: FINANCE + DATA SCIENCE, BS

In Workflow

1. U Program Review (dforgacs@illinois.edu; eastuby@illinois.edu; aledward@illinois.edu)
2. 1260 Committee Chair (gpennacc@illinois.edu)
3. 1260 Head (l-chan2@illinois.edu)
4. 1434 Head (namato@illinois.edu; vmahesh@illinois.edu; egunter@illinois.edu)
5. 1992 Head (knox@illinois.edu)
6. 1257 Head (tyson@illinois.edu)
7. 1583 Head (libo@illinois.edu)
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9. KP Dean (candyd@illinois.edu)
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14. University Librarian (jpwilkin@illinois.edu)
15. Provost (kmartens@illinois.edu)
16. Senate EPC (bjlehman@illinois.edu; moorhouz@illinois.edu; kmartens@illinois.edu)
17. Senate (jtempel@illinois.edu)
18. U Senate Conf (none)
19. Board of Trustees (none)
20. IBHE (none)
21. DMI (eastuby@illinois.edu; aledward@illinois.edu; dforgacs@illinois.edu)

Approval Path

1. Tue, 30 Mar 2021 19:26:56 GMT
   Deb Forgacs (dforgacs): Approved for U Program Review
2. Tue, 30 Mar 2021 20:55:07 GMT
   George Pennacchi (gpennacc): Approved for 1260 Committee Chair
3. Thu, 01 Apr 2021 14:37:12 GMT
   Louis Chan (l-chan2): Approved for 1260 Head
4. Fri, 02 Apr 2021 20:11:02 GMT
   Elsa Gunter (egunter): Approved for 1434 Head
5. Fri, 02 Apr 2021 22:28:20 GMT
   Emily Knox (knox): Approved for 1992 Head
6. Sat, 03 Apr 2021 16:28:19 GMT
   Jeremy Tyson (tyson): Approved for 1257 Head
7. Sat, 03 Apr 2021 16:32:40 GMT
   Bo Li (libo): Approved for 1583 Head
8. Tue, 06 Apr 2021 19:04:09 GMT
   Brooke Newell (bsnewell): Approved for KP Committee Chair
9. Tue, 06 Apr 2021 19:05:53 GMT
   Candy Deaville (candyd): Approved for KP Dean
10. Tue, 06 Apr 2021 19:14:43 GMT
    Emily Knox (knox): Approved for LP Dean
11. Tue, 06 Apr 2021 19:27:59 GMT
    Kelly Ritter (ritterk): Approved for KV Dean
12. Sat, 10 Apr 2021 01:04:49 GMT
    Joseph Mahoney (josephm): Approved for KM Committee Chair
13. Sat, 10 Apr 2021 02:27:29 GMT
    Mark Peecher (peecher): Approved for KM Dean
14. Sat, 10 Apr 2021 02:35:51 GMT
    John Wilkin (jpwilkin): Approved for University Librarian

15. Sat, 10 Apr 2021 14:07:18 GMT
    Kathy Martensen (kmartens): Approved for Provost

New Proposal

Date Submitted:Tue, 30 Mar 2021 19:06:32 GMT

Viewing:: Finance + Data Science, BS

Changes proposed by: Hanna Richmond

Proposal Type

Proposal Type:

Major (ex. Special Education)

Proposal Title:

If this proposal is one piece of a multi-element change please include the other impacted programs here.*example: A BS revision with multiple concentration revisions*

A proposal to create a Finance plus Data Science degree program ("FIN+DS Degree") as part of the University-wide "X+DS Degree" initiative.

EP Control Number

EP.21.126

Official Program Name

Finance + Data Science, BS

Effective Catalog Term

Fall 2021

Sponsor College

Gies College of Business

Sponsor Department

Finance

Sponsor Name

Louis K.C. Chan

Sponsor Email

l-chan2@illinois.edu

College Contact

Jessen Hobson

College Contact Email

jlhobson@illinois.edu

Program Description and Justification

Provide a*brief*description and justification of the program, including highlights of the program objectives, and the careers, occupations, or further educational opportunities for which the program will prepare graduates, when appropriate.

An outline of a degree plan to incorporate a strong data science core set of courses alongside a specialization, thereby training students to make informed financial decisions that are grounded in careful analysis of data and deep understanding of business logic.

The FIN+DS degree is comprised of these components:
1. The data science core coursework
a. This coursework is comprised of:
i. Two (2) courses from Statistics
ii. Two (2) courses from Computer Science
iii. Two (2) courses from the iSchool
iv. Two (2) courses from Mathematics
2. The coursework in the area of specialization
3. Coursework in non-major general business

JUSTIFICATION:
Ubiquitous digital technology and the generation of massive amounts of data are rapidly transforming society and multiple fields of inquiry. This transformation has created exciting opportunities and worrisome scenarios across multiple domains of human endeavor. Like the industrial technologies of the early-20th century, the new digital technologies of the early-21st century have great potential to transform society, for good or ill. The University of Illinois has a high calling to prepare students to lead society's digital transformation.

There is substantial demand, both from students and from employers, for educational programs in data science. A 2017 study by researchers at IBM and Burning Glass Technologies predicts the demand for Data Scientists will grow by 28% by 20201. Enrollment in the undergraduate majors "Statistics" and "Statistics and Computer Science," which provide students access to some of the competencies of data science, have grown by a factor of six in the last ten years.
Data science is emerging as a subject of great importance in many domains of human and scholastic endeavor. National policy documents for data science majors emphasize that engagement with an application domain is an important part of data science education. The University of Illinois' white paper on data science education recommended the development of "X+Data Science Majors" as an innovative approach to offering broad collaborative opportunities for Illinois students to engage with data science.

The FIN+DS Degree
The finance profession, with its strong quantitative orientation and evidence-based approach to decision-making, has a strong affinity for data science. Accordingly, explicitly adding a data science component to the FIN undergraduate program would provide more options for undergraduate employment and would better prepare students for graduate work. A recent article in Bloomberg News, for example, reports that in the financial sector job postings that list big data
skills as required grew by 60% over the last year. Finally, the Education Working Group of the Illinois Data Science Initiative has recommended an undergraduate degree in Data Science, and views the transition of the Statistics and Computer Science degree to one in Data Science as an expedient path towards achieving that goal.

