
- In Year 2, we will hire a third full-time lecturer ($70,000) and three more TAs are requested (add $83,500 for 2 PhD TAs and 1 MS TA); existing faculty/staff will receive a 2% raise. The recruiting cost will be at $14,000 and the software licensing fees at $10,000.
- In Year 3, a second tenure-track faculty will be added to this program ($100,000) and existing faculty/staff will receive a 2% raise. Two more TAs are added (add $60,500 for 2 PhD TAs). The recruiting cost will be at $12,000 and the software licensing fees at $15,000.
- In Year 4, a fourth full-time lecturer will be hired ($70,000), and existing faculty/staff will receive a 2% raise. Two more TAs are added (add $53,250 for 1 PhD TA and 1 MS TA). The recruiting cost will be at $13,000 and the software licensing fees at $15,000.
- In Year 5, a third tenure-track faculty will be added to this program ($100,000) and existing faculty/staff will receive a 2% raise. Two more TAs are added (add $53,250 for 1 PhD TA and 1 MS TA). The recruiting cost will be at $14,000 and the software licensing fees at $20,000.
- The Watson School will cover the cost needed before the start of the program as well as the cost for equipment, supplies (software) and recruiting activities. The university will cover all the cost related to personnel and TAs starting from Year 1 on.
- We do not anticipate the need of additional library, lab and capital expenses.

b) Complete the five-year SUNY Program Expenses Table, below, consistent with the resource plan summary. Enter the anticipated underlined academic years in the top row of this table. List all resources that will be engaged specifically as a result of the proposed program (e.g., a new faculty position or additional library resources). If they represent a continuing cost, new resources for a given year should be included in the subsequent year(s), with adjustments for inflation or negotiated compensation. Include explanatory notes as needed.

SUNY Program Expenses Table
(OPTION: You can paste an Excel version of this schedule AFTER this sentence, and delete the table below.)

Program Expenses Categories	Before Start	Academic Year 1	Academic Year 2	Academic Year 3	Academic Year 4	Academic Year 5
(a) Personnel (including faculty, staff and TAs): fringes not included.	$70,000	$438,900	$599,508	$768,658	$902,731	$1,068,421
(b) Library						
(c) Equipment (servers/storage)	$40,000					
(d) Laboratories						
(e) Supplies (software)	$10,000	$10,000	$10,000	$15,000	$15,000	$20,000

(f) Capital Expenses						
(g) Other (Specify): Recruiting Expenses (ads and recruiting trips)	$20,000	$15,000	$14,000	$12,000	$13,000	$14,000
(h) Sum of Rows Above	**$140,000**	**$463,900**	**$623,508**	**$795,658**	**$930,731**	**$1,102,421**

Section 6. Library Resources

a) Summarize the analysis of library collection resources and needs *for this program* by the collection librarian and program faculty. Include an assessment of existing library resources and accessibility to those resources for students enrolled in the program in all formats, including the institution's implementation of SUNY Connect, the SUNY-wide electronic library program.

   No additional library resources are needed for this program.

b) Describe the institution's response to identified collection needs and its plan for library development.

Section 7. External Evaluation

SUNY and SED require external evaluation of all proposed graduate degree programs. List below all SUNY-approved evaluators who conducted evaluations (adding rows as needed), and **append at the end of this document** each original, signed *External Evaluation Report.* ***NOTE:*** *To select external evaluators, a campus sends 3-5 proposed evaluators' names, titles and CVs to the assigned SUNY Program Reviewer, expresses its preferences and requests approval.*

Evaluator 1	**Evaluator 2**
Name: Andre van der Hoek	Name: Faisal Akkawi
Title: Professor and Chair	Title: Executive Director of Information Systems Program
Institution: UC Irvine Dept. of Informatics	Institution: Northwestern University

Section 8. Institutional Response to External Evaluator Reports

   Append at the end of this document a single *Institutional Response* to all *External Evaluation Reports.*

Section 9. SUNY Undergraduate Transfer

   NOTE: *SUNY Undergraduate Transfer policy does not apply to graduate programs.*

Section 10. Application for Distance Education

a) Does the program's design enable students to complete 50% or more of the course requirements through distance education? [ ] No   [X] Yes. If yes, **append** a completed *SUNY Distance Education Format Proposal* at the end of this proposal to apply for the program to be registered for the distance education format.

b) Does the program's design enable students to complete 100% of the course requirements through distance education? [X] No   [ ] Yes

Section MPA-1. Need for Master Plan Amendment and/or Degree Authorization

a) Based on guidance on Master Plan Amendments, please indicate if this proposal requires a Master Plan Amendment.
   [ ] No   [ ] Yes, a completed *Master Plan Amendment Form* is **appended** at the end of this proposal.

b) Based on *SUNY Guidance on Degree Authorizations* (below), please indicate if this proposal requires degree authorization.

[ ] No   [X] Yes, once the program is approved by the SUNY Provost, the campus will work with its Campus Reviewer to draft a resolution that the SUNY Chancellor will recommend to the SUNY Board of Trustees.

***SUNY Guidance on Degree Authorization.** Degree authorization is required when a proposed program will lead to a [new degree](#) (e.g., B.F.A., M.P.H.) at an existing level of study (i.e., associate, baccalaureate, first-professional, master's, and doctoral) in an existing disciplinary area at an institution. Disciplinary areas are defined by the [New York State Taxonomy of Academic Programs](#). Degree authorization requires approval by the SUNY Provost, the SUNY Board of Trustees and the Board of Regents.*

Appended Items: Materials required in selected items in Sections 1 through 10 and MPA-1 of this form should be appended after this page, with continued pagination. In the first column of the chart below, please number the appended items, and append them in number order.

Number	Appended Items	Reference Items
	For multi-institution programs, a letter of approval from partner institution(s)	Section 1, Item (e)
	For programs leading to professional licensure, a side-by-side chart showing how the program's components meet the requirements of specialized accreditation, Commissioner's Regulations for the Profession, or other applicable external standards	Section 2.3, Item (e)
	For programs leading to licensure in selected professions for which the SED Office of Professions (OP) requires a specialized form, a completed version of that form	Section 2.3, Item (e)
	OPTIONAL: For programs leading directly to employment, letters of support from employers, if available	Section 2, Item 2.3 (h)(2)
1	*For all programs*, a plan or curriculum map showing the courses in which the program's educational and (if appropriate) career objectives will be taught and assessed	Section 2, Item 7
2	*For all programs*, a catalog description for each existing course that is part of the proposed graduate major program	Section 3, Item (b)
3	*For all programs with new courses,* syllabi for all new courses in a proposed graduate program	Section 3, Item (c)
	For programs requiring external instruction, a completed *External Instruction Form* and documentation required on that form	Section 3, Item (d)
4	*For programs that will depend on new faculty*, position descriptions or announcements for faculty to-be-hired	Section 4, Item (b)
5	*For all programs*, original, signed External Evaluation Reports from SUNY-approved evaluators	Section 7
6	*For all programs*, a single Institutional Response to External Evaluators' Reports	Section 8
	For programs designed to enable students to complete at least 50% of the course requirements at a distance, a *Distance Education Format Proposal*	Section 10
	For programs requiring an MPA, a *Master Plan Amendment* form	Section MPA-1

Program Learning Objectives	Courses Covering Learning Goal	Assessed in
Demonstrate proficiency in data mining and the use of machine learning systems, using large scale databases and modern data analytics tools.	IS501	IS501
Demonstrate proficiency in installing and maintaining computer, networking, and software systems. Demonstrate proficiency in selection and integration of both software and hardware for complex information systems. Familiarity with modern operating systems and their suite of tools (e.g., Linux servers) will be achieved.	IS502	IS502
Demonstrate proficiency in incorporating and applying security and privacy modules for information systems.	IS502	IS502
Demonstrate an understanding of the legal, ethical, and professional responsibilities in an information systems setting.	IS502	IS502
Demonstrate knowledge and proficiency in designing, developing, and deploying database systems, and be capable of developing customized software and scripting tools to use and access information contained within these databases.	IS532	IS532
Work both independently and on a team to design and develop new functionality for a large information system.	IS501, IS502, IS532	IS532
Demonstrate experiential learning via prototyping, implementing, testing, and analyzing a large scale information systems project.	IS595	IS595
Demonstrate proficiency in organizing and presenting information, through oral presentation.	IS595	IS595

These courses can form part of the Elective Offerings.

