NEW GRADUATE CONCENTRATION PROPOSALS
ARIZONA STATE UNIVERSITY
GRADUATE EDUCATION

This form should be used for academic units wishing to propose a new concentration for existing graduate degrees.

A concentration is a subspecialty within a degree and major. It indicates the fulfillment of a designated, specialized course of study, which qualifies the student with skills and training in one highly concentrated area of the major. Concentrations are formally-recognized educational designations (including the assignment of a university plan code for reporting/record-keeping purposes and appearance on the ASU transcript). Concentrations are distinguished from more informal academic distinctions such as "emphases," "tracks," "foci," "options," etc.

Submit the completed and signed (chairs, unit deans) proposal to the **Office of Graduate Academic Programs**, mail code 1003 and electronic copies to eric.wertheimer@asu.edu or amanda.morales-calderon@asu.edu.

Please type.

Contact Name(s): K. Selcuk Candan	**Contact Phone(s):** 5-2770
College/School/Division Name: Ira A. Fulton Schools of Engineering	
Academic Unit Name: (or proposing faculty group for interdisciplinary proposals) School of Computing, Informatics, and Decision Systems Engineering	
Existing Graduate Degree and Major under which this concentration will be established: Master of Computer Science (MCS) in Computer Science	
Proposed Concentration Name: Big Data Systems	
Requested Effective Term and Year: FALL 2014	
Do Not Fill in this information: Office Use Only **Plan Code:**	**CIP Code:**

1. Overview

A. Provide a brief description (*not to exceed 150 words*) of the new concentration (including the focus of the new concentration, relationship to other concentrations within this degree program, etc).

Furthering the ongoing technological revolution necessitates a new crop of data engineers with solid systems, engineering, algorithmic, and mathematical backgrounds and excellent data management and analysis skills. The concentration will meet the growing need for data scientists and engineers that can architect, implement, and manage large data systems for industry and scientific discovery. The concentration will provide expertise in designing scalable (parallel, distributed, and real-time) systems for acquiring, storing, securing, and accessing large-scale heterogeneous multi-source data over its life cycle and in using analytical tools to mine information from the data. The proposed concentration will not overlap with any existing concentrations. While this concentration places extra emphasis on practical applications and targets individuals seeking to expand their knowledge through the completion of a project portfolio, a companion concentration proposal under the MS in Computer Science program features strong emphasis on student research. The concentration will be offered through on-campus core and elective courses. Projected enrollment is 25 students after three years with 15 graduating per year.

2. Impact Assessment

A. Explain the unit's need for the new concentration (e.g., market demand, research base, direction of the discipline, and interdisciplinary considerations). How will the new concentration complement the existing degree program, including enrollment, national ranking, etc.?

There is increasing demand from industry and government for engineers with solid systems, engineering, algorithmic, and mathematical backgrounds and excellent data management and analysis skills. The proposed concentration will fill a gap in the existing degree program by data scientists and engineers that can architect, implement, and manage large data systems for industry and scientific discovery. This will help both recruitment of graduate students and will facilitate improved relationships with industry, including internships, fellowships, and joint research endeavors. The program will include research, case studies, and representatives from the industry and government to provide a holistic perspective in research and teaching and have direct local and national impact.

B. Please identify other **related** ASU programs and describe how the new concentration will complement these existing ASU programs? **(If applicable, statements of support from affected academic unit administrators should be included with this proposal submission.)**

There is only one graduate program that related to the proposed concentration: "Master of Science in Business Analytics" in W.P. Carey School of Business. The focus of that degree is to deepen students' understanding of analytical methods and computational tools to serve as business analysts. The focus of the proposed concentration, in contrast, is to educate computer scientists (more specifically data scientists and engineers) in architecting, implementing, and managing scalable data systems for knowledge discovery in diverse application domains, from science, government, to industry.

C. Is this an interdisciplinary concentration? If yes, please address the relationship of the proposed concentration to other existing degree programs and any parallel or similar concentrations in those degree programs. **(Please include relevant Memoranda of Understanding regarding this interdisciplinary concentration from all applicable academic units.)**

No. The proposed concentration will be entirely housed within the Computer Science graduate program in the School of Computing, Informatics, and Decision Systems Engineering.

3. Academic Requirements and Curriculum

A. What are the total minimum hours required for the major and degree under which the proposed concentration will be established?