Data Science is broad, far-reaching and encompassing discipline that lives in every field. This proposal builds on the University-wide initative, which seeks to expand the Data Science vision for Illinois to every department, though a model of "X+DS" programs hosted in the department of the specialization ("X").

Corresponding Degree

BS Bachelor of Science

Is this program interdisciplinary?

Yes

Interdisciplinary Colleges and Departments (list other colleges/departments which are involved other than the sponsor chose above)

In Spring 2017, the College of Liberal Arts & Sciences submitted an Investment for Growth Proposal to “Jump Start Data Science”, focusing on undergraduate data science education. Interim Provost John Wilkin supported the proposal, but called on LAS to work with thee colleges (Engineering, the iSchool, and the Gies College of Business) to develop a collaborative approach to undergraduate data science at Illinois.

Those deans formed a task force (herein the “Data Science Education Task Force” or DSETF) to explore opportunities and make proposals for undergraduate data science education at Illinois. The DSETF conducted its work during academic years 2017—2018 and 2018—2019. At the core of their work was the vision that every Illinois undergraduate should have the opportunity to have a meaningful exposure to data science.

In February 2019, the four deans agreed to support a shared framework for X+Data Science majors, based on suggestions from the DSETF. The framework consisted of the following pieces.

1) A set of core competencies and common features which will be expected of X+Data science majors, together with a reference standard set of courses and activities that fulfills the data science portion of those expectations
2) Each college can propose its own X+Data Science majors, which will be majors of that college. They may differ from the reference standard approach. When they do so, they should explain how the proposed major provides the expected competencies and features of an X+Data Science major in a manner that is appropriate for their students.
3) The deans will engage with the campus leadership to establish a Data Science Education committee. The committee will:
• Keep track of offerings related to data science to facilitate collaboration and reduce redundancy
• Facilitate the development of data science programs by connecting undergraduate data science education resources across the university
• Advise colleges on matters related to undergraduate data science education
• Review X+Data Science major proposals, commenting on how they meet the expectations for X+Data Science majors and engage collaboratively and strategically with the university’s resources in data science education

College

Grainger College of Engineering

Department

Computer Science

Do you need to add an additional interdisciplinary relationship?

Yes

College

Information Science, School of

Department

Information Sciences

Do you need to add an additional interdisciplinary relationship?

Yes

College

Liberal Arts & Sciences

Department

Mathematics

Do you need to add an additional interdisciplinary relationship?

Yes

College

Liberal Arts & Sciences

Department

Statistics

Academic Level

Undergraduate

Will you admit to the concentration directly?

No

Is a concentration required for graduation?

No

CIP Code

307102 - Business Analytics.

Is This a Teacher Certification Program?

No

Will specialized accreditation be sought for this program?

No

Institutional Context

University of Illinois at Urbana-Champaign

Describe the historical and university context of the program's development. Include a short summary of any existing program(s) upon which this program will be built.

Explain the nature and degree of overlap with existing programs and, if such overlap exists, document consultation with the impacted program's home department(s).

The university's 2018 Strategic Plan The Next 150 calls for "[p]rovid[ing] all Illinois students the opportunity to have a meaningful exposure to data science."
In Spring 2017, the College of Liberal Arts & Sciences submitted an Investment for Growth Proposal to "Jump Start Data Science," focusing on undergraduate data science education. Interim Provost John Wilkin supported the proposal, but called on LAS to work with the colleges (Engineering, the iSchool, and the Gies College of Business) to develop a collaborative approach to undergraduate data science at Illinois. Those deans formed a task force (herein the "Data Science Education Task Force" or DSETF) to explore opportunities and make proposals for undergraduate data science education at Illinois. The DSETF conducted its work during academic years 2017—2018 and 2018—2019. At the core of their work was the vision that every Illinois undergraduate should have the opportunity to have a meaningful exposure to data science. The degree program differs from other undergraduate degree programs in data science because it provides the student with substantial exposure to data science and to Scholarship in Finance. It differs from other degrees in Finance because of the unique, interdisciplinary exposure to data science.

University of Illinois

Briefly describe how this program will support the University's mission, focus and/or current priorities. Demonstrate the program's consistency with and centrality to that mission.

This proposal is a subset of the "Data Science" degree proposal as a general framework for specializations in Data Science. See the "Data Science" degree proposal for full details on the program's role to support excellence at The University of Illinois. The College of Business at the University of Illinois Urbana-Champaign can count several generations of students who have gone on to key leadership positions in the financial sector in Illinois, nation-wide and overseas. Currently, state-of-the-art best practice for financial professions include the data analytic skill sets required to sift through large volumes of data to uncover solutions to business problems and effectively communicate analyses, findings, and conclusions. Accordingly, it is important to formally integrate into the undergraduate curriculum a variety of courses that cultivate and sharpen these skills alongside more traditional content. Numerous reports on the finance industry's hiring needs highlight the need to train students in this important area. A 2016 survey of 422 European and U.S. executives conducted by the Economist Intelligence Unit reports that analytics and big data will be the most important digital competency for their organizations in the next three years. In response, the Association to Advance Collegiate Schools of Business (AACSB), the primary accreditation authority for business schools, is pushing business schools to respond by adding data analytics to their curricula.

State of Illinois

Indicate which of the following goals of the Illinois Board of Higher Education's Strategic Initiative are supported by this program: (choose all that apply)

Educational Attainment - increase educational attainment to match the best-performing states.
High Quality Credentials to Meet Economic Demand - Increase the number of high-quality post-secondary credentials to meet the demands of the economy and an increasingly global society.
Integration of Educational, Research and Innovation Assets - Better integrate Illinois' educational, research and innovation assets to meet economic needs of the state and its regions.

Describe how the proposed program supports these goals.

In the private sector, the demand for data science professionals is growing at a very rapid pace, with the number of data science job opening expected to grow by 15% to 25% over the next five years, depending on the job description.

Numerous reports on the finance industry's hiring needs highlight the need to train students in this important area. A 2016 survey of 422 European and U.S. executives conducted by the Economist Intelligence Unit reports that analytics and big data will be the most important digital competency for their organizations in the next three years. In response, the Association to Advance Collegiate Schools of Business (AACSB), the primary accreditation authority for business schools, is pushing business schools to respond by adding data analytics to their curricula.

Admission Requirements

Desired Effective Admissions Term

Fall 2021

Provide a brief narrative description of the admission requirements for this program. Where relevant, include information about licensure requirements, student background checks, GRE and TOEFL scores, and admission requirements for transfer students.