CS 533: Information Retrieval
Course Topics: Indexing and data structures for storing and searching the index. Boolean, statistical, inference nets and knowledge-based models. Thesaurus construction. Query expansion. Natural language and linguistic techniques. Evaluation. Distributed information retrieval. Information integration and fusion. Dissemination of information. Summaries, themes and reading tours. Hypertext. Internet tools. Intelligent agents. Digital libraries

CS 535: Introduction to Data Mining
Basic topics of data mining, including data preprocessing, mining association rules, classification rules, clustering rules, post processing and mining in unstructured data.
Prerequisites: CS 375, MATH 304 and MATH 327 or MATH 448 (All prerequisites must have a grade of C- or better).

CS 536: Machine Learning
This course provides a broad introduction to machine learning and its applications. Major topics include: supervised learning (generative/discriminative learning, parametric/non-parametric learning, support vector machines); computational learning theory (bias/variance tradeoffs, VC theory, large margins); unsupervised learning; semi-supervised learning; reinforcement learning. The course will give students the basic ideas and intuition behind different techniques as well as a more formal understanding of how and why they work. The course will also discuss recent applications of machine learning, such as to data mining, bioinformatics, and information retrieval.
Prerequisites: CS 375 and MATH 327 or equivalent

CS 538: Introduction to Multimedia Database Systems
Introduction to the organization of multimedia database systems. Review of conventional database systems, including design principles and typical architectures. Organization of multimedia content. Advanced data structures for image, text, video, audio and combined databases. Other topics include physical storage and retrieval, multimedia presentations and network issues.
Prerequisite: CS 432 or 532 or equivalent.

CS544: Programming for the Web
An in-depth understanding of programming for the World Wide Web: detailed coverage of widely used language(s) for web programming, asynchronous programming, principles of web architecture, web protocols, web design patterns, client-side programming, templating, server-side programming, a technical history of the web, web security. Students are expected to have experience with a modern programming language and will be assigned programming projects using current state-of- the-art web technologies.
Prerequisite: CS 320 or CS 350 or CS 375.

CS545: Software Engineering
Software engineering practice applied to the life cycle of software applications and engineering projects. Software project planning and management: risk management, estimation, scheduling, trade studies, CM and SQA. Software development: process model selection, domain analysis, requirements gathering, analysis and design modeling, user interface design, architectural and detailed design, documentation, testing strategies/methods, test plan generation, and reuse. Advanced topics include formal methods and cleanroom software engineering. Requires a major team project.
Prerequisites: CS 350 or CS 375 (All prerequisites must have a grade of C- or better)

CS551: Systems Programming
A detailed study of the application program interface of a modern operating system. File operations, concurrency, processes, threads, inter-process communication, synchronization, client-server programming, multi-tier programming.

Prerequisite: CS 350 (All prerequisites must have a grade of C- or better).

CS 558: Introduction to Computer Security
The course provides an introduction to the principles and practices of network, computer, and information security. Topics include authentication and cryptographic techniques, intrusion detection, access control, security policies, and program/policy analysis techniques.
Prerequisites: CS 350 and CS 375 (All prerequisites must have a grade of C- or better).

CS 559: Science of Cyber Security
This course focuses on techniques that approach cyber security problems in a principled manner using concepts from data mining, game theory, graph theory, and psychology. The intent of this course is to permit students to bridge the divide between real-world cyber threats and formal, scientific foundations of solutions that address such threats. Real-world cyber security issues, such as spamming, phishing attacks, malware, sybil attacks in social networks, and DDoS attacks, are used to illustrate how cyber threats can be modeled with abstract representations that are amenable to rigorous analysis and formal reasoning. The course also emphasizes the development of cyber defense mechanisms that are rooted in scientific foundations. Prerequisite: CS 350 and CS 375.

CS 634: Web Data Management
Advanced topics in Web data management. New techniques for retrieving documents from search engines, including the use of links and user-behavior knowledge. Meta-search engine techniques, including resource discovery and result fusion. Database approaches for Web data management. Semi-structured data management, including data models, query languages and XML. Topics may vary when offered in different years.
Prerequisite: CS 432 or 532 or Equivalent.

IS 501: Information Systems I: Python and Data Mining

Course Description:
This course provides an introduction using the Python programming language, and also introduces basic concepts in machine learning and data mining. No prior programming language experience is expected: students will develop basic coding skills. There will be an emphasis on the use of sophisticated libraries and software packages available for a variety of data intensive tasks.

Course Objectives: The course provides a foundation in programming, and the use of Python to take advantage of machine learning and data mining packages.

Credits: 3.
Contact hours per week: 3.

Learning Outcomes: Upon successful completion of this course, students will
1.   Develop familiarity with the Python programming language
2.   Become proficient in installing and maintaining software packages for Python
3.   Develop skills needed for advanced data visualization tasks
4.   Become proficient in applying machine learning to a variety of problems

Planned Topics:
1.   Installation and setup of Python
2.   Introduction to Python programming
3.   Control, data structures, functions, packages
4.   The Numpy package
5.   Arrays, scalars, functions, input and output
6.   Parsing of JSON and HTML
7.   Interfacing with Python with commercial spreadsheet applications
8.   Data visualization
9.   Machine Learning with Python
        a)   Linear regressions
        b)   Classification methods
        c)   Bayesian techniques
        d)   Decision trees
        e)   Natural Language processing

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Potential Textbook: Python for Data Analysis, Wes McKinney, O'Reilly Books

IS 502: Information Systems II: Management of Systems

Course Description:
Vast quantities of computing resources and storage are easily available – either through commercial providers (e.g., AWS), or from in-house systems. The focus of this course is in specifying, deploying, and managing these resources, and matching them to various computing needs. Security of these systems is a key concern, and a major focus of the course. Ethical and legal concerns (e.g., privacy, anonymity, tracking, surveillance, data preservation) are also considered in depth.

Course Objectives: This course provides an introduction to large information systems, and how they are effectively utilized and administered.

Credits: 3.
Contact hours per week: 3.

Learning Outcomes: Upon successful completion of this course, students will
1.   Become familiar with the range of computing resources available
2.   Develop an understanding of legal and ethical requirements for large information systems
3.   Be able to specify, configure, and maintain computing resources for information systems

Planned Topics:
- Managing Information Security
- Ethics and Legal Requirements
- Organizational Planning
- Contingency Planning
- Information Security Policies
- Developing Security Programs for Organizations
- Management Models and Practices
- Risk Management

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Potential Textbook: Management Information Systems, Laudon & Laudon, Pearson

IS505 Software Project Management

Course Description: Software development is a fast growing and evolving industry where companies have to produce quickly to compete domestically and internationally. Although project management has been an established field for many years, managing Software Development and Information Technology Projects requires ideas and information that go beyond standard project management. This course presents an understandable, integrated view of the many concepts, skills, tools, and techniques involved in software project management. This course is structured around PMI's (Project Management Institute - the global leader in project management research, standards and advocacy) 10 knowledge areas of Project Management and applying them to software development. Specifically, students will learn these 10 distinctions of PM and how to develop a software plan that includes: its associated programming tasks, milestones and deliverables, software scheduling and how/why to establish relationships among the different tasks.

