

November 6, 2013

MEMORANDUM

TO: State Board of Regents
FROM: David L. Buhler
SUBJECT: Utah Valley University – Bachelor of Science in Statistics

Issue

Utah Valley University (UVU) requests approval to offer a Bachelor of Science (BS) in Statistics, effective Spring Semester 2014. The Institutional Board of Trustees approved the degree on March 28, 2013. The Program Review Committee reviewed the proposal on October 9, 2013, and approved it to be placed on the Regents' agenda.

Background

The proposed BS in Statistics would prepare students for graduate study in statistics or entry into the workforce. Although the Utah Department of Workforce Services shows modest demand in the narrowly-defined "statistician" occupational category, the UVU proposal notes that graduates in statistics are typically able to secure employment in a wide range of settings (business, government, health care, etc). Furthermore, those who continue their education and complete an MS in Statistics are in particularly high demand.

The necessary courses, funding, library and information resources, and personnel are in place at Utah Valley University to offer a BS in Statistics. The budget and faculty will need to be carefully managed during the early years, and an additional faculty member may become necessary as enrollments in the program rises. Appropriate Expected Standards of Performance have been outlined for the proposed BS in Statistics, as well as an assessment plan that includes use of the Major Field Test and surveys of graduates. UVU would be the first open-enrollment institution in Utah to offer a BS in Statistics, and 70 majors are projected to be enrolled in the program by Year Five.

Policy Issues

The proposed degree has been developed and reviewed in accordance with processes established by Utah Valley University and the Board of Regents. Degrees in statistics are currently offered by the University of Utah and Utah State University, and the departments at those institutions have endorsed UVU's proposal. The USHE Chief Academic Officers have also reviewed and are supportive of Utah Valley University's request to offer a BS in Statistics.

Commissioner's Recommendation

The Commissioner recommends the Regents approve the request by Utah Valley University to offer a Bachelor of Science in Statistics, effective Spring 2014.

David L. Buhler
Commissioner of Higher Education

DLB/GVB
Attachment

**Program Description
Utah Valley University
BS in Statistics**

Section I: The Request

Utah Valley University requests approval to offer a Bachelor of Science in Statistics, effective Spring Semester 2014. The institutional Board of Trustees approved the degree on March 28, 2013.

Section II: Program Description

Complete Program Description

The BS in Statistics can be used in a wide variety of applications in the sciences and in industry to predict trends, determine the significance of the results of experiments, and estimate characteristics of populations with measurable confidence levels from statistics derived from samples. Students who continue into graduate school and receive an MS in Statistics are in high demand and have good starting salaries. The government is one of the largest employers of statistics graduates, who are employed in various capacities. In the health care industry, statisticians are used to measure the significance of the results of clinical trials and in the area of bioinformatics. Statisticians are employed for quality control in manufacturing industries. They also measure the usefulness of approaches to manufacturing problems by estimating the likelihood of associated factors. For example, they might determine the probable output from a system or determine which aspects of a product are best correlated with customer demand. In business, statisticians are employed to predict and manage risk, as well as optimize the effectiveness of marketing by measuring the most receptive demographic for a product or service and the response of that demographic to various marketing strategies. Statisticians are also employed to predict market trends for the stock market or foreign exchange. They are employed by banks, often as loan officers, and their skills can be used for setting interest rates and predicting which loans are likely to be good investments which will result in a positive return. Statisticians are also systems analysts, actuaries, auditors, security brokers, and trade specialists.

Purpose of Degree

Statistics degrees are highly marketable, and there is only one other USHE institution offering the same degree. Utah Valley University would make a good second "feeder" school for local graduate schools, such as the University of Utah. BYU also has a statistics program, but their admissions standards for in-state students are rather high, so their program does not meet all the needs of the local population. UVU would be able to provide this degree to Utah students who are not otherwise able to participate in such a program.

Institutional Readiness

The Mathematics department faculty members are already sufficient for the implementation of the program. The mathematics courses available include many of the courses needed for the statistics degree, and the remaining courses needed for the degree have been created. The mathematics degree already has an actuarial science emphasis, which has a substantial statistical component.