These are the same as those for our other degrees, which means the requirements are handled at the campus level.

Describe how critical academic functions such as admissions and student advising are managed.

Admissions is managed through campus. FIN+DS graduates will benefit from the same extensive career services and advising services provided to all Gies students. The Departments of Statistics and Computer Science and the iSchool will provide advising for the data science portion of the degree program and will interface with our advisors.

Enrollment

Number of Students in Program (estimate)

Year One Estimate

10

5th Year Estimate (or when fully implemented)

50

Estimated Annual Number of Degrees Awarded

Year One Estimate

0

5th Year Estimate (or when fully implemented)

10

What is the matriculation term for this program?

Fall

What is the typical time to completion of this program?

4 years

What are the minimum Total Credit Hours required for this program?

124 hours

Delivery Method

This program is available:

On Campus

Budget

Will the program or revision require staffing (faculty, advisors, etc.) beyond what is currently available?

No

Resource Implications

Facilities

Will the program require new or additional facilities or significant improvements to already existing facilities?

No

Technology

Will the program need additional technology beyond what is currently available for the unit?

No

Non-Technical Resources

Will the program require additional supplies, services or equipment (non-technical)?

No

Resources

For each of these items, be sure to include in the response if the proposed new program or change will result in replacement of another program(s). If so, which program(s), what is the anticipated impact on faculty, students, and instructional resources? Please attach any letters of support/ acknowledgement from faculty, students, and/or other impacted units as appropriate.

Faculty Resources

Please address the impact on faculty resources including any changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc. Describe how the unit will support student advising, including job placement and/or admission to advanced studies.

No changes in number of faculty outside of the Gies College is needed beyond the faculty increases outlined in the “Data Science” major proposal. No increases in number of faculty within the Gies College is required.We currently have capacity to address the expected minor increases in enrollments due to this program. FIN+DS students will benefit from the same career services and advising services provided to all Gies students. The Departments of Statistics and Computer Science and the iSchool will provide advising for the data science portion of the degree program and will interface with our advisors.

Library Resources

Describe your proposal's impact on the University Library's resources, collections, and services. If necessary please consult with the appropriate disciplinary specialist within the University Library.

There is no expected impact.

Instructional Resources

Will there be any reduction in other course offerings, programs or concentrations by your department as a result of this new program/proposed change?

No

Does the program include other courses/subjects impacted by the creation/revision of this program?

No

Financial Resources

How does the unit intend to financially support this proposal?

We currently have capacity to address the expected minor increases in enrollments due to this program. FIN+DS students will benefit from the same career services and advising services provided to all Gies students. The Departments of Statistics and Computer Science and the iSchool will provide advising for the data science portion of the degree program and will interface with our advisors.

Will the unit need to seek campus or other external resources?

No

Attach letters of support

Letters of support.pdf

Are you seeking a change in the tuition rate or differential for this program?

Yes

If yes, please enter your college budget office contact information and have them contact provostbudget@illinois.edu for next steps.

Gina Oleynichak - Director of Budgets and Resource Planning
goleynic@uillinois.edu

Market Demand

What market indicators are driving this proposal? If similar programs exist in the state, describe how this program offers a unique opportunity for students:

Numerous reports on the finance industry's hiring needs highlight the need to train students in this important area. A 2016 survey of 422 European and U.S. executives conducted by the Economist Intelligence Unit reports that analytics and big data will be the most important digital competency for their organizations in the next three years. In response, the Association to Advance Collegiate Schools of Business (AACSB), the primary accreditation authority for business schools, is pushing business schools to respond by adding data analytics to their curricula.

What type of employment outlook should these graduates expect? Explain how the program will meet the needs of regional and state employers, including any state agencies, industries, research centers, or other educational institutions that expressly encourage the program's development.

In the private sector, the demand for data science professionals is growing at a very rapid pace, with the number of data science job opening expected to grow by 15% to 25% over the next five years, depending on the job description.

There is substantial demand, both from students and from employers, for educational programs in data science. A 2017 study by researchers at IBM and Burning Glass Technologies predicts the demand for Data Scientists will grow by 28% by 20201. Enrollment in the undergraduate majors "Statistics" and "Statistics and Computer Science," which provide students access to some of the competencies of data science, have grown by a factor of six in the last ten years.
Data science is emerging as a subject of great importance in many domains of human and scholastic endeavor. National policy documents for data science majors emphasize that engagement with an application domain is an important part of data science education. The University of Illinois' white paper on data science education recommended the development of "X+Data Science Majors" as an innovative approach to offering broad collaborative opportunities for Illinois students to engage with data science.

What resources will be provided to assist students with job placement?

FIN+DS graduates will benefit from the same extensive career services and advising services provided to all Gies students.

Program Regulation and Assessment

Briefly describe the plan to assess and improve student learning, including the program's learning objectives; when, how, and where these learning objectives will be assessed; what metrics will be used to signify student's achievement of the stated learning objectives; and the process to ensure assessment results are used to improve student learning. (Describe how the program is aligned with or meets licensure, certification, and/or entitlement requirements, if applicable).

Learning objectives and assessment for success in this program will be handled following our current process for all undergraduate Finance students. Success in the advanced classes requires success in prerequisites. We carefully monitor student progress through the initial years of the major in the advising process, giving mentoring where necessary.

Is the career/profession for graduates of this program regulated by the State of Illinois?

No

Program of Study

"Baccalaureate degree requires at least 120 semester credit hours or 180 quarter credit hours and at least 40 semester credit hours (60 quarter credit hours) in upper division courses" (source: https://www.ibhe.org/assets/files/PrivateAdminRules2017.pdf). For proposals for new bachelor's degrees,

if this minimum is not explicitly met by specifically-required 300- and/or 400-level courses, please provide information on how the upper-division hours requirement will be satisfied.

All proposals must attach the new or revised version of the Academic Catalog program of study entry. Contact your college office if you have questions.

For new programs, attach Program of Study

Academic Catalog Entry for Finance + DS, BS.docx
FIN_DS_25Mar2021_s.pdf

Catalog Page Text

Catalog Page Text: Description of program for the catalog page. This is not official content, it is used to help build the catalog pages for the program. Can be edited in the catalog by the college or department.