Students must take the 30 credits of coursework.

B. Please provide the admissions criteria for the proposed concentration. If they are identical to the admission criteria for the existing major and degree program under which this concentration will be established, you may attach a copy of these criteria as they appear on the departmental website, or other source (please indicate source). Please also list all undergraduate and graduate degrees and/or related disciplines that are required for admission to this concentration program.

In addition to completing the ASU Graduate Admissions application, the following materials must also be submitted to complete the application package:

U.S. Residents:

- One set of official transcripts from every college and university attended, including ASU, unless the student graduated from ASU
- Official GRE test scores
- Three letters of recommendation
- Statement of purpose

International Applicants:

- Academic credentials (all international records must be submitted in the original language accompanied by an official English translation). If the student has attended a U.S. institution, one set of official transcripts from every college and university attended, except ASU.
- Official GRE General test scores taken within the last five years
- Official TOEFL score, taken within the last two years (only required for those who did not graduate with a baccalaureate degree from an accredited U.S. institution). The TOEFL score must be valid on the first day of class for the term the student is applying for. CIDSE requires that TOEFL scores must be above 575 (paper), or 90 (iBT), or minimum IELTS is an overall band scores of 7.0.
- Three letters of recommendation
- Statement of purpose

For students seeking a Masters in Computer Science, the GRE is not required by students who have graduated from ASU's undergraduate B.S. in Computer Science or the B.S.E. in Computer Systems Engineering degree programs.

Knowledge in calculus is required to be successful in a CIDSE Graduate Program. Below you will find the calculus courses that must be completed with a grade of 'C' or better prior to applying to the program. The admissions committee will review the student's application and make the determination.

Program	Calculus Requirement
Computer Science	CALC 1 & 2 or equivalent (CALC 3 or equivalent is recommended)

Below are the minimum GPA requirements. This GPA is calculated from the last 60 hours of the undergraduate degree.

Program	GPA Requirement
Computer Science	3.25 or higher

Students who do not meet the minimum GPA requirement can schedule an appointment with a CIDSE Graduate Academic Advisor.

At the time of application there should be no more than three deficiency courses pending in the following list (deficiency prerequisites are for non-computer science bachelor degree holders). The admissions committee will review the student's application and make the determination of equivalence:

- CSE 230 COMPUTER ORGANIZATIONS AND ASSEMBLY LANGUAGE PROGRAMMING (3)

  Register-level computer organization. Instruction set architecture. Assembly language. Processor organization and design. Memory organization. IO programming, Exception/interrupt handling.

  Prerequisites: Pre-requisite: CSE 120 or EEE 120 with C or better; CSE 100, 110 or 200 with C or better OR Computer Science or Computer Systems Engineering Graduate student.

- CSE 310 DATA STRUCTURES AND ALGORITHMS (3)

  Advanced data structures and algorithms, including stacks, queues, trees (B, B+, AVL), and graphs. Searching for graphs, hashing and external sorting.

  Prerequisite: Pre-requisite with C or better: CSE 220 or 240; MAT 243 (CMS students may sub MAT 300); Comp Sys Engineering, Comp Sci, Informatics, Engr Mgt, Computational Math Sci, Geographic Information Sci or Biomedical Informatics or CSE grad student.

- CSE 340 PRINCIPLES OF PROGRAMMING LANGUAGES (3)

  Formal syntactic and semantic descriptions, compilation and implementation issues, and theoretical foundations for several programming paradigms.

  Prerequisites: Computer Systems Engineer BSE or Computer Science BS student; CSE 310 with C or better; CSE 230 or EEE 230 with C or better OR CSE Graduate student.

- CSE 355 INTRODUCTION TO THEORETICAL COMPUTER SCIENCE (3)

  Introduction to formal language and automata, Turing machines decidability/undecidability, recursive function theory, and complexity theory. Prerequisite: Computer Systems Engineering BSE or Computer Science BS students; CSE 310 with C or better OR CSE Graduate student

- CSE 360 INTRODUCTION TO SOFTWARE ENGINEERING(3)

  Software life cycle models; project management, team development environments and methodologies; software architectures; quality assurance and standards; legal, ethical issues.

  Prerequisite: Computer Systems BSE or Computer Science BS or Geographic Information Science BS or Engineering Mgmt BSE student or Biomedical Informatics BS; CSE 220 or 240 with C or better, or Computer Science Graduate student.