Course Objectives: Students will learn industry-standard practices and methodologies for managing large software projects.

Credits: 3
Contact hours per week: 3.

Learning Outcomes: Upon successful completion of this course, students will have

- A broad understanding of the software project management project life cycle and key project delivery methods;
- An understanding of the importance of planning and what skills are required to produce a solid project plan;
- Consider roles and responsibilities for all key players in the process.
- The ability to properly apply project management methods to the requirements, architecture, design, development and testing portions of the project;
- The ability to monitor and report on the status of a project;
- Learn to integrate the project management standards in all phases of the project (Design, development, test, release, etc..).
- Recognize risks and uncertainties and their effective management process.

Planned Topics include:

The Project Management Knowledge (from PMI's PMBOK) areas are discussed in detail:
- Introduction to Project Management
- The Project Management and Information Technology Context
- The Project Management Process Groups: A Case Study
- Project Integration Management (including code/release versioning)
- Project Scope Management
- Project Time Management
- Project Cost Management
- Project Quality Management (including continuous code integration)
- Project Human Resource Management (including teams and workstyles)
- Project Communications Management
- Project Risk Management
- Software Management Ethics
- Project Stakeholder Management (including teams and workstyle)

Course format

Lectures; Section quizzes; Midterm Exam; Final Exam; Semester Project.

Participation: Part of the grade will be based on class participation, as active participation leads to better learning and understanding. In a business environment the project management spends most of his time working with teams and managers to ensure consistent project communication. Students will not be graded on class participation. However, students should be prepared, have a view on the discussion questions, and be willing to share it. Regularly missing lecture or failing to contribute to class discussion will result in a lower participation grade.

Exam: There will be a midterm and final exam. The format of both exams will be closed book in class exams.

Project: There will be a semester long Software Planning Project performed in groups of 3 to 5 people. Each group will formulate a Software Project and then "plan it" to completion by using the concepts we learn in class. Your deliverables will be:

   (i) Phase I – a project Charter, Software development plan, Software Architecture and associated WBS 2 dictionary

   (ii) Phase II – a WBS 4 document at the work item level and associated Gantt chart in Microsoft Project with 75 development tasks

Grading: Your grade will be calculated by a weighted average with the following weights:
- 20 Points – Weekly/Class quiz and Homework.
- 25 Points - Midterm.
- 25 Points – Final Exam.
- 20 Points – Semester long project.
- 10 Points – Class Participation
- 100 point maximum score

Guest Lecturers:

Speakers from industry will occasionally guest lecture in the class. The guest lecturers are enterprise technical experts with significant project management experience. They will provide an overview of their company's technical capabilities and team responsibilities illustrating how they manage future deliverables, responsibilities and communications. Please be prompt and courteous.

Required Textbook:

   Kathy Schwalbe, *Information Technology Project Management*, Seventh Edition, ISBN-13: 9781133526858

IS531: Enterprise Network Security

Course Description:

This course provides a broad introduction to security issues that concern enterprise networks. It is designed to be highly practical, and students are expected to learn through projects. Topics covered in this course may include:

- **Overview of enterprise network security:** introduction to enterprise network security
- **Network security:** network-based attacks and defenses, network security protocols, web security, wireless security
- **Software security:** software hacking, malware
- **System security:** access control, virtualization
- **Data security:** encryption, crypto hash, data integrity

Course Objectives: This course provides a foundation in security concepts for large network systems. It also provides an overview of a number of topics in encryption and data integrity.

Credits:3
Contact hours per week: 3

Learning Outcomes: Upon successful completion of this course, students will be able to:

- Demonstrate a thorough knowledge of network security
- Demonstrate familiarity with a range of network attacks
- Utilize software for data encryption and ensuring data integrity

Text Books: (recommended but not required)

Mark Stamp, *Information Security: Principles and Practice*, Second edition.

Course Software:

C/C++, Java, and Python.

Slides:

Course slides are posted on <u>MyCourses</u> immediately after each lecture.

Assignments:

All assignments, which will be posted on <u>MyCourses</u>, should be done individually. No assignment will be accepted after 48 hours from the deadline. Late assignments will be penalized 10% per day.

Grading (tentative):

Quizzes: 20%
Presentations: 10%
Course Projects: 40%
Exams (closed book): 30%

Final grade will be calculated over the entire class. The TA will grade assignments and the programming project. If you have questions about the grading of assignments and the programming project, please first contact the TA. This is used to ensure consistent grading. If the issue has not been resolved by the TA, then talk to the instructor, preferably during office hours.

Academic Honesty:

All students should follow <u>Student Academic Honesty Code</u>. (**if you have not already read it, please read it carefully**). All forms of cheating will be treated with utmost seriousness. You may discuss the problems with other students, however, you must write your OWN codes and solutions. Discussing solutions to the problem is NOT acceptable. If you have any questions about whether an act of collaboration may be treated as academic dishonesty, please consult the instructor before you collaborate.

Students with Special Needs:

If you have a physical, psychological, or learning disability that may impact on your ability to carry out assigned course work, please contact the staff in the DSS. DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential.

IS 532: Database Systems

Course Description: The focus of this course will be on understanding information systems and infrastructure used in Data Analytics. The course will provide an introduction to elements of database design and database query languages. Students will also gain technical understanding of and hands-on experience with the information technology infrastructure required for data analytics.

The course content is in twofold. The first part of the course focuses on traditional databases and structured data. It covers association between data elements and data models (including entity-relationship and relational models), relational database design techniques, database query languages. Students will be exposed to the basics in query processing, transaction management, and concurrency control.

The second part of the course covers non-relational databases and big data infrastructure. Students compare and contrast as well as have hands-on experience with various non-relational databases including document, graph, and column databases. Students will also be exposed to Hadoop environment and basic services available in this environment, including MapReduce, distributed file systems, storage, and processing.

Course Objectives: This course is designed to provide a solid foundation and background in traditional database systems and large data repositories. Students will be exposed to data storage and retrieval as well as data management practices in the course.

Credits: 3.
Contact hours per week: 3.

Learning Outcomes: Upon successful completion of this course, students will be able to:

- Demonstrate an understanding of the relational data model and the entity-relationship model,
- Demonstrate an understanding of the database design process and theory as well as the ability to perform database design. This process includes conceptual design (E-R diagram), logical design based on the relational model, table normalization, and internal design,
- Demonstrate an understanding of basic relational database operations and the ability to use SQL at expert level,
- Understand the fundamental concepts, terminology, and principles of information technology infrastructure necessary for business analytics,
- Be able to store, process, and access data for the purpose of business analytics,
- Have hands-on experience with variety of non-relational databases to be able to perform basic functions,
- Be able to make sense of data using visualization.

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Potential Software: Students will be exposed to the following software: Oracle, Hadoop, SAP HANA, MongoDB, Neo4j, and Hive.