This major is sponsored by the Finance Department in the Gies College of Business, in collaboration with the Departments of Statistics, Computer Science, iSchool, and Mathematics. The FIN + Data Science major is designed for students who desire to supplement their finance foundation with a strong background in data science. The major prepares students for professional or graduate work in all Finance fields, but particularly those focused on analytics.

Statement for Programs of Study Catalog

Minimum hours for graduation: 124 hours

University Composition Requirements

Code	Title	Hours
Composition I: Principles of Composition[1]		4-7
Advanced Composition		3

General Education Requirements

Code	Title	Hours
A minimum of six courses is required, as follows:		18
Humanities & the Arts: Literature & the Arts (1-2 courses)[2]		
Humanities & the Arts: Historical & Philosophical Perspectives (1-2 courses)[2]		
Natural Sciences & Technology: Physical Sciences (0-2 courses)[3]		
Natural Sciences & Technology: Life Sciences (0-2 courses)[3]		
Behavioral Sciences (1 course)		
Cultural Studies: Non-Western Cultures (1 course)		
Cultural Studies: U.S. Minorities Cultures (1 course)		
Cultural Studies: Western/Comparative Cultures (1 course)		
Quantitative Reasoning (2 courses)		

Language Other Than English

Code	Title	Hours
Completion of the third semester or equivalent of a language other than English is required. Completion of three years of a single language in high school satisfies this requirement.		0-15

Business Core

Code	Title	Hours
ACCY 201 & ACCY 202	Accounting and Accountancy I and Accounting and Accountancy II	6
BADM 275	Fundamentals of Operations Management	3
BADM 300	The Legal Environment of Bus	3
BADM 310	Mgmt and Organizational Beh[4]	3
BADM 320	Principles of Marketing	3
BADM 449	Business Policy and Strategy	3
BUS 101	Professional Responsibility and Business[5]	3
BUS 201	Business Dynamics	3
BUS 401	Global Business Perspectives	3
CMN 101	Public Speaking	3
ECON 102 & ECON 103	Microeconomic Principles and Macroeconomic Principles	6
FIN 221	Corporate Finance	3
TOTAL HOURS		**42**

Finance Specialization

Code	Title	Hours
FIN 300	Financial Markets	3
FIN 321	Advanced Corporate Finance	3
FIN 411	Investment & Portfolio Mngt	3
Four additional full-semester, 3 hours 400 level-Finance courses exceptFIN 494or 495 Senior Research) andFIN 490(Special Topics).		12
FIN 412	Options and Futures Markets	3
FIN 415	Fixed Income Portfolios	3
FIN 418	Financial Modeling	3
FIN 423	Financing Emerging Businesses	3
FIN 424	Mergers and Acquisition	3
FIN 432	Managing Fin Risk for Insurers	3
FIN 433	Corporate Risk Management	3
FIN 435	Personal Wealth Management	3
FIN 444	Urban Real Estate Valuation	3
FIN 445	Real Estate Investment	3
FIN 447	Real Estate Development	3
FIN 463	Investment Banking	3
FIN 464	Applied Financial Analysis	3
Total Hours		**21**

Data Science Core

Code	Title	Hours
Mathematical Foundations		**7**
MATH 234	Calculus for Business I	4
MATH 227	Linear Algebra for Data Science	3
or MATH 257	Linear Algebra with Computational Applications	
Data Science Fundamentals		**12**
STAT/CS/IS 107	Data Science Discovery	4
STAT 207	Data Science Exploration	4
CS 307	Modeling and Learning in Data Science	4
Computational Fundamentals		**4**
CS 277	Algorithms and Data Structures for Data Science	4
Social Impact in Data Science		**6**

IS 467	Ethics and Policy for Data Science	3
IS 477	Data Management, Curation & Reproducibility	3
Total Hours		**29**

Meaningful Research or Discovery Experience

Code	Title	Hours
One of the most important skills a student will gain in a FIN + DS degree will be the ability to present data in meaningful ways. A meaningful research and discovery experience is as much a pillar of this degree program as both the core coursework and the area of specialization. This capstone experience can be fulfilled throughBUS 301, listed above in the Business Core. This course is an active learning, real-client experience that will allow students to join their data science skills with their business skills.		3

Summary of Total Hours

Code	Title	Hours
General Education Requirements		25
Total Business Core Hours		42
Total Finance Specialization Hours		21
Total Data Science Core Hours		29
Meaningful Research or Discovery Experience		3
Total Hours		**124**

[1]*For a list of the specific courses that meet this requirement, see the college Office of Undergraduate Affairs in 1055 Business Instructional Facility or see the Course Explorer for a list of approved general education courses.*

[2]*Three courses in the Humanities & the Arts area are required and students must complete at least one course in the Literature & the Arts and Historical & Perspectives subcategories. At least one of the courses must be a 200 or higher level course.*

[3]*Two courses in the Natural Sciences & Technology area are required. It is strongly recommended that students complete one course in the Physical Sciences and Life Sciences subcategories.*

[4]*This course includes limited voluntary participation as a subject in experiments.*

[5]BUS 101, BUS 201, BUS 301 *and* BUS 401 *are required for all Gies College of Business students. Students who enter the College their first year take each sequential course every fall. Inter-College transfer students take*BUS 301*and*BUS 401*in their sophomore year. Off-campus transfer students take*BUS 101*and*BUS 201*in their junior year.*

EP Documentation

Attach Rollback/Approval Notices

RE_ Questions for Education Policy Committee on Finance + Data Science, BS.pdf

DMI Documentation

Program Reviewer Comments

Deb Forgacs (dforgacs) (Mon, 29 Mar 2021 21:23:15 GMT): Rollback: requested.
Kathy Martensen (kmartens) (Mon, 19 Apr 2021 19:16:23 GMT): Updated references to total hours from 120 to 124 -- see attached email correspondence from sponsor in EP Documentation section. Note that the Word doc attachments contain the incorrect total hours.

Key: 970

FIN+DS Proposal to the Senate Educational Policy Committee

PROPOSAL TITLE:

A proposal to create a Finance plus Data Science degree program ("FIN+DS Degree") as part of the University-wide "X+DS Degree" initiative.