- CSE 430 OPERATING SYSTEMS (3)

  Operating system structure and services, processor scheduling, concurrent processes, synchronization techniques, memory management, virtual memory, input/output, storage management, file systems.

  Prerequisites: Computer Systems Engineering BSE or Computer Science BS student; CSE 230 or EEE 230 with C or better; CSE 310 with C or better OR CSE Graduate student.

C. If the proposed concentration is part of a larger, interdisciplinary agenda, please provide additional admission information related to students who may enter with various academic backgrounds, including expected entry-level competencies. As applicable, please also address the courses that must be taken to remedy any relevant deficiencies for incoming students.

The proposed concentration is not part of a larger, interdisciplinary agenda.

D. What knowledge, competencies, and skills (learning outcomes) should graduates have when they complete this proposed concentration program? Examples of program learning outcomes can be found at (https://uoeee.asu.edu/program-outcomes).

1. The graduates of the concentration will be able to make informed decisions regarding data storage, indexing, querying, and retrieval. They will be able to reason about query optimization and execution alternatives and will be able to plan within the trade-offs introduced by concurrency control, transaction management, and recovery protocols and algorithms.
2. The graduates will have acquired knowledge regarding cutting-edge algorithms and systems for
    a. temporal and spatial data analyses,
    b. summarization, cleaning, visualization, anomaly detection,
    c. real-time processing for streaming data,
    d. representations and fusion for unstructured/structured data, semantic Web,
    e. graph-based models, social networks, and
    f. performance and scalability, distributed architectures.
3. The graduates will be able to use as well as develop high performance distributed and/or parallel data architectures that can match the scale of the data and support split second decision making, through data fusion and integration and analysis and forecasting algorithms.
4. The graduates will be able to use as well as develop real-time, on-line data processing systems for temporally and spatially distributed observations for “data in motion” in applications, including those that include mobile applications, location-aware services, and human behavior modeling at individual and population scales.
5. The graduates will be able to use as well as develop scalable batch processing systems for “data at rest”.
6. The graduates will be able to use as well as develop tools that support entity analytics, (social and other) network analytics, text analytics, and media analytics not for traditional applications like monitoring and security, but also for emerging applications, including enabling interest detection for retail/advertisement, social media, energy, healthcare, and finance.
7. The graduates will be able to use tools and develop frameworks for federated and cloud based data storage, analysis, and modeling and mediated data services delivery.
8. The graduates will be able to use tools and develop frameworks that can make unstructured data queriable, prioritize and rank data, correlate and identify the gaps in the data, highlight what is normal and not normal, and automate the ingest of the data. The graduates will also learn algorithms, techniques, and tools for reducing the size and/or dimensionality of the data to make data amenable to analysis.
9. The graduates will be able to design and develop adaptive systems that take into account known models, but also adapt the models to new emerging patterns. Graduates will also be able to use tools and develop systems that can go back in history to validate models and go forward into future to support forecasting and if-then hypothesis testing.
10. The graduates will be to make informed architectural decisions based on a good understanding on how available technologies differ and complement each other and what scalability/consistency trade-offs they provide. They will be able to pick and deploy the appropriate data management, processing, and analysis systems (including commercial and open-source) with the suitable structured or unstructured data model for the particular task and domain application needs.
11. The graduates will have the necessary skills to communicate with technical and non-technical co-workers

E. How will students be assessed and evaluated in achieving the knowledge, competencies, and skills outlined in 3.D. above? Examples of assessment methods can be found at (http://www.asu.edu/oue/assessment.html).

The goal of the assessment is to verify that students demonstrate understanding of scholarly learning in computer science and big data systems and are able to produce and communicate technical results, as outlined in Section 3.D. The assessment process and structure are further detailed below:

Outcome (Section D)	Assessments (for course descriptions, see Section F)
1	Midterm in CSE510, Final in CSE510, Project in CSE510, Midterm in CSE512, Final in CSE512, Project in CSE512.
2a	Midterm in CSE515, Project in CSE515,
2b	Midterm in CSE572, Final in CSE572, Project in CSE572
2c	Final in CSE510
2d	Midterm in CSE591 (SWM), Final in CSE591 (SWM), Project in CSE591 (SWM)
2e	Midterm in CSE515, Midterm in CSE572, Project in CSE572
2f	Final in CSE510, Project in CSE510, Final in CSE512, Project in CSE512, Final in CSE591 (VCC), Project in CSE591 (VCC).
3	Projects in CSE510, CSE591 (VCC), CSE572, CSE 591 (SWM).
4	Projects in CSE512 and CSE572 .
5	Projects in CSE510 and CSE591 (VCC)
6	Projects in CSE572, CSE575, and CSE591 (DV)
7	Projects in CSE512 and CSE591 (VCC).
8	Midterm and final exams and projects in CSE 515, CSE 572, and CSE575.
9	Projects in CSE 572 and CSE591 (DV)
10	Final exams and projects in CSE510, CSE512, and CSE591 (VC).
11	Culminating experience reports

Each of these assessments, except for the culminating experience report (i.e., project portfolio), will be measured in a scale of 0-100 point scale. The project portfolio will be assessed at ASU letter scale. Each assessment tool will be designed to measure student recall, comprehension, application, analysis, synthesis, and/or evaluation (judging by criteria) abilities, depending on the nature of the outcome. In addition, we will also use analytic and holistic rubrics and indirect measures, including student/alumni surveys, job placement data, and student course evaluations, to assess and evaluate the effectiveness of the concentration in achieving the knowledge, competencies, and skills outlined in 3.D.

- Satisfactory program performance is indicated when more than 80% of the students satisfactorily demonstrate advanced scholarly learning in computer science and big data systems by obtaining a grade of 80 or better on their first attempt on the examinations and project deliverables.
- Satisfactory program performance is indicated when more than 80% of the students will successfully demonstrate advanced scholarly learning in computer science and big data systems and ability to produce and communicate technical results by preparing and obtaining a grade of B or better for their portfolio.
- Satisfactory program performance is also indicated when more than 90% of the students completing the program are appropriately employed in an area utilizing the knowledge skills developed in the program or in further graduate study.

F. Please provide the curricular structure for the proposed concentration.

Each MCS in computer science student defines a potentially unique program of study subject to approval by the graduate programs office and Graduate Education. The student must complete a minimum of 30 credit hours of approved graduate-level work. At least 24 of the 30 credit hours must be computer science and engineering (CSE) 500-level credits at ASU. At least 30 hours must be for formal course work (including CSE 591 but excluding credits for CSE 590 Reading and Conference). Students must complete one course in three areas to cover a wide range of knowledge. The three areas are:

applications: courses are in the areas of artificial intelligence, databases, graphics and multimedia

foundations: courses focus on algorithms, mathematical logic and computer science theory

systems: courses cover topics in architecture, networks, operating systems and software engineering

At least two out of the three area courses must be at 500 level (not CSE 598). The classes listed as 400 level must be taken as CSE 598. Concentration students must complete 15 credit hours on big data systems courses, including the following three required courses and any two courses in the list of electives listed below:

Required Core Courses for the Degree			**Credit Hours**
Students are required to take at least 3 courses from each of the areas listed below as a core requirement with academic advisor approval. See attached list of existing courses in Attachment A.			**9**
Foundations			**3**
Systems			**3**
Applications			**3**
Required Concentration Courses			**Credit Hours**
(Prefix & Number)	*(Course Title)*	*(New Course?) Yes or No?*	**9**
CSE510	Database Management System Implementation	No	3
CSE512	Distributed Database Systems	No	3
CSE572 or IEE520	Data Mining or Statistical Learning for Data Mining	No	3
Elective or Research Concentration Courses *(as deemed necessary by supervisory committee)* *Students choose two courses from the list below for a total of six credit hours.*			**Credit Hours**
(Prefix & Number)	*(Course Title)*	*(New Course?) Yes or No?*	**(Insert Section Sub-total)** **6**
CSE575	Statistical Machine Learning	No	3
CSE 591	Topic: Data Visualization (DV)	Currently special topics: will be made a regular course	3
CSE591	Topic: Virtualization and Cloud Computing (VCC)	Currently special topics: will be made a regular course	3
CSE591	Topic: Semantic Web Mining (SWM)	Currently special topics: will be made a regular course	3
CSE515	Multimedia and Web Databases	No	3
Note: Additional elective coursework may be required. *If the student takes CSE510, CSE512, CSE572, or CSE515 as part of the 9 credit core courses for the MCS degree, then the student has to take 3 additional credits to ensure that the total credit hours is equal to 30.*			0-3
Culminating Experience ***E.g.*** *- Capstone project, applied project,* ***thesis*** *(****masters only*** *– 6 credit hours) or* ***dissertation*** *(****doctoral only*** *– 12 credit hours) as applicable*			**Credit Hours** **(Insert Section Sub-total)**