Faculty

Faculty Category	Faculty Headcount – Prior to Program Implementation	Faculty Additions to Support Program	Faculty Headcount at Full Program Implementation
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)			
Full-time Tenured	13		13
Full-time Non-Tenured	6		6
Part-time Tenured			
Part-time Non-Tenured	2		2
With Master's Degrees			
Full-time Tenured	4		4
Full-time Non-Tenured			
Part-time Tenured			
Part-time Non-Tenured	10	1	11
With Bachelor's Degrees			
Full-time Tenured			
Full-time Non-Tenured			
Part-time Tenured			
Part-time Non-Tenured	1		1
Other			
Full-time Tenured			0
Full-time Non-Tenured			
Part-time Tenured			
Part-time Non-Tenured	9		9
Total Headcount Faculty			
Full-time Tenured	17	0	17
Full-time Non-Tenured	6	0	6
Part-time Tenured	0	0	0
Part-time Non-Tenured	22	1	23
Total Department Faculty FTE (As reported in the most recent A-1/S-11 Institutional Cost Study for “prior to program implementation” and using the A-1/S-11 Cost Study Definition for the projected “at full program implementation.”)	31.2	.8	32

Staff

The present Mathematics department advisors and administrative assistant will be sufficient support to implement the BS in Statistics.

Library and Information Resources

Books

Mathematical statistics materials are located in Library of Congress call number areas, QA 276-280, with 150 volumes, plus 19 e-books held in this classification range. A broader search in the catalog on the subject keyword term, “statistics,” (which would include such terms as “medical statistics” or “business statistics”) yields a total of 781 titles.

Journals

The library holds 46 journals in mathematical statistics and 47 journals in general statistics, as well as the 14 titles published by the American Mathematical Association. The library subscribes to the major mathematical index, *MathSciNet*, as well. Any article not owned by UVU library can be obtained electronically through Interlibrary Loan on an average of two working days. Journals are accessible at all times from any point on the Web using the library homepage via a proxy server.

Media

The library owns six titles (21 videos) in statistics.

Reference

Statistics students and faculty have a librarian assigned specifically to the Mathematics department for the purposes of instruction, individual consultation, and collection development. The current librarian has a minor in mathematics from the University of Missouri.

Both books and journal articles may be placed on reserve for individual classes, either in print or electronically, and linked from the course management software, Canvas.

Access

As UVU is a part of the Utah Academic Library Consortium, all UVU student cards are good at every public college or university library in Utah, as well as the libraries of two private schools, Brigham Young University and Westminster College.

Admission Requirements

Completion of MATH 1210 and MATH 1220 (or equivalent) with an overall GPA of 2.0 or better is required for admission. The student must also meet with the Mathematics department advisor and declare their intent to major in statistics.

Student Advisement

When students begin the BS in Statistics, they will meet with the Mathematics department advisor to go over a plan for graduation, including what classes should be taken during which semesters in order to graduate expeditiously.

Justification for Graduation Standards and Number of Credits

The proposed program requires the standard 120 credit hours.

External Review and Accreditation

No external consultants were used, and no special accreditation will be sought.

Projected Program Enrollment and Graduates; Projected Departmental Faculty/Students:

Data Category	Current – Prior to New Program Implementation	Projected Year 1	Projected Year 2	Projected Year 3	Projected Year 4	Projected Year 5
Data for Proposed Program						
Number of Graduates in Proposed Program	X	8	8	8	9	10
Total # of Declared Majors in Proposed Program	X	30	47	60	65	70
Departmental Data – For All Programs Within the Department						
Total Department Faculty FTE (as reported in Faculty table above)	31.2	31.7	32	32	32	32
Total Department Student FTE (Based on Fall Third Week)	970	977	976.1	977.67	978.47	979.13
Student FTE per Faculty FTE (ratio of Total Department Faculty FTE and Total Department Student FTE above)	31.1	30.8	30.6	30.6	30.6	30.6
Program accreditation-required ratio of Student FTE/Faculty FTE, if applicable.	NA	NA	NA	NA	NA	NA

Expansion of Existing Program

The BS in Statistics would not be an expansion of an existing program.

Section III: Need

Program Need

Statistics is an important field of study with many well-paying job opportunities. UVU has students with an interest in a BS in Statistics, who have indicated they believe they would pursue this degree if it were available. Furthermore, the classes which would accompany such a degree would provide a good foundation for majors in other sciences who wish to better understand appropriate sampling design and the interpretation of data for use in research in their own fields. With a significant and growing number of statisticians in the Mathematics department, UVU is in a good position to offer a BS in Statistics. Many students are unable to get into BYU or USU, or simply wish to attend UVU, and it would be helpful to offer those students the option of pursuing this valuable degree.