SPONSORS:

Louis K.C. Chan, Finance Department Head and Hoeft Professor of Business, 217-333-6391, l-chan2@illinois.edu

Robert Brunner, Associate Dean for Innovation, 217-244-6099, bigdog@illinois.edu

COLLEGE CONTACT:

Jessen Hobson, Professor of Accountancy, 217-265-0327, jlhobson@illinois.edu

BRIEF DESCRIPTION:

An outline of a degree plan to incorporate a strong data science core set of courses alongside a specialization, thereby training students to make informed financial decisions that are grounded in careful analysis of data and deep understanding of business logic.

The FIN+DS degree is comprised of these components (please see the table below for details):

1. The data science core coursework
    a. This coursework is comprised of:
        i. Two (2) courses from Statistics
        ii. Two (2) courses from Computer Science
        iii. Two (2) courses from the iSchool
        iv. Two (2) courses from Mathematics
2. The coursework in the area of specialization
3. Coursework in non-major general business

JUSTIFICATION:

Ubiquitous digital technology and the generation of massive amounts of data are rapidly transforming society and multiple fields of inquiry. This transformation has created exciting opportunities and worrisome scenarios across multiple domains of human endeavor. Like the industrial technologies of the early-20th century, the new digital technologies of the early-21st

century have great potential to transform society, for good or ill. The University of Illinois has a high calling to prepare students to lead society's digital transformation.

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The FIN+DS Degree

The finance profession, with its strong quantitative orientation and evidence-based approach to decision-making, has a strong affinity for data science. Accordingly, explicitly adding a data science component to the FIN undergraduate program would provide more options for undergraduate employment and would better prepare students for graduate work. A recent article in Bloomberg News, for example, reports that in the financial sector job postings that list big data skills as required grew by 60% over the last year. Finally, the Education Working Group of the Illinois Data Science Initiative has recommended an undergraduate degree in Data Science, and views the transition of the Statistics and Computer Science degree to one in Data Science as an expedient path towards achieving that goal.

Data Science is broad, far-reaching and encompassing discipline that lives in every field. This proposal builds on the University-wide initative, which seeks to expand the Data Science vision for Illinois to every department, though a model of "X+DS" programs hosted in the department of the specialization ("X").

BUDGETARY AND STAFF IMPLICATIONS:

1) Resources
    a. How does the unit intend to financially support this proposal?

        This is a revision of an existing degree program to partner with a data science component, and for the most part involves merely a shift in enrollments of courses taken within the units already. New courses largely shift enrollments away from existing courses (e.g., STAT 100 and CS 105 → STAT/CS/IS 107; STAT 200 + STAT 212 → STAT 207; MATH 225; etc.). In particular, as the appendix depicts, this new major simply adds a core of data science courses to the existing FIN major. Three of these courses, STAT/CS/IS 107, STAT 207, and CS 307, will take the place of three existing courses in the Business Core, namely, CS 105, BADM 210, and BADM 211.

[1] Markow, Braganza, Taska, Miller, and Hughes, "The Quant Crunch: How the demand for data science skills is disrupting the job market", published by IBM, Burning Technologies, and the Business-Higher Education Forum, 2017. Available at https://www.ibm.com/downloads/cas/3RL3VXGA.

b. How will the unit create capacity or surplus to appropriately resource this program? If applicable, what functions or programs will the unit no longer support to create capacity?

   Each affected unit can shift teaching resources to the extent necessary, as discussed above. The Departments of Statistics and Computer Science and the iSchool will provide advising for the data science portion of the degree program and will interface with our advisors.

c. Will the unit need to seek campus or other external resources?

   No

d. Please provide a letter of acknowledgment from the college that outlines the financial arrangements for the proposed program.

   See attached

2) Resource Implications

   a. Please address the impact on faculty resources including the changes in numbers of faculty, class size, teaching loads, student-faculty ratios, etc.

      No changes in number of faculty outside of the Gies College is needed beyond the faculty increases outlined in the "Data Science" major proposal. No increases in number of faculty within the Gies College is required.

   b. Please address the impact on course enrollment in other units and provide an explanation of discussions with representatives of those units.

      Outside of Gies, the addition of FIN+DS program will impact only fields involved within the FIN+DS program. No changes of enrollment impacting departments other than Computer Science, Statistics, Math, and the iSchool are expected.

   c. Please address the impact on the University Library

      There is no expected impact.

   d. Please address the impact on technology and space (e.g. computer use, laboratory use, equipment, etc.)

      There is no expected impact beyond the demand already present.

For new degree programs only:

3) Briefly describe how this program will support the University's mission, focus, and/or current priorities. Include specific objectives and measurable outcomes that demonstrate the program's consistency with and centrality to that mission.

This proposal is a subset of the "Data Science" degree proposal as a general framework for specializations in Data Science. See the "Data Science" degree proposal for full details on the program's role to support excellence at The University of Illinois.

The College of Business at the University of Illinois Urbana-Champaign can count several generations of students who have gone on to key leadership positions in the financial sector in Illinois, nation-wide and overseas. Currently, state-of-the-art best practice for financial professions include the data analytic skill sets required to sift through large volumes of data to uncover solutions to business problems and effectively communicate analyses, findings, and conclusions. Accordingly it is important to formally integrate into the undergraduate curriculum a variety of courses that cultivate and sharpen these skills alongside more traditional content.

Numerous reports on the finance industry's hiring needs highlight the need to train students in this important area. A 2016 survey of 422 European and U.S. executives conducted by the Economist Intelligence Unit reports that analytics and big data will be the most important digital competency for their organizations in the next three years. In response, the Association to Advance Collegiate Schools of Business (AACSB), the primary accreditation authority for business schools, is pushing business schools to respond by adding data analytics to their curricula.

4) Please provide an analysis of the market demand for this degree program. What market indicators are driving this proposal? What type of employment outlook should these graduates expect? What resources will be provided to assist students with job placement?

In the private sector, the demand for data science professionals is growing at a very rapid pace, with the number of data science job opening expected to grow by 15% to 25% over the next five years, depending on the job description. FIN+DS graduates will benefit from the same extensive career services and advising services provided to all Gies students.

5) If this is a proposed graduate program, please discuss the programs intended use of waivers. If the program is dependent on waivers, how will the unit compensate for lost tuition revenue?

Not applicable

DESIRED EFFECTIVE DATE:

Effective beginning in Fall 2021.