Portfolio	**0**
Other Elective or Research Courses	**Credit Hours (Insert Section Sub-total) 6**
Students choose six credit hours of other elective or research coursework approved by their academic advisor.	**6**
Total required credit hours	**30**

G. Please describe the primary course delivery mode, (e.g., online, face-to-face, off-site etc.). **Please note:** If this proposed initiative will be offered **completely** online, clearly state that in this section, and fill out the applicable section in the Operational Appendix.

Face-to-face.

H. Please **describe** the culminating experience(s) required for completion of the existing degree and major, and the proposed concentration (e.g., thesis, dissertation, comprehensive exams, capstone course(s), practicum, applied projects, etc.).

The MCS degree requires 30 credit hours and a 3-course project portfolio. The proposed concentration will require that 2 out of 3 projects in the portfolio will be from required/elective concentration courses in which the student received a "B"(3.00) grade or higher.

This entails completing a project in three Engineering 500 level courses (excluding CSE 598 courses and can include CSE 591 courses) in which a final grade of at least “B” was earned in each course, and creating a portfolio for approval by the Graduate Program Director. Students must write the portfolio reports in a typewritten format approximately 10 pages in length. Students must include an overview on each of the three projects and what was learned during the projects. If the project was a group project, then the individual contribution of the student must be identified. The Project Portfolio may include a relevant bibliography. The faculty of the courses the student is using for the portfolio report must sign and date the portfolio cover sheet. After the Graduate Program Director is satisfied with the student’s Project Portfolio, the Report of Final Master’s Culminating Experience form will be signed. The Project Portfolio must be submitted to the graduate advisor along with the Report of Final Master’s Culminating Experience form and the Report of Final Master’s Culminating Experience form is sent to Graduate Education for processing.

I. Please **describe** any other requirements for completion of the existing degree and major, and the proposed concentration (e.g., internships, foreign language skills, etc.).

The proposed concentration does not have any additional requirements.

J. **For interdisciplinary programs**, additional sample curricular structures must be included as appendix items to this proposal relating to students with various academic backgrounds who may pursue the proposed concentration, including expected mastery of core competencies (e.g., course work, skills, and/or knowledge).

The proposed concentration is not part of an interdisciplinary program.

4. Administration and Resources

A. How will the proposed concentration be administered (including recommendations for admissions, student advisement, retention etc.)? Describe the administering body in detail, especially if the proposed concentration is part of a larger interdisciplinary initiative. How will the graduate support staffing needs for this proposed concentration program be met?

The proposed concentration will be administered within the existing admission, advising, and administration structured of the Computer Science graduate program and CIDSE.

B. How many students will be admitted immediately following final approval of the concentration? What are enrollment projections for the next three years?

Up to 15 students will be admitted immediately following approval of the concentration. The enrollment projection within three years is 25 students after three years with 15 graduating per year.

C. What are the resource implications for the proposed concentration, including any projected budget needs? Will new books, library holdings, equipment, laboratory space and/or personnel be required now or in the future? If multiple units/programs will collaborate in offering this concentration please discuss the resource contribution of each participating program. Letters of support must be included from all academic units that will commit resources to this concentration.

- Teaching Assistant: The courses that are included in the concentration are software and systems project oriented and thus require, overall 2-3 teaching assistants per semester. These will be assigned in accord with the School's standard course support procedures.
- Lab creation and maintenance: Since the projects will involve scalable data management and analysis, the concentration will require a (potentially virtual) cluster of 20-30 servers. We will use open source software (except Matlab). The setup will be managed using existing CIDSE and ETS technical staff.
- Course release for course redesign: The revamping of the existing curricular material to be aligned with the proposed concentration (together with the companion MS concentration) will require 1 semester course release for 1 faculty.
- New faculty hiring: While there is sufficient faculty to start and deliver the concentration for one to two years, in the longer term, the concentration (together with the companion MS concentration) requires 2 new data systems oriented faculty members. An open search is currently being conducted as part of the normal hiring process in CIDSE.