Labor Market Demand

According to the Utah Department of Workforce Services website,¹ there is a need for about ten new

¹ <http://jobs.utah.gov>

statisticians per year in Utah (about 1% of the total U.S. demand).² However, it is important to keep in mind that this number only includes employment within the Bureau of Labor Statistics (BLS) employment category 152041, which is the statistician category as defined by the BLS Standard Occupational Classification system. This category does not include statistics faculty in colleges or universities, actuaries, or a number of other jobs with different Bureau of Labor Statistics classifications for which graduates with statistics degrees are frequently employed. For instance, recent job postings for statisticians at the Utah Department of Workforce Services website over a seventeen-day period (4/10/2012 to 4/26/2012) included Clinical Development Analyst, Biostatistician, Managed Care Analyst, Clinical Product Manager, Clinical Outcomes Analyst, and Senior Statistician. Therefore, a significant proportion of statistical jobs are not included in category 152041. Another approach to estimating market demand is to find out how many statisticians are graduating each year and how successful these graduates are in finding employment that is closely related to their major. The statistics department at Brigham Young University has the largest number of BS Statistics graduates in Utah. Upon contacting BYU, it was ascertained they graduate 20 to 25 statistics majors each year, and the department is able to place all the graduates in either graduate school or employment.

Student Demand

About five students a year are taking courses in the Mathematics department in order to meet the prerequisites for the Master of Biostatistics program at the University of Utah. It is reasonable to expect that these students might be more interested in taking classes within the BS in Statistics program since that degree would more closely conform to the material for the Biostatistics program. Statistics graduates who go on to complete an MS degree are in particularly high demand and on average have a median starting salary of about \$80,000 (according to the American Statistical Association).

Similar Programs

Utah State University and Brigham Young University both offer BS degrees in Statistics. Utah State University has both a BS in Statistics program and a BS in Composite Applied Mathematics and Statistics program. The University of Utah has an MS in Statistics program. The Utah Valley University Mathematics department is prepared to offer a BS degree in Statistics with minimal changes to faculty and no changes to staff, so the cost would be relatively small. The degree is highly marketable nationally, and UVU has the largest student population in the state. Though BYU has a BS in Statistics program, their entry requirements for in-state students exclude most applicants, so their program does not meet the needs of many Utah students. Currently, no open-enrollment institution in Utah offers a BS in Statistics.

Collaboration with and Impact on Other USHE Institutions

The University of Utah may benefit indirectly because UVU is likely to produce some graduates that might feed into their MS Statistics program. Most USHE institutions will probably not be affected by the change at all.

Benefits

UVU would benefit from offering a BS in Statistics because UVU has students who wish to pursue the degree. In addition, many students in majors in scientific fields would benefit from taking classes included in a BS in Statistics program. Such classes teach all those working on research involving experiments or observational studies (or any form of sampling) how to properly gather and interpret their data.

² <http://jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do>

Consistency with Institutional Mission

A serious university should endeavor to meet student needs in the most marketable areas, if it can reasonably do so, and create strong programs in fields which have a substantial impact upon the world as a whole. Statistics is among the most useful fields for most practical purposes. A BS in Statistics would make UVU a stronger university. In addition to the fact that such a degree is a valuable component of a serious institution, the mission statement of UVU states that "The University prepares professionally competent people of integrity who, as lifelong learners and leaders, serve as stewards of a globally interdependent community." To be an effective steward of a globally interdependent community, it is important to be able to interpret predictive data demonstrating the effects of actions. The procedures for determining probability, trends, and the past effectiveness of influencing various events by imposing different types of stimuli are central to a BS in Statistics.

Section IV: Program and Student Assessment

Program Assessment

The fundamental goals of the program are: first, that students completing a BS in Statistics be able to either move on to graduate school or find a job which uses their degree; and second, that students completing the program must have achieved a high level of competence in the field of statistics. In particular, they should be able to determine appropriate sampling techniques, derive and use moment generating functions, understand proofs of the main theorems of statistics, and select and apply appropriate probability distributions to model and draw conclusions from data. In order to measure success in these (very general) goals, the UVU Mathematics department plans to administer the Major Field Test to assess weaknesses in comprehension. A survey is also planned for students who are graduating, or have graduated in the last year or two, for the purpose of determining whether graduates were accepted into a graduate program or were able to find a job that made use of statistics.