STATEMENT FOR PROGRAMS OF STUDY CATALOG: *(All proposals must include either a new or revised version of the entry in the Programs of Study Catalog, if applicable. Entries will be published as approved by the Senate. Future changes in the statement for Programs of Study Catalog which reflect changes in the curriculum, must go through the normal review process at the appropriate levels.)*

This major is sponsored by the Finance Department in the Gies College of Business, in collaboration with the Departments of Statistics, Computer Science, iSchool, and Mathematics. The FIN + Data Science major is designed for students who desire to supplement their finance foundation with a strong background in data science. The major prepares students for professional or graduate work in all Finance fields, but particularly those focused on analytics.

For the Degree of Bachelor of Science in Finance

Finance + Data Science

E-mail: finance@illinois.edu

Minimum required major and supporting course work normally equates to 60-68 hours

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

Twelve hours of 300 and 400-level courses must be taken on this campus.

Minimum hours required for graduation: 124 hours

Departmental distinction: To graduate with distinction requires a specified minimum grade point average in all Computer Science, Statistics, Information Science, and Mathematics courses listed below. A GPA of 3.25 is required for Distinction, 3.5 for High Distinction, and 3.75 for Highest Distinction.

Course and Title	Hours
Business Core, Total	**42**
Accounting and Accountancy I: ACCY 201	**3**
Accounting and Accountancy II: ACCY 202	**3**
Business Analytics I: BADM 210	**Fulfilled through DS Core below**
Business Analytics II: BADM 211	**Fulfilled through DS Core below**
Fundamentals of Operations Management: BADM 275	**3**
The Legal Environment of Bus: BADM 300	**3**
Mgmt and Organizational Beh: BADM 310	**3**
Principles of Marketing: BADM 320	**3**
Business Policy and Strategy: BADM 449	**3**
Professional Responsibility and Business: BUS 101	**3**
Business Dynamics: BUS 201	**3**
Business in a Global Perspective: BUS 401	**3**

Course and Title	Hours
Public Speaking: CMN 101	**3**
Intro to Computing: Non-Tech: CS 105	**Fulfilled through DS Core below**
Microeconomic Principles: ECON 102	**3**
Macroeconomic Principles: ECON 103	**3**
Corporate Finance: FIN 221	**3**
Calculus for Business: MATH 234	**Listed below**
Data Science Core	**29**
Mathematical Foundations	**7**
Calculus: MATH 234	4
Linear Algebra: MATH 227 or MATH 257	3
Data Science Fundamentals	**12**
Data Science Discovery: STAT/CS/IS 107	4
Data Science Exploration: STAT 207	4
Modeling and Learning in Data Science: CS 307	4
Computational Fundamentals	**4**
Algorithms and Data Structures for Data Science: CS 277	4
Social Impact in Data Science	**6**
Ethics and Policy for Data Science: IS 467	3
Data Management, Curation & Reproducibility: IS 477	3
Meaningful Research or Discovery Experience	**3**
One of the most important skills a student will gain in an FIN+DS degree will be the ability to present data in meaningful ways. A meaningful research and experience is as much a pillar of this degree program as both the core coursework and the area of specialization. This capstone experience can be fulfilled through BUS 301, listed above in the Business Core. This course is an active learning, real-client experience that will allow students to join their data science skills with their business skills.	
Coursework in Area of Specialization	**21**
Financial Markets: FIN 300	3
Advanced Corporate Finance: FIN 321	3
Investment & Portfolio Mngt: FIN 411	3

Course and Title	Hours
Four additional full-semester, 3 hours 400 level-Finance courses except FIN 494 or 495 Senior Research) and FIN 490 (Special Topics).	12
Options and Futures Markets: FIN 412	
Fixed Income Portfolios: FIN 415	
Financial Modeling: FIN 418	
Financing Emerging Businesses: FIN 423	
Mergers and Acquisition: FIN 424	
Managing Financial Risk for Insurers: FIN 432	
Corporate Risk Management: FIN 433	
Personal Wealth Management: FIN 435	
Urban Real Estate Valuation: FIN 444	
Real Estate Investment: FIN 445	
Real Estate Development: FIN 447	
Investment Banking: FIN 463	
Applied Financial Analysis: FIN 464	
TOTAL HOURS	**95**

Appendix A:

Coursework Description

The core coursework comprised in the FIN+DS degree plan prepares students with a strong background in data science, inferential thinking, computational thinking, and real-world relevance.

Mathematical Foundations	
MATH 234: Calculus *This requirement can be fulfilled by MATH 220 ("Calculus"), MATH 221 ("Calculus I"), or MATH 234 ("Calculus for Business").* **Prerequisites:** MATH 112 **Proposed Topic Coverage:** Integrals and derivatives provides the basic mathematical tools for both optimization and finding extrema, maxima, and minima. Students will be exposed to programming techniques to use this fundamental mathematical background in CS 307.	Credit Hours: 4
MATH 227 or MATH 257: Linear Algebra for Data Science *This is a new course developed from MATH 225 with a focus on Data Science.* **Prerequisites:** MATH 220, MATH 221, or MATH 234 ("Calculus" from above) **Purpose:** Linear algebra is the mathematics that underlies most mathematical approaches to analysis of data. This course serves as a prerequisite to CS 307. **Example Description** *(from Berkeley's "Data Science for Linear Algebra" course)*: This connector will cover introductory topics in the mathematics of data science, focusing on discrete probability and linear algebra and the connections between them that are useful in modern theory and practice. We will focus on matrices and graphs as popular mathematical structures with which to model data. For examples, as models for term-document corpora, high-dimensional regression problems, ranking/classification of web data, adjacency properties of social network data, etc.	Credit Hours: 3