D. Please list the primary faculty participants in this proposed concentration.

Name	*Title*	*Area(s) of Specialization as they relate to proposed concentration*
K. Selcuk Candan	Professor	Databases and data management
Hasan Davulcu	Assoc. Professor	Databases and data extraction
Dijuang Huang	Assoc. Professor	Data clouds
Huan Liu	Professor	Data mining and analysis
Ross Maciejewski	Assistant Professor	Data visualization
Jieping Ye	Assoc. Professor	Data analysis
George Runger	Professor	Data mining

E. Is there a graduate faculty structure for this concentration program that will differ from the original degree program graduate faculty structure (***for PhD programs only***)? If yes, please include the name of the graduate faculty group and whether they will participate in offering this concentration.

No.

5. Additional Material — Please attach any additional information that you feel relates to the proposed concentration. **(Please label accordingly, i.e., Appendix or Attachment A, B, etc.)**

Approvals *(if the proposal submission involves multiple units, please include letters of support from those units)*

DEPARTMENT CHAIR or SCHOOL DIRECTOR

SIGNATURE — DATE: 2/14/14

DEAN (Please print or type)

June L Coldfelt

SIGNATURE — DATE: 3/19/14

The following section will be completed by Graduate Education following the recommendations of faculty governance bodies.

VICE PROVOST FOR GRADUATE EDUCATION

SIGNATURE — DATE

Please note: Proposals for new concentrations also require the review and recommendation of approval from the University Graduate Council, Curriculum and Academic Programs Committee (CAPC), the Academic Senate (Information item only), and the Office of the Provost before they can be put into operation.

The final approval notification will come from the Office of the Provost.

GF1112E-92

APPENDIX

OPERATIONAL INFORMATION FOR GRADUATE PROGRAMS

(This information is used to populate the Graduate Programs Search/catalog website.)

1. Provide a brief (catalog type - no more than 150 words) **program description**.

The Big Data Systems concentration under the MCS in Computer Science degree program is designed for graduate students who want to pursue a thorough education in the area of big data systems. The goal of this concentration is to provide students the knowledge, skills and the advanced development capability expertise in designing scalable (parallel, distributed, and real-time) systems for acquiring, storing, processing, and accessing large-scale heterogeneous multi-source data and in using analytical tools to mine information from the data. The graduates will be able to pick and deploy the appropriate data management, processing, and analysis systems with the suitable structured or unstructured data model for the particular task and domain application needs. The concentration will meet the growing need for data scientists and engineers that can architect, implement, and manage large data systems and, thus, students will have a competitive advantage to secure employment.

2. Campus(es) where program will be offered:

*** To select desired box**, place cursor on the left side of the box, right click mouse, select ***Properties***, under ***Default Value*** select ***Checked***, press ***OK*** and the desired box will be checked.

☐ **ASU Online only (all courses online)** – (Office of the Provost and ASU Online approval is needed)

All other campus options (please select all that apply):

☐ Downtown ☐ Polytechnic

☒ Tempe ☐ West

☐ **Both** on-campus **and** ☐ ASU Online **(*)** – Office of the Provost and ASU Online approval is needed for this option. (Check applicable campus from options listed).

3. Keywords: (List all keywords that could be used to search for this program. Keywords should be specific to the proposed program.)

Data, big data, scalability, data volume, data variety, data velocity, data veracity, databases, DBMS, storage, indexing, querying, retrieval, query optimization, concurrency, consistency, transaction, data mining, data analysis, spatial data, summarization, clustering, cleaning, anomaly detection, feature selection, recommender systems, data streaming, data fusion, unstructured data, semi-structured data, graph-data, distributed databases, data integration, parallel databases, data warehouses, NoSQL, MapReduce, relational data, sensor data, personal data, mobile data, scientific data, spatial data, temporal data, multimedia data, social data, social media, data in motion, data at rest, entity analytics, machine learning, network analytics, graph analytics, text analytics, media analytics, data cleaning, data quality, data ingest, dimensionality reduction, data clouds, data assurance, pattern analysis, data scalability, data processing, semantic web, RDF, data alignment, data models, column stores, key-value stores, data-as-a-service, multi-tenant DBMSs, data visualization

4. Area(s) of Interest:

*** To select desired box**, place cursor on the left side of the box, right click mouse, select ***Properties***, under ***Default Value*** select ***Checked***, press ***OK*** and the desired box will be checked