Potential Texts: Following textbooks can be used as reference books:
- *Database Systems* by M. Kifer, A. Bernstein, and P. M. Lewis, second edition
- *Hadoop: The Definitive Guide* by Tom White, third edition
- *Programming Hive: Data Warehouse and Query Language for Hadoop* by Edward Capriolo, first edition
- *Designing Data-Intensive Applications* by Martin Kleppmann, first edition

IS533 Web Based Information Retrieval and Search

Course Description:

Indexing and data structures for storing and searching the index. Boolean, statistical, inference nets and knowledge-based models. Thesaurus construction. Query expansion. Natural language and linguistic techniques. Evaluation. Distributed information retrieval. Information integration and fusion. Dissemination of information. Summaries, themes and reading tours. Hypertext. Internet tools. Intelligent agents. Digital libraries.

Course Objectives: This course provides in-depth coverage of searching and extracting information from Web based systems.

Credits: 3
Contact hours per week: 3

Learning Outcomes

- Learn basic concepts, models, methods and principles of information retrieval.
- Learn measures and techniques to evaluate IR systems.
- Learn basic Web search techniques.
- Learn fundamental techniques to implement IR systems.

Textbook

- Introduction to Information Retrieval by C. Manning, P. Raghavan and H. Schutze, Cambridge University Press, 2008. The entire book is available at http://nlp.stanford.edu/IR-book/ for free.

Reference Books

- Search Engines: Information Retrieval in Practice by Bruce Croft, Donald Metzler, and Trevor Strohman, Addison-Wesley, 2009.
- Information Retrieval: Implementing and Evaluating Search Engines by S. Buttcher, C. Clarke and G. Cormack, MIT Press, 2010.
- Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data by B. Liu, Springer, Second Edition, 2011.

Lecture Notes and Papers

- Lecture Notes (PowerPoint Slides) and selected relevant research papers will be posted in the course folder on blackboard.

Lecture Topics

The following chapters (excluding chapters 5, 10, 14-17) in the text book will be covered:

- Chapter 1: Boolean retrieval
- Chapter 2: The term vocabulary & postings lists
- Chapter 3: Dictionaries and tolerant retrieval
- Chapter 4: Index construction
- Chapter 6: Scoring, term weighting & the vector space model
- Chapter 7: Computing scores in a complete search system

- Chapter 8: Evaluation in information retrieval
- Chapter 9: Relevance feedback & query expansion
- Chapter 11: Probabilistic information retrieval
- Chapter 12: Language models for information retrieval
- Chapter 13: Text classification & Naive Bayes
- Chapter 18: Matrix decomposition & latent semantic indexing
- Chapter 19: Web search basics
- Chapter 20: Web crawling and indexes
- Chapter 21: Link analysis

Grading Policy

- Midterm exam 15%
- Final exam 15%
- Homework Assignments 25%
- Project 40%
- Class Participation 5%

  Class participation includes attendance and participation of class discussions. Student attendance is required and will be checked regularly by the instructor. Missing each class will result in a penalty of 0.5 point unless compelling reason for missing the class can be presented in writing to the instructor. Class participation will also be graded by how actively a student participates in class discussions.

- Late penalty. Late homework and project assignments will be penalized at a rate of 5% per day until the hard deadline (no assignment will be accepted after the hard deadline).

Academic Honesty

Academic honesty and integrity are expected of every student. Dishonesty and cheating in all academic work related to this course, when discovered, will be severely punished. Please read the Student Academic Honesty Code at http://www2.binghamton.edu/watson/advising/pdfs/honesty-policy.pdf.

Students must do their assignments/projects/exams by themselves. For the project report, students must write it using their own languages. All referenced works (including ideas, algorithms, programs, tables, figures, open source tools, etc.) must be clearly cited within the main body of the report and their full citations must be listed at the end of the report. Students' own contributions (new ideas, algorithms, programs, etc.) must be clearly identified.

Classroom Etiquette

- Cell phone: Cell phones must be turned off or in vibrate alert mode.
- Computer: Laptop/notebook computers are not allowed during class.

IS535: Applied Data Mining

Course Description: With advances in modern technology, such as the widespread use of electronic records or the internet, the sheer volume of data that is collected is staggering. The challenge is to distill this data into useful knowledge that has relevance for managerial decisions. Data mining techniques provide solutions to this challenge. To illustrate, some recent applications of data mining include (i) models to predict consumer preferences, e.g. Netflix recommendation system and (ii) models to detect fraudulent credit card transactions, (iii) prediction of diseases in the medical diagnosis field.

Course Objectives: This course is designed to build strong skills in the use of data mining software packages.

Credits: 3
Contact hours per week: 3

Learning Outcomes: On the completion of the course, students will:

- Have knowledge of basic data mining concepts, algorithms, and techniques.
- Understand the circumstances and conditions when and where these data mining algorithms and techniques can be applied
- Be able to use existing data mining tools, such as R software.
- Be able to apply these tools to solve real-world problems

Potential Textbook: "Data Mining: Concepts and Techniques," Third Ed., by Jiawei Han, Micheline Kamber, Tand Jian Pei, Morgan Kaufmann, 2012

Homework: Homework will be assigned 3 – 5 times through the semester and be graded based on correctness.

Participation: Part of the grade will be based on class participation, as active participation leads to better learning and understanding. Students should be prepared, have a view on the discussion questions, and be willing to share it. Regularly missing lecture or failing to contribute to class discussion will result in a lower participation grade.

Exam: There will be a midterm and/or final exam.

Project: There will be a semester long data mining project that can be either individual or group-based. Your deliverables will be:
 (i) an output file containing the data as the results of the project
(ii) a final presentation and write-up summarizing your findings and conclusions based on the output data you have obtained during the project term due at the end of the semester.

Grading: Your grade will be calculated by a weighted average with the following weights:
      40% exams,
      30% homework,
      20% project,
      10% class participation.

Topics:
- Week 1 Introduction to fundamental concepts.
- Week 2. Data preprocessing: data cleaning, integration, transformation.
- Week 3. Data preprocessing: data reduction.
- Week 4. Classification: discriminative models.
- Week 5. Classification: generative models.
- Week 6. Prediction and ensemble learning.

- o Week 7: Cluster analysis: classic models
- o Week 8: Cluster analysis: advanced models.
- o Week 9: Cluster analysis: relational models.
- o Week 10: Association rule mining.
- o Week 11. Correlation analysis and causality analysis.
- o Week 12. Trend analysis.
- o Week 13. Unstructured data mining.

IS 536 Applied Machine Learning

Course Description: Machine learning is the science of getting computers to make decisions without being explicitly programmed. This course provides a broad introduction to machine learning and its applications. It introduces students the basic ideas and intuition behind different machine learning techniques and algorithms as well as an understanding of how and why they work. The course also discusses applications of machine learning and practical guidelines in applying machine learning techniques in real-world problems.

Course Objectives: This course provides students with in-depth practical use of machine learning software tools and systems.

Credits: 3
Contact hours per week: 3

Learning Outcomes: On the completion of the course, students will:

- Have knowledge of basic concepts, algorithms, and techniques of machine learning
- Understand the differences between various machine learning techniques and which ones are appropriate for different problems
- Be able to use machine learning tools
- Be able to apply machine learning techniques to real-world problems

Textbook (recommended): *Machine Learning*, Tom Mitchell, McGraw Hill, 1997.

List of topics:

- Introduction
- Supervised learning (parametric/non-parametric learning, generative/discriminative learning, hypothesis evaluation)
- Model selection and computational learning theory (bias/variance tradeoffs and PAC learning)
- Unsupervised learning (k-Means, EM, clustering evaluation)
- Reinforcement learning (Q-learning, temporal difference learning)
- Ensemble learning (bagging, boosting, random forests)

Homework: There will be 4 written/programming assignments during the semester.

Presentation: Each student will be required to give one individual or group (of two students) presentation on a selected topic (a list of topics given by the instructor).