Data Science Fundamentals	
STAT/CS/IS 107: Data Science Discovery *(This course is being piloted in Spring 2019, on offer starting Fall 2019.)* **Prerequisites:** None. (This course is designed for first semester freshman.) **Purpose:** Provides students with an introduction to data science through hands-on, real-world data with elementary statistical analysis and Python programming. Allows students to continue with advanced topics in STAT 207.	Credit Hours: 4
STAT 207: Data Science Exploration **Prerequisites**: STAT/CS/IS 107 *(This is new course to be developed as a follow-on to STAT/CS/IS 107.)* **Proposed Topic Coverage:** Students will further explore the data science life cycle, including hypothesis formulation, best practices for data collection and cleaning, exploratory data analysis with visualizations, uncertainty quantification, prediction using multiple regression and machine learning, and reporting. Each topic will be applied computationally with large, real-world datasets that expand on the computational skills learned in STAT/CS/IS 107.	Credit Hours: 4
CS 277: Algorithms and Data Structures in Data Science **Prerequisites**: STAT 207 + Calculus *(This is new course to be developed as a follow-on to STAT 207.)* **Proposed Topic Coverage:** Introduction to fundamental concepts in Computer Science including algorithms, data structures, run-time complexity, and object-oriented programming. Includes elementary analysis of arrays, lists, stacks, queues, heaps, binary trees, balanced tress, hash tables, and graphs with a significant	Credit Hours: 4

component of programming project focused in Data Science using the Python programming language.	
CS 307: Modeling and Learning in Data Science **Prerequisites**: STAT 207 + Linear Algebra (requires Calculus) *(This is new course to be developed as a follow-on to STAT 207.)* **Proposed Topic Coverage:** Significant coverage of probability with emphasis on using computation to design solutions to data-centric problems. Inclusion of random variables, Monte Carlo methods, discrete and continuous distributions, conditional probability, Bayes theorem, moment generating functions, central limit theorem, and maximum likelihood estimation. Students will apply these concepts in multiple applications of classical machine learning algorithms using Python and Python libraries.	Credit Hours: 4

Societal Impact in Data Science	
IS 467: Ethics & Policy for Data Science **Prerequisites:** None **Purpose:** This class explores concepts in data ethics and policy using several frameworks from both a theoretical and practical point of view. The aim of the class is to provide students with knowledge and skills needed to address a variety of ethical and policy topics.	Credit Hours: 3
IS 477: Data Management, Curation & Reproducibility **Prerequisites:** None **Purpose:** This course provides an overview of a broad range of theoretical and practical problems in data management and curation examining issues related to appraisal and selection, long lived data collections, research lifecycles, reproducibility, workflows, metadata, and legal and intellectual property issues.	Credit Hours: 3

Part 2: Coursework in Area of Specialization

The FIN+DS degree plan has an area of specialization from Finance that requires the following courses.

Financial Markets: FIN 300	Credit Hours: 3
Advanced Corporate Finance: FIN 321	Credit Hours: 3
Investment & Portfolio Mngt: FIN 411	Credit Hours: 3
Four additional full-semester, 3 hours 400 level-Finance courses except FIN 494 or 495 Senior Research) and FIN 490 (Special Topics).	Credit Hours: 12
Options and Futures Markets: FIN 412	
Fixed Income Portfolios: FIN 415	
Financial Modeling: FIN 418	
Financing Emerging Businesses: FIN 423	
Mergers and Acquisition: FIN 424	
Managing Financial Risk for Insurers: FIN 432	
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Personal Wealth Management: FIN 435	
Urban Real Estate Valuation: FIN 444	
Real Estate Investment: FIN 445	
Real Estate Development: FIN 447	
Investment Banking: FIN 463	
Applied Financial Analysis: FIN 464	

Part 3: A Meaningful Research or Discovery Experience

One of the most important skills a student will gain in an FIN+DS degree will be the ability to present data in meaningful ways. A meaningful research and experience is as much a pillar of this degree program as both the core coursework and the area of specialization. This capstone experience can be fulfilled through BUS 301, listed above in the Business Core. This course is an active learning, real-client experience that will allow students to join their data science skills with their business skills. Credit Hours: 3

Academic Catalog Entry
Bachelor of Science in Finance + Data Science

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For the Degree of Bachelor of Science in Finance

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E-mail: finance@illinois.edu

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as both the core coursework and the area of specialization. This capstone experience can be fulfilled through BUS 301, listed above in the Business Core. This course is an active learning, real-client experience that will allow students to join their data science skills with their business skills. Credit Hours: 3

ILLINOIS

SCHOOL OF INFORMATION SCIENCES
501 E. Daniel St., MC-493
Champaign, IL 61820-6211

March 4, 2021

Members of the Education Policy Committee:

I am writing to indicate our support for the following proposals:
Accountancy + Data Science
Astronomy + Data Science
Finance + Data Science
Information Sciences + Data Science

These programs will provide students across the university with the opportunity to study data science along with a disciplinary specialization. In particular, we support including IS 467 and IS 477. The School of Information Sciences will provide seats for all X + DS students in these courses starting in Fall 2021. Each course will be offered at least once per academic year.

Sincerely,

Dr. Emily Knox
Interim Associate Dean for Academic Affairs

ILLINOIS

MATHEMATICS

College of Liberal Arts & Sciences
273 Altgeld Hall, MC-382
1409 W. Green Street
Urbana, IL 61801 USA

March 8, 2021

To whom it may concern,

I am writing to indicate the support of the Department of Mathematics for the following proposals:

- Accountancy + Data Science
- Astronomy + Data Science
- Finance + Data Science
- Information Sciences + Data Science

These programs will provide students across the university with the opportunity to study data science along with a disciplinary specialization.

The Department of Mathematics supports the inclusion of the following courses in these proposals:

- MATH 220/221
- MATH 234
- MATH 227 or MATH 257

We will provide seats for X + DS students in these courses starting in Fall 2021. We intend to offer MATH 220 every semester, and MATH 221 and MATH 234 at least once per year. MATH 227 and MATH 257 are new courses, which we anticipate to offer for the first time during the 2021-2022 academic year. We intend to offer at least one of these courses each semester.

Sincerely,

Jeremy Tyson
Professor and Chair

ILLINOIS

DEPARTMENT OF COMPUTER SCIENCE
Thomas M. Siebel Center for Computer Science
201 N. Goodwin Ave.
Urbana, IL 61801-2302 USA

NANCY M. AMATO
Abel Bliss Professor and Head
2248 Siebel Center
namato@illinois.edu

March 4, 2021

To Whom It May Concern,

I am writing to indicate the support of the Department of Computer Science for the following proposals:

- Accountancy + Data Science
- Astronomy + Data Science
- Finance + Data Science
- Information Sciences + Data Science

These programs will provide students across the university with the opportunity to study data science along with a disciplinary specialization.

The Department of Computer Science supports including STAT/CS/IS 107 (to be co-taught by Statistics and Computer Science), CS 277, and CS/STAT 307 in the data science core curriculum. We will provide seats for X + DS students in these courses starting in Fall 2021. We intend to offer STAT/CS/IS 107 every semester and CS 277 and CS/STAT 307 at least once a year.