A. Select **one (1)** primary area of interest from the list below that applies to this program.

☐ **Architecture & Construction**
☐ **Arts**
☐ **Business**
☐ **Communication & Media**
☐ **Education & Teaching**
☐ **Interdisciplinary Studies**
☐ **Law & Justice**
☐ **Mathematics**
☐ **Psychology**
☐ **STEM**

- ☒ **Engineering & Technology**
- ☐ **Entrepreneurship**
- ☐ **Health & Wellness**
- ☐ **Humanities**
- ☐ **Science**
- ☐ **Social and Behavioral Sciences**
- ☐ **Sustainability**

B. Select **one (1)** secondary area of interest from the list below that applies to this program.

- ☐ **Architecture & Construction**
- ☐ **Arts**
- ☐ **Business**
- ☐ **Communications & Media**
- ☐ **Education & Teaching**
- ☐ **Engineering & Technology**
- ☐ **Entrepreneurship**
- ☐ **Health & Wellness**
- ☐ **Humanities**
- ☐ **Interdisciplinary Studies**
- ☐ **Law & Justice**
- ☐ **Mathematics**
- ☐ **Psychology**
- ☐ **STEM**
- ☒ **Science**
- ☐ **Social and Behavioral Sciences**
- ☐ **Sustainability**

(NEW GRADUATE INITIATIVES)

PROPOSAL PROCEDURES CHECKLIST

Academic units should adhere to the following procedures when requesting new curricular initiatives (degrees, concentrations or certificates).

☐ **Obtain the required approval from the Office of the Provost to move the initiative forward for internal ASU governance reviews/approvals.**

- Establishment of new curricular initiative requests; degrees, concentrations, or certificates
- Rename requests; existing degrees, concentrations or certificates
- Disestablishment requests; existing degrees, concentrations or certificates

☐ **Submit any new courses that will be required for the new curricular program to the Curriculum ChangeMaker online course approval system for review and approval.**

- Additional information can be found at the Provost's Office Curriculum Development website: Courses link
- For questions regarding proposing new courses, send an email to: courses@asu.edu

☐ **Prepare the applicable proposal template and operational appendix for the proposed initiative.**

- New degree, concentration and certificate templates (contain proposal template and operational appendix) can be found at the Provost's Office Curriculum Development website: Academic Programs link

☐ **Obtain letters or memos of support or collaboration. (if applicable)**

- When resources (faculty or courses) from another academic unit will be utilized
- When other academic units may be impacted by the proposed program request

☐ **Obtain the internal reviews/approvals of the academic unit.**

- Internal faculty governance review committee(s)
- Academic unit head (e.g. Department Chair or School Director)
- Academic unit Dean (will submit approved proposal to the curriculumplanning@asu.edu email account for further ASU internal governance reviews (as applicable, University Graduate Council, CAPC and Senate)

Additional Recommendations - All new graduate programs require specific processes and procedures to maintain a successful degree program. Below are items that Graduate Education strongly recommends that academic units establish after the program is approved for implementation.

☐ **Set-up a Graduate Faculty Roster for new PhD Programs** – This roster will include the faculty eligible to mentor, co-chair or chair dissertations. For more information, please go to http://graduate.asu.edu/graduate_faculty_initiative.

☐ **Establish Satisfactory Academic Progress Policies, Processes and Guidelines** – Check within the proposing academic unit and/or college to see if there are existing academic progress policies and processes in place. If none have been established, please go to http://graduate.asu.edu/faculty_staff/policies and scroll down to the **academic progress review and remediation processes** (for faculty and staff) section to locate the reference tool and samples for establishing these procedures.

☐ **Establish a Graduate Student Handbook for the New Degree Program** – Students need to know the specific requirements and milestones they must meet throughout their degree program. A Graduate Student Handbook provided to students when they are admitted to the degree program and published on the website for the new degree gives students this information. Include in the handbook the unit/college satisfactory academic progress policies, current degree program requirements (outlined in the approved proposal) and provide a link to the Graduate Policies and Procedures website. Please go to http://graduate.asu.edu/faculty_staff/policies to access Graduate Policies and Procedures.