Examinations: There will be several quizzes in class and two exams for this class.

Grading: Final grades will be based on homework (4 assignments, 40%), quizzes (10%), exams (two exams, 40%), and presentation (10%).

IS537 Advanced Tools for Data Science

Course Description:
The social Web is arguably the richest source of data in existence, however, collecting, managing, and analyzing social media data is not necessarily straight forward. While the Web is a mostly open and ubiquitous source of data, challenges like scale and ephemerality of data are challenges that must be overcome. Due to the heterogeneous nature of social media data, in terms of both acquisition methods and format, a sufficiently large toolbox of technologies and techniques must be used. Data scientists must make choices in terms of scalable data collection system architecture, extraction tools, and storage systems. While every data source is different, practical experience with tools and frameworks serve to provide the necessary foundation to design and implement the tools needed to collect any Web based data.

Course Objectives: This course provides in-depth instruction on the use of sophisticated analysis tools available to mine information from social media sources.

Credits: 3
Contact hours per week: 3

Learning Outcomes:
1.　Demonstrate an understanding of HTTP protocols, and REST methods.
2.　Demonstrating an understanding of JSON encodings
3.　Be familiar with a variety of data storage systems
4.　Have familiarity with ethical and legal considerations for social media data

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Main Topics:

- Basics of HTTP and REST
    - Avoid using larger frameworks like Scrapy; learn how to use lower level HTTP libraries like `requests` first
- Streaming/asynchronous APIs
    - E.g., Twitter streaming API
- HTML parsing
    - xpath/xquery; definitely ***do*** allow use of more complicated libraries; ensure that regex is never considered for HTML parsing!
- JSON
    - Heavy _heavy_ focus here
- RDBMS/hybrid dbs
    - Postgresql (with an emphasis on JSONB column types/queries)
- Document stores
    - ElasticSearch
    - MongoDB
    - There are other viable document stores as well; Mongo is quite easy to understand and has a pretty elegant distribution model and ES is pretty good for implementing more general use data access APIs.
- Job Queue Systems
    - Specifically in terms of horizontal scalability and implications with respect to IO bound work (which crawling is)
- Legal/ethical concerns
    - New SDNY case that dropped yesterday sets a bit of precedence that we can legally get whatever public data we want that is not behind an authentication wall.
    - Privacy implications (e.g., GDPR)

147

IS541: Mobile Applications for Social Networks

Course Description: The course provides an introduction to app development for both the iOS and Android platforms, with an emphasis on the use of mobile devices to access social network resources. Authorization tokens, RESTful APIs, and Web interfaces in general, will be discussed. Social networks and mobile devices present a range of privacy and ethical challenges; lectures will include consideration of the ethical and legal obligations of apps to protect user privacy, security, and anonymity.

Course Objectives: This course will provide an introduction to app development environments, along with their WYSIWYG user interface tools.

Credits: 3
Contact hours per week: 3

Learning Outcomes:

- Demonstrate proficiency with the Android Studio development environment
- Demonstrate proficiency with the Xcode development environment
- Be familiar with basic user interface developments in an object oriented paradigm
- Be familiar with Social Network APIs (Twitter, Facebook), and utilize libraries to access them
- Be familiar with the ethical and legal obligations for social network applications

Course Grading: Grading will be based on projects (60%), regular coding check-ins (20%), and peer reviews of software (20%)

Potential Textbooks: Course material is available with on-line documentation for both Android Studio and XCode. Documentation and tutorial material for API access to social network services are also available on-line.

IS542: Object Oriented Design with Design Patterns

Course Description

The course focuses on development of practical software development skill in Java, with an emphasis on Object Oriented Design and Design Patterns. Software projects will revolve around the use of Java to take advantage of large Information Systems applications. Provides the foundations of software development using Java and the data structures provided by Java. Problem solving using object-oriented programming techniques is emphasized. Topics include primitive and reference data types, variables, expressions, assignment, functions/methods, parameters, selection, iteration, recursion, exception handling, generic linear data structures, trees and maps, file types, file I/O, simple GUIs, programming to an interface, use of inheritance, Javadoc documentation, and introduction to Java streams and threads. Required laboratory provides supervised problem solving, programming using the command line as well as Eclipse or Netbeans development environments, code backup in a version control repository, debugging and JUnit testing techniques.

Course Objectives: This course is designed to provide a solid foundation in Object Oriented Programming using Java.

Credits: 3
Contact hours per week: 3

Prerequisites:

- IS501

Textbook: Big Java Early Objects, 7th Edition by Cay Horstmann, John Wiley and Sons (2018)

Learning Outcomes

Upon completion of this course students will understand and be proficient in the use and application of:

- Programming in Java using both the command line and an IDE
- Declaration, types and assignment of primitive variables in Java
- A variety number types and their range and precision
- Control flow constructs: if statements, while loops, do-while loops, for loops, enhanced for loops
- Methods and their parameters, return values. Method calls and arguments. Lambda expressions
- Arrays
- Simple recursive methods
- I/O for the console. Reading and writing binary and text files
- Interfaces, Classes and Objects, implementation of interfaces, subclasses and inheritance
- Variables declared as reference types and the concept of the run-time type (dynamic type) of a variable
- Lists (especially ArrayLists), Maps, Trees
- Programming with Streams
- Javadoc comments
- Overloading and overriding of methods. Polymorphism (dynamic dispatching of method calls)
- Simple JUnit testing and basic code debugging
- Exceptions and exception handling

In addition, they will have seen an introduction to the following:

- The call stack and activation records
- Diagrammatic representation of the run-time structure of objects and the connecting references between them
- Sorting and searching of arrays
- Big-Oh notation
- The definition and use of Java enums
- Java timers for animation
- Java Swing components and layout managers
- Event handling and user interaction using GUI interfaces supplied by the instructor.
- Java Streams (since Java 8)
- Java Modules (since Java 9)
- Simple methods to draw graphics on the screen using JComponent.
- Identification of classes and methods in the design of object-oriented software

Grading:

Final grade is based on:

- Exams in Class and Final*   35%
- Exams in Lab*   20%
- Quizzes and Lab Activities   10%
- Assignments   25%
- Project   10%

IS544: Web-Based Programming

Course Description: An in-depth understanding of programming for the World Wide Web: detailed coverage of widely used language(s) for web programming, asynchronous programming, principles of web architecture, web protocols, web design patterns, client-side programming, templating, server-side programming, a technical history of the web, web security. Students are expected to have experience with a modern programming language and will be assigned programming projects using current state-of-the-art web technologies.

Course Objectives: This course provides a foundation in the development of software applications designed for the web, particularly with Javascript.

Credits: 3
Contact hours per week:

Learning Outcomes: Upon successful completion of this course, students will be able to:

- Develop small applications in Javascript
- Demonstrate an understanding of web protocols and programming practices
- Demonstrate an understanding of the different technologies available in both web browsers and web servers

Main Topics:

- Javascript: 4-5 weeks.
- Asynchronous programming.
- Technical history of the web.
- HTTP protocol.
- Web architecture, Representational State Transfer (REST).
- Web services.
- Browser technologies.

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Potential Textbooks:
Web Design with HTML, CSS, JavaScript and JQuery, Duckett, Wiley
JavaScript: The Good Parts, Crockford, O'Reilly

IS553 Blockchain and Beyond

Course Description: There are a wide range of encryption and digital signature technologies, that are being deployed in new and surprising ways. Block chain, for example, has enabled decentralized currency systems such as Bitcoin, which may upend on-line commerce. The course focuses on these new technologies, and their applications, and on how large scale distributed information systems can empower them further.