Sincerely,

Nancy M. Amato
Abel Bliss Professor and Head
Department of Computer Science

UNIVERSITY OF ILLINOIS
AT URBANA–CHAMPAIGN

Department of Statistics
101 Illini Hall
725 South Wright Street
Champaign, IL 61820

October 5, 2020

To Whom It May Concern,

I am writing to indicate the support of the Department of Statistics for the following proposals:

- Accountancy + Data Science
- Astronomy + Data Science
- Finance + Data Science
- Information Sciences + Data Science

These programs will provide students across the university with the opportunity to study data science along with a disciplinary specialization.

The Department of Statistics supports including STAT/CS/IS 107 (to be co-taught by Statistics and Computer Science) and STAT/CS 207 or STAT 212 in the data science core curriculum. We will provide seats for X + DS students in these courses starting in Fall 2021. We intend to offer STAT/CS/IS 107 every semester and other courses at least once a year.

Sincerely,

Bo Li
Professor and Chair
Department of Statistics

telephone 217-333-2167 • *fax* 217-244-7190

From: Hobson, Jessen
To: Amos, Jenny; Chan, Kuo Chi
Cc: Miller, Nolan H
Subject: RE: Questions for Education Policy Committee on Finance + Data Science, BS
Date: Saturday, April 17, 2021 1:50:57 PM
Attachments: image002.png
image003.png
image004.png
image005.png
image006.png
image007.png

Hi Jenny. Sorry for the delay in my response to you—our undergraduate office was following up on your first question. Please find responses to your questions below. Please reach out for any other questions. I have copied Louis (the department EO) in case he has anything to add.

- Are the credit hours toward graduation 120 or 124? We noticed that the regular BS Finance is 124 and the Academic Catalog Entry for Finance + DS, BS.docx attachment in CIM-P says 124, but FIN+DS degree requirements table says 120 and so does the question about number of credit hours

>Thank you for catching this, Jenny. After verification with our undergraduate office, the minimum requirements should be 124. The catalog online has a typo and refers to both 120 and 124. We are getting the catalog fixed.

- I do not think that this can be implemented for Fall 2021 admissions, did you mean Fall 2022 for effective and admissions dates?

>Thank you for this suggestion. We recognize that you are more informed about the likelihood of these being ready for Fall 2021. That is of course our preference, but if that is impossible we are willing to change these to Fall 2022.

- BUS 301 not listed in Bus Core in either course listing in CIMP or the attachment (though a footnote mentions that it is), does that increase Bus Core hours to 45? And that brings the course hours total to 123?

>Thank you for the chance to explain this. BUS 301 is required and counted under “Meaningful Research or Discovery Experience”. Thus, Business Core = 42 credits, Data Science Core = 29 credits, Meaningful Research or Discovery Experience (which is BUS 301) = 3, and Coursework in Area of Specialization = 21, for a total of 95, before GEs.

- Has a sample schedule been generated? Considering students will have either 0 or 1 total hours of free electives, it seems every semester would have to be crafted perfectly for a student to graduate in 4 years as the proposal indicates will be possible.

>Thank you for mentioning this. The size of these degrees has been a consistent and concerted concern for the department and the college for many months. Our College has a large Business Core, in addition to large individual major requirements. This led us to reduce the business core by three classes, as well as counting BUS 301 as the “Meaningful Research or Discovery Experience” (as you saw above). With these changes, and using reasonable assumptions, our average student would be able to complete the degree, ignoring electives in about 115 credits. Our average AP student would be able to complete the degree, again before electives, with 95 credits (due to testing out of GE and Business Core classes). As you imply, this still does not allow a lot of room for electives and “missteps”, but does make it possible for the diligent and motivated student to successfully graduate in 4 years. Ultimately, the expected popularity of these degrees lead our Dean to advise us to move forward with the reductions in the Business Core mentioned above. Our advising groups are aware

of these concerns and we are working with them to maximize the success of each student that contemplates these degrees. If you need something more formal, please let me know—I could get something late this evening.

- We also wanted to know if students will have to enter college with a certain ALEKS score to graduate on time and if the program will be accessible to inter-college or off-campus transfer students.

Currently, we are not planning on formally asking for ALEKS scores. Through our advising we will carefully council students regarding their likely success in the degree. We will make it available to inter-college or off-campus transfer students, but will monitor this to minimize students taking on more than they can reasonably complete, since these students may struggle to complete the degree in a reasonable amount of time.

Jessen Hobson
Professor of Accountancy
Director, University of Illinois-Deloitte Foundation Center for Business Analytics
Co-Director, Gies Behavioral Research Lab
4011 BIF, 515 East Gregory Drive, Champaign, IL 61820
217-265-0327 | jLhobson@illinois.edu

Gies College of Business
UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

From: Amos, Jenny <jamos@illinois.edu>
Sent: Friday, April 16, 2021 11:03 AM
To: Chan, Kuo Chi <l-chan2@illinois.edu>; Hobson, Jessen <jlhobson@illinois.edu>
Cc: Miller, Nolan H <nmiller@illinois.edu>
Subject: Questions for Education Policy Committee on Finance + Data Science, BS

Hello Louis and Jessen (Nolan in copy)

I am the subcommittee chair in charge of reviewing your proposal on behalf of the Education Policy Committee.

My subcommittee and I have some questions that I believe we will need answers to before we can vote on the proposal.

EP.21.126 Finance + Data Science, BS

- Are the credit hours toward graduation 120 or 124? We noticed that the regular BS Finance is 124 and the Academic Catalog Entry for Finance + DS, BS.docx attachment in CIM-P says 124, but FIN+DS degree requirements table says 120 and so does the question about number of credit hours
- I do not think that this can be implemented for Fall 2021 admissions, did you mean Fall 2022 for effective and admissions dates?

- BUS 301 not listed in Bus Core in either course listing in CIMP or the attachment (though a footnote mentions that it is), does that increase Bus Core hours to 45? And that brings the course hours total to 123?
- Has a sample schedule been generated? Considering students will have either 0 or 1 total hours of free electives, it seems every semester would have to be crafted perfectly for a student to graduate in 4 years as the proposal indicates will be possible.
- We also wanted to know if students will have to enter college with a certain ALEKS score to graduate on time and if the program will be accessible to inter-college or off-campus transfer students.

Best,

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