Attachment A

List of Area Courses

FOUNDATIONS

CSE 450/598 Design and Analysis of Algorithms

CSE 457/598 Theory of Formal Languages

CSE 459/598 Logic for Computer Scientists I

CSE 550 Combinatorial Algorithms and Intractability

CSE 552 Randomized and Approximation Algorithms

CSE 555 Theory of Computation

SYSTEMS

CSE 420/598 Computer Architecture I

CSE 432/598 Operating System Internals

CSE 434/598 Computer Networks

CSE 440/598 Compiler Construction

CSE 460/598 Software Analysis and Design

CSE 462/598 Software Engineering Project II

CSE 517 Hardware Design Languages

CSE 520 Computer Architecture II

CSE 530 Embedded Operating Systems Internals

CSE 531 Distributed Operating Systems

CSE 534 Advanced Computer Networks

CSE 535 Mobile Computing

CSE 536 Theory of Operating Systems

CSE 539 Applied Cryptography

CSE 543 Information Assurance and Security

CSE 561 Modeling and Simulation Theory and Applications

CSE 563 Software Requirements and Specification

CSE 564 Software Design

CSE 565 Software Verification, Validation and Testing

CSE 566 Software Project, Process and Quality Management

CSE 591 Mobile Ad Hoc Networking and Computing

CSE 591 Wireless Networks

APPLICATIONS

CSE 408/598 Multimedia Information Systems

CSE 412/598 Database Management

CSE 470/598 Computer Graphics

CSE 471/598 Introduction to Artificial Intelligence

CSE 477/598 Introduction to CAGD

CSE 509 Digital Video Processing

CSE 510 Database System Implementation

CSE 511 Semi-Structured Data Management

CSE 512 Distributed Databases

CSE 514 Object-Oriented Databases

CSE 515 Multimedia and Web Databases

CSE 539 Applied Cryptography

CSE 570 Advanced Computer Graphics I

CSE 571 Artificial Intelligence

CSE 572 Data Mining

CSE 573 Advanced Computer Graphics II

CSE 574 Planning and Learning

CSE 577 Advanced Computer-Aided Geometric Design I

CSE 578 Advanced Computer-Aided Geometric Design II

CSE 591 Enterprise/Service-Oriented Computing

Ira A. Fulton Schools of Engineering

Official Submission

From: Jeremy Helm
Sent: Thursday, March 20, 2014 7:35 AM
To: curriculumplanning@asu.edu; Amanda Morales-Calderon
Cc: James Collofello; Brian Skromme; K. Selcuk Candan (candan@asu.edu)
Subject: FW: Big Data Systems Concentrations

Good morning,

Please find attached two approved proposals to establish new graduate concentrations in existing MCS and MS degrees. Signatures and impact statement are included in the attached PDF.

Jeremy Helm

Director, Academic Administration & Student Success

Ira A. Fulton Schools of Engineering

Arizona State University

Tempe, AZ 85287-8109

(480) 965-8931 voice

(480) 965-8095 fax

Jeremy Helm

Subject: FW: Big Data Systems Concentrations

-------- Original Message --------
Subject:RE: Big Data Systems Concentrations
Date: Fri, 7 Mar 2014 13:40:25 +0000
From: Amy Hillman <AMY.HILLMAN@asu.edu>
To: Ronald Askin <Ron.Askin@asu.edu>, Michael Goul <Michael.Goul@asu.edu>
CC: Sandeep Gupta <Sandeep.Gupta@asu.edu>, "Selcuk.candan@asu.edu" <Selcuk.candan@asu.edu>

Hi Ron,

Mike and I agree this is no problem or concern for our MS in Business Analytics.

Amy

****
Amy J. Hillman
Rusty Lyon Chair of Strategy
Dean, W. P. Carey School of Business
Arizona State University
amy.hillman@asu.edu
****

From: Ronald Askin
Sent: Thursday, March 06, 2014 6:06 PM
To: Amy Hillman; Michael Goul
Cc: Sandeep Gupta; Selcuk.candan@asu.edu
Subject: FW: Big Data Systems Concentrations

We want to specify a Big Data Systems concentration in our Masters degree programs in Computer Science. The attached proposals are similar with the exception being that MCS is without thesis and MS is with thesis. We would appreciate if Carey could provide a statement of support or just acknowledgement of you being aware of this effort and that it does not have any significant impact on existing programs. We have about 500 Masters students in CS and an increasing number are asking for this option as a way of acknowledging where they are placing their emphasis.

Thanks and let me know if you have any questions.

Ron