Course Objectives: This course is designed to provide an introduction to Blockchain, and develop familiarity and proficiency in deploying it in a variety of application areas.

Credits: 3
Contact hours per week: 3

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Learning Outcomes: Upon successful completion of this course, students will be able to:

- Demonstrate an understanding of Blockchain systems
- Demonstrate an understanding of hashing techniques
- Utilize public key encryptions effectively
- Handle key distribution in a secure and reliable manner

Main Topics:
- Public key encryption systems
- Hash functions
- Digital signatures
- Bitcoin mining
- Merkle Trees
- Consensus protocols
- Applications of Block Chain

Potential Textbook: Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Bambara & Allen, McGraw-Hill

IS554: Data Analytics for Security

Course Description: For large distributed systems, vast quantities of data pass through, and there can be a wide range of requests made. Analyzing trends in data access, and the types of data passing through, can expose anomalies that may be caused by a cyber-attack, or a failure or misconfiguration of the system. This course provides a hands-on approach to applying data analytics technology to securing and maintaining large information systems.

Course Objectives: This course provides in-depth experience with data analytics software packages, to develop a practical hands-on skill set.

Credits: 3
Contact hours per week: 3

Learning Outcomes: Upon successful completion of this course, students will be able to:

- Demonstrate an understanding of data analytics techniques such as clustering and classification
- Demonstrate proficiency with a variety of data analytics tools
- Apply tools to practical problems such as intrusion detection

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Main Topics:

- Clustering
- Classification
- Rule Mining
- Anomaly Detection
- Malware Detection
- Spam Detection
- Fraud
- Intrusion Detection

Potential Textbook: Management of Information Security, Thompson.

IS558 Web and Database Security

Course Description:
The web, and web-connected databases, are the cornerstone of modern Internet activity. Their pivotal role makes them prime targets for cyber-attacks. Web servers such as Apache have a number of critical attack surfaces; understanding the correct configuration and use is essential. Similarly, large data databases have interfaces to public networks, with many ways to exploit them. This course provides practical training in the use of web servers and databases, so that they can be deployed securely as part of a large information system. Advanced topics in Web data management, with an emphasis on secure access, will be covered. New techniques for retrieving documents from search engines, including the use of links and user-behavior knowledge. Meta-search engine techniques, including resource discovery and result fusion. Database approaches for Web data management. Semi-structured data management, including data models, query languages and XML. Topics may vary when offered in different years.

Course Objectives: This course is designed to provide a practical understanding of security issues for web servers, and web-accessible databases.

Credits: 3
Contact hours per week: 3

Learning Outcomes: Upon successful completion of this course, students will be able to:

- Effectively configure the Apache Web Server, including package installation
- Configure SSL keys to ensure web server security
- Demonstrate an understanding of SQL servers, and how they may be attacked through script injections
- Demonstrate an understanding of cross-site scripting, and how it may be vulnerable to attack

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Main Topics:

- Configuration of the Apache Web server
- Package management for Apache
- Web Cookies and session logging
- SQL Injection attacks
- Cross-site scripting
- Database account management
- Configuration of SSL for Web Access
- Phishing attacks

Potential Textbook: Guide to Network Security Fundamentals, Ciampa, CompTIA Books.

IS559 Information Systems Security

Course Description:
This course focuses on techniques that approach cyber security problems in a principled manner using concepts from data mining, game theory, graph theory, and psychology. The intent of this course is to permit students to bridge the divide between real-world cyber threats and formal, scientific foundations of solutions that address such threats. Real-world cyber security issues, such as spamming, phishing attacks, malware, sybil attacks in social networks, and DDoS attacks, are used to illustrate how cyber threats can be modeled with abstract representations that are amenable to rigorous analysis and formal reasoning. The course also emphasizes the development of cyber defense mechanisms that are rooted in scientific foundations.

Course Objectives: This course is designed to provide an in-depth understanding of cybersecurity challenges, and in the design and configuration of information systems to make them resilient to attack.

Credits: 3
Contact hours per week: 3

Learning Outcomes: Upon successful completion of this course, students will be able to:

- Demonstrate an understanding of malware, phishing, and DDoS attacks
- Demonstrate familiarity with methods to thwart attacks, and to detect security vulnerabilities
- Have hands-on experience with security tools available to system administrators

Course Grading: Grading points will be based on 2 exams (50%), 6 assignments (30%), and 1 project (20%).

Main Topics:

- Authentication techniques
- Cryptography and Public Key systems
- Data encryption, and ensuring availability and integrity
- Accountability and non-repudiation
- Disaster recovery
- Cyber resiliency

Potential Textbook: Principles of Information Security, Whitman & Mattord, CENGAGE Learning

IS 500A: Information Systems Practicum I

Catalog Description:
This course emphasizes hands-on programming skills, along with developing familiarity with software development systems, software package management, and the use of a variety of software tools. Lectures and exercises will emphasize the use of practical software tools, scripting languages, and information handling techniques, to perform data mining and data analytics tasks.

This course is strongly recommended for students without extensive programming skills prior to entering into the program. This course does not count towards the 30-credit requirement for the program degree.

Pre-requisites: none

Credits: 3 credits

Format: Hands-on in-class programming, with some lectures.

Learning Outcomes:

- Develop proficiency software development tools, with an emphasis on Python and scripting languages;
- Competence with debugging and logging tools;

Grading: Final grades will be based on programming assignments (80%) and participation (20%).

IS 500B: Information Systems Practicum II

Catalog Description: Current topics in security, and hands-on use of analytics tools to help secure systems, will be emphasized. This course is meant to be complementary to security lectures from IS532 (Database Systems), and will provide introductions to many topics covered in cybersecurity electives. This course does not count towards the 30-credit requirement for the program degree.

Pre-requisites: none

Credits: 3 credits

Format: Lectures, with detailed discussion

Learning Outcomes:

- Develop a familiarity with attack vectors and methods to secure against them
- Gain practical experience with logging features available in a variety of systems

Grading: Final grades will be based on in-class assignments (80%) and participation (20%).

Position 1: Senior Lecturer/Program Director

Responsibilities: (1) Responsible for program management, leading outreach activities related to recruitment of students for the program, course scheduling and student counselling for the MS in Information Systems (MSIS) program. (2) Teach 1-2 required and elective courses for the MSIS program each semester.

Major Qualifications: Master's degree or Ph.D. in Information Systems or a closely-related discipline; extensive industrial experience in information systems desired; leadership/management experience; demonstrated evidence for effective teaching.

Additional Requirements: Candidates should be effective in delivering and supervising laboratory sessions. In addition to teaching and a commitment to diversity and inclusiveness, faculty members are expected to engage in curriculum and course development activities and service activities as needed.

Rank and Salary: The senior lecturer position is a professional position with a salary up to $80,000, depending upon experience.

Department: The MS in Information Systems is located within the Computer Science Department of the Thomas J. Watson School of Engineering & Applied Science. The Department has well-established Ph.D. and M.S. programs, an accredited B.S. program in Computer Science, and is on a successful and aggressive growth plan.

Binghamton University is an Equal Opportunity/Affirmative Action/Disability/Veterans Employer.

Position 2: Lecturer

Responsibilities: Teach 6 required and elective courses for the MSIS program during each academic year.

Major Qualifications: Master's degree or Ph.D. in Information Systems or a closely related discipline; demonstrated teaching experience within an Information Systems or a closely related program.

Additional Requirements: Candidates should be effective in delivering course material in both laboratory and lecture settings and have a commitment to diversity and inclusiveness. Expertise/experience in information security and cybersecurity. In addition to teaching, faculty members are expected to engage in curriculum and course development activities, as well as service to the school in a variety of ways as needed.

Rank and Salary: The lecturer position is a professional position with a salary up to $68,000, depending upon experience.

Department: The Computer Science Department (CS) is located within the Thomas J. Watson School of Engineering & Applied Science has well-established Ph.D. and M.S. programs, an accredited B.S. program, and is on a successful and aggressive growth plan.

Binghamton University is an Equal Opportunity/Affirmative Action/Disability/Veterans Employer.

Position 3: Tenure-Track Assistant Professor

Responsibilities: (1) Teach 3 required and elective courses for the MSIS program during each academic year; (2) conduct sponsored research; (3) provide services to the school and the research community; and (4) demonstrate a commitment to diversity and inclusiveness. Junior tenure-track faculty members have a significantly reduced teaching load for at least the first three years.

Major Qualifications: Applicants must have a Ph.D. in Information Systems or a closely related discipline with expertise in Database Systems, Data Mining, and Machine Learning by the appointment date. Strong evidence of research capabilities and commitment to teaching are essential.

Rank and Salary: This is a tenure-track assistant professor position with a salary of $100,000.

Department: The Computer Science Department (CS) located within the Thomas J. Watson School of Engineering & Applied Science has well-established Ph.D. and M.S. programs, an accredited B.S. program, and is on a successful and aggressive growth plan.

Binghamton University is an Equal Opportunity/Affirmative Action/Disability/Veterans Employer.

(See attached PDF files)

Overall, both reviewers were positive and supported the effort to develop the new program. They provided a number of detailed and helpful suggestions, which should strengthen the program, and improve the focus. Both recommended that the program move forward.

Their recommendations, and the proposal enhancements made to address them, are as follows.

- Both reviewers felt that software development requirements were excessive, and could be significantly reduced. There was concern that the proposed program was too closely aligned with CS, and that students might not perceive the distinctions.
    - We have changed the requirements and course program to focus on only one programming language, Python. Python is widely used for machine learning and data science applications, and is relatively easy to learn and to apply. We preserve the opportunity for students to take courses featuring Java and C++ as electives, should they choose to do so.
- The reviewers felt that the number of required courses was too high, and that students would prefer more flexibility in their studies.
    - We have reduced the number of required courses from four to three. Two courses that had been part of our core, which emphasized topics that were closer to CS, have been revised to reflect a more hands-on practical approach to the administration and use of large information systems.
- One reviewer felt very strongly that many students might wish to take individual courses on a part-time basis, and in piecemeal fashion. Rather than focusing on incoming graduate students who had a goal of completing an MS in a few years – he suggested that we consider working professionals who might take a course or two per year to enhance their skills, with a goal of preparing for commercial certification rather than a university diploma.
    - We have revised the proposed course offerings to reduce prerequisite requirements, and to make them more "stand-alone." This makes course sequencing easier for the students, and gives more flexibility in the selection of courses they take, but puts additional demands on staffing within the CS department.
    - The two new core courses, which were revised in accordance with the reviewer suggestions, are designed to prepare students for commercial certification exams if they choose to pursue them.
- Both reviewers felt that one of the tracks initially proposed, Systems Development, was too closely aligned to CS, and that it would not be attractive to potential students.
    - We have replaced the Systems Development track with a Web-Based Information Systems track. The tracks now considered are Cyber Security and Applied Data Science (which both reviewers supported), along with the new track which puts an emphasis on managing the unstructured information of the web.
- Reviewers voiced concern that some courses initially planned as cross-listing with computer science would not be perfectly aligned with the needs of information systems students.
    - We have revised the proposed curriculum to reduce the reliance on existing CS courses, adding a number of new courses. These new courses have some topic similarity to courses in CS, but will be customized and taught specifically for information systems students. The reviewers felt that the courses should be "practical, applied, hands on," and less theoretical in nature.
- The reviewers diverged on the approach to online education. One reviewer strongly advocated for the program to embrace online education at scale, and to do so quickly; he felt that the prominence and strength of the university would attract many students. The second reviewer was also optimistic, but felt that the best course of action would be to proceed carefully and cautiously.
    - While we appreciate the enthusiasm of the first reviewer, we plan to slowly expand into online courses. Binghamton has earned a reputation for high quality, affordable education, and we are determined to continue this tradition. Rapid growth into online courses have the potential of overwhelming the department. The proposed program is modestly sized, and will allow for close monitoring of individual students and course content, so that we can quickly identify and remedy any problems that arise.

In the long term, online education will likely become a major facet of the program – but this only makes sense if we have both the institutional resources to scale, and complete confidence in the course materials and how they are presented. We have selected the Distance Education option in this proposal and completed the Distance Education Format Proposal to be ready to move into online format in the future.

**Distance Education Format Proposal
For A Proposed or Registered Program**
Form 4
Version 2014-11-17

When a new or existing program is designed for a distance education format, a campus Chief Executive Officer or Chief Academic Officer should submit a signed cover letter and this completed form to the SUNY Provost at *program.review@suny.edu*. According to MSCHE, the 50% standard includes only courses offered in their entirety via distance education, not courses utilizing mixed delivery methods. Also, MSCHE requires that the first two programs for which 50% or more is offered through distance education be submitted for Commission review and prior approval of a substantive change.

- All campuses must complete the following sections: Sections 1 - 3, and Part B: Program Specific Issues.

- Part A must be completed if the proposing campus has not previously submitted this form with a completed Part A: Institution-wide Issues, or has made significant changes to its institution-wide distance education operations since last completing Part A. This applies even if the institution has programs registered to be delivered at a distance.

Section 1. General Information		
a) Institutional Information	Institution's 6-digit SED Code:	**211000**
	Institution's Name:	Binghamton University
	Address:	*4400 Vestal Parkway East, Binghamton, NY 13902*
b) Registered or Proposed Program	Program Title:	Information Systems
	SED Program Code	??
	Award(s) (e.g., A.A., B.S.):	Master of Science (M.S.)
	Number of Required Credits:	Minimum [30] If tracks or options, largest minimum [36]
	HEGIS Code:	[0702.00]
	CIP 2010 Code:	[11.0103]
c) Distance Education Contact	Name and title: Aondover Tarhule, Vice Provost and Dean of the Graduate School	
	Telephone: 607-777-2070 E-mail: atarhule@binghamton.edu	
d) Chief Executive or Chief Academic Officer Approval	**Signature affirms that the proposal has met all applicable campus administrative and shared governance procedures for consultation, and the institution's commitment to support the proposed program.** *E-signatures are acceptable.* Name and title:	
	Signature and date:	
	If the program will be registered jointly[1] with one or more other institutions, provide the following information for each institution:	

---

[1] If the partner institution is non-degree-granting, see SED's CEO Memo 94-04.

	Partner institution's name and 6-digit SED Code:
	Name, title, and signature of partner institution's CEO (or **append** a signed letter indicating approval of this proposal):

Year	Anticipated Headcount Enrollment			Estimated FTE
	Full-time	**Part-time**	**Total**	
1	40	2	42	
2	90 (50 new)	5	95	
3	110 (60 new)	7	117	
4	130 (70 new)	9	139	
5	150 (80 new)	10	160	

Section 3: Program Information

a) *Term length* (in weeks) for the distance program: **15 weeks**

b) Is this the same as term length for classroom program? [ ] No [X] Yes

c) How much "*instructional time*" is required per week per credit for a distance course in this program? (Do not include time spent on activities that would be done outside "class time," such as research, writing assignments, or chat rooms.)   *NOTE: See SUNY policy on credit/contact hours and SED guidance.*

   One hour of "instructional time" is required per week per credit.

d) What proportion or percentage of the program will be offered in Distance Education format? Will students be able to complete 100 percent of the program online? If not, what proportion will be able to be completed online?

   At least 50% of the program will be offered in Distance Education format. That refers to graduate courses that are offered asynchronously via our EngiNet distance learning program or MyCourses. Students complete course assignments and submit them to a course management system (MyCourses).

e) What is the maximum number of students who would be enrolled in an online course section?

   The maximum is 25.

Part A: Institution-wide Issues: Submit Part A only for the **first** Distance Education program proposed by your institution using this form. SUNY and the State Education Department will keep this in a master file so that your institution will not need to resubmit it for each new proposed online program, **unless there are significant changes, such as a new platform**.

Part A.1. Organizational Commitment

a) Describe your institution's planning process for Distance Education, including how the need for distance access was identified, the nature and size of the intended audiences, and the provisions for serving those audiences, including how each student's identity will be verified.

b) Describe your institution's resources for distance learning programs and its student and technical support services to ensure their effectiveness. What course management system does your institution use?

c) Describe how the institution trains faculty and supports them in developing and teaching online courses, including the pedagogical and communication strategies to function effectively. Describe the qualifications of those who train and/or assist faculty, or are otherwise responsible for online education.

d) If your institution uses courses or academic support services from ***another provider***, describe the process used (with faculty participation) to evaluate their quality, academic rigor, and suitability for the award of college credit and a degree or certificate.

e) Does your institution have a clear ***policy on ownership of course materials*** developed for its distance education courses? How is this policy shared with faculty and staff? ***NOTE:*** *You may refer to* [SUNY's statement on copyright and faculty ownership of instructional content](#)*, and/or faculty contract provisions.*

Part A.2. Learner Support

a) Describe how your institution provides distance students with ***clear information*** on:
- Program completion requirements
- The nature of the learning experience
- Any specific student background, knowledge, or technical skills needed
- Expectations of student participation and learning
- The nature of interactions among faculty and students in the courses.
- Any technical equipment or software required or recommended.

b) Describe how your institution provides distance learners with adequate ***academic and administrative support***, including academic advisement, technical support, library and information services, and other student support services normally available on campus. Do program materials clearly define how students can access these support services?

c) Describe how ***administrative processes*** such as admissions and registration are made available to distance students, and how program materials inform students how to access these services.

d) What ***orientation*** opportunities and resources are available for students of distance learning?

Part B: Program-Specific Issues: Submit Part B for each new request to add Distance Education Format to a proposed or registered program.

Part B.1. Learning Design

a) How does your institution ensure that the ***same academic standards and requirements*** are applied to the program on campus and through distance learning? If the curriculum in the Distance Education program differs from that of the on-ground program, please identify the differences.

Lectures will be recorded live on-campus and digitally captured using Panopto or Camtasia. The recorded lectures will be posted to a course management system (MyCourses). Course materials, including lecture notes, will be posted to MyCourses. Students enrolled in a distance learning section will need to meet course deadlines for assignments and exams, which will be the same deadlines for students enrolled in the on-campus section of that course. The instructors will use the same set of standards as for the on-campus section.

b) Are the courses that make up the distance learning program offered in a sequence or configuration that allows *timely completion of requirements*?

The required courses for our graduate programs will be offered at least once a year, along with an online section. This format will accommodate the distance learning students. Full-time students enrolled in the online courses will be able to complete the Master program in 1.5-2 years. Part-time students will be able to complete their Master program in 3-4 years.

c) How do faculty and others ensure that *the technological tools* used in the program are appropriate for the content and intended learning outcomes?

EngiNet has been in operation for over two decades on the Binghamton University campus, delivering courses asynchronously with our on-campus sections of those courses. The University's LMS (MyCourses) provides appropriate means to deliver educational content asynchronously.

d) How does the program provide for appropriate and flexible interaction between faculty and students, and among students?

The programs will use several strategies to promote student connectivity and engagement. Academic advisement will be conducted via emails, teleconference meetings, and/or WebEx meetings. The University's LMS (MyCourses) will continue to provide blogs and discussion boards that facilitate discussions and exercises among the on-campus and online students.

e) How do faculty teaching online courses verify that the student who registers in a distance education course or program is the same student who participates in and completes the course or program and receives the academic credit?

Each student is assigned a unique sign-in and password for access to our University's LMS. The Center for Learning and Teaching (CLT) vetted a series of online verification software packages for the university. These measures would be used in addition to the university's standard authentication processes.

Part B.2. Outcomes and Assessment

a) Distance learning programs are expected to produce the *same learning outcomes* as comparable classroom-based programs. How are these learning outcomes identified – in terms of knowledge, skills, or credentials – in course and program materials?

Our online courses will be offered asynchronously with the on-campus courses. Lectures will be recorded live on-campus and digitally captured using Panopto or Camtasia. Students enrolled in an online section of a course will have to meet course deadlines for assignments and exams, similar to students enrolled in the on-campus section of that course. The learning outcomes of the online section will be the same as for the on-campus section.

b) Describe how the *means chosen for assessing student learning* in this program are appropriate to the content, learning design, technologies, and characteristics of the learners.

The same means will be used for assessing student learning in both our on-campus and online sections of the courses.

Part B.3. Program Evaluation

a) What process is in place to monitor and *evaluate the effectiveness* of this particular distance education program on a regular basis?

Several evaluation tools will be used to monitor and evaluate the effectiveness of on-campus programs and online programs:
- **Student Opinion of Teaching (SOOT) survey will be administrated for all courses through MyCourses.**
  The survey uses a Likert Scale to assess students' perception of the quality of course preparation and teaching, instructor's knowledge in the course materials, and usefulness of instructional materials and assignments.
- **Learning objectives will be assessed through evaluation measures used in classes, including assignments, exams, etc.**

- **Students completing the program will be included in the Graduate School's established post-graduation program evaluations.**

b) How will the evaluation results will be used for *continuous program improvement*?

The Department of Computer Science conducts end-of-the-semester course reviews with the faculty, two times a year, in accordance with the general Middle States assessment process. During those reviews, the student outcomes for the courses will be measured, the overall scores will be determined, problems/issues will be identified, and solutions will be proposed to address the problems/issues.

c) How will the evaluation process assure that the *program results in learning outcomes appropriate to the rigor and breadth* of the college degree or certificate awarded?

The evaluation process for the online program will be the same as that for our on-campus programs.

Part B.4. Students Residing Outside New York State

SUNY programs must comply with all "authorization to operate" regulations that are in place in other U.S. states where the institution has enrolled students or is otherwise active, based on each state's definitions.

a) What processes are in place to monitor the U.S. state of residency of students enrolled in any distance education course in this program while residing in their home state?

Residency status of each student is initially established based on admissions data. Students may apply through the Office of Student Accounts to change their residency status. Residency classification is determined by a review of all of the information provided on the admissions application in accordance with
guidelines provided by SUNY's Residency Policy.

b) Federal regulations require institutions delivering courses by distance education to provide students or prospective students with contact information for filing complaints with the state approval or licensing entity in the student's state of residency and any other relevant state official or agency that would appropriately handle a student's complaint. What is the URL on your institution's website where contact information for filing complaints for students in this program is posted? *NOTE: Links to information for other states can be found at here.*

For summer session students: http://www.binghamton.edu/clt/summer-session/academic-information.html
For winter session students: http://www.binghamton.edu/clt/winter-session/academic-information.html
For all students, the university Ombudsman: http://www.binghamton.edu/ombudsman/index.html