Expected Standards of Performance

Students graduating with a BS in Statistics should be able to:

- Demonstrate an understanding of the theoretical basis for statistical inference and the proofs and applications of the central theorems of statistics, including (but not limited to) the Law of Large Numbers, the derivation of moment generating functions, Bayes' Theorem, Cramer's Theorem, the Neyman-Pearson Lemma and the Gauss-Markov theorem;
- Choose from appropriate sampling techniques and procedures for statistical analysis which are used in practice, and draw meaningful and reliable inferences from data. These procedures include analysis of variance, the design of experiments and surveys, and regression analysis. Students should know the standard probability distributions and know how and when to apply each distribution;
- Demonstrate competence in the effective use of computational aids such as the Statistics Analysis System (SAS);
- Communicate their results effectively, both orally and in writing.

These criteria were agreed upon by the statistics faculty and the department chair, primarily using typical outcomes at other universities as a template. The Major Field Test will be used as a summative assessment measure of these outcomes.

Section V: Finance

Budget

5-Year Budget Projection						
Departmental Data	Current Budget— Prior to New Program Implementation	Year 1	Year 2	Year 3	Year 4	Year 5
Personnel Expense						
Salaries & Wages	\$1,863,243	\$1,874,353	\$1,880,575	\$1,881,268	\$1,881,989	\$1,882,739
Benefits	\$741,282	\$742,460	\$743,119	\$743,193	\$743,269	\$743,349
Total Personnel Expense	\$2,604,525	\$2,616,813	\$2,623,694	\$2,624,460	\$2,625,258	\$2,626,087
Non-personnel Expense						
Travel	\$19,917	\$20,417	\$20,417	\$20,417	\$20,417	\$20,417
Capital						
Library						
Current Expense	\$39,568	\$40,568	\$40,568	\$40,568	\$40,568	\$40,568
Total Non-personnel Expense	\$59,485	\$60,985	\$60,985	\$60,985	\$60,985	\$60,985
Total Expense (Personnel + Current)	\$2,664,010	\$2,677,798	\$2,684,679	\$2,685,445	\$2,686,243	\$2,687,072
Departmental Funding						
	Year 1	Year 2	Year 3	Year 4	Year 5	
Appropriated Fund	\$2,664,010	\$2,677,798	\$2,684,679	\$2,685,445	\$2,686,243	\$2,687,072
Other:						
Special Legislative Appropriation						
Grants and Contracts						
Special Fees/Differential Tuition						
Total Revenue	\$2,664,010	\$2,677,798	\$2,684,679	\$2,685,445	\$2,686,243	\$2,687,072
Difference						
Revenue - Expense	\$0	\$0	\$0	\$0	\$0	\$0
Departmental Instructional Cost/Student Credit Hour* (as reported in institutional Cost Study for “current” and using the same Cost Study Definition for “projected”)	\$87	\$91	\$92	\$92	\$92	\$92

Funding Sources

No external funding sources have been acquired, so funding will come through UVU, supplemented by enrollment growth.

Reallocation

The problem will be maintaining a good teacher-to-student ratio for classes taught during the first few years, because of small class sizes in the upper-division statistics courses at the beginning of the degree

program. This could be offset somewhat by either slightly increasing class sizes for some of the Mathematics department classes or by being more meticulous about closing sections that have borderline enrollments, which might be integrated into other sections.

Impact on Existing Budgets

The Mathematics department's hourly budget could be negatively impacted for a few years, but the effect will probably be manageable. There may also be other ways to cut spending (out-of-country travel requests without strong justification) so that funds could be shifted from the department budget to cover the deficiency in the hourly budget.

Section VI: Program Curriculum

All Program Courses

Course Prefix and Number	Title	Credit Hours
General Education Requirements		
ENGL 1010	Introduction to Writing	3
ENGL 2010 or ENGL 2020	Intermediate Writing – Humanities/ Social Sciences or Intermediate Writing – Science and Technology	3
MATH 1050	College Algebra	4
Complete one of the following:		
HIST 2700 and HIST 2710	US History to 1877 and US History since 1877	
HIST 1700	American Civilization	
HIST 1740	US Economic History	
POLS 1000	American Heritage	
POLS 1100	American National Government	
Complete the following:		
PHIL 2050	Ethics and Values	3
HLTH 1100 or PES 1097	Personal Health and Wellness or Fitness for Life	2
Distribution Courses:		
Biology	Biology	3
PHYS 2210	Physics for Scientists and Engineers I	4
PHYS 2215	Physics for Scientists and Engineers I Lab	1
One other Biology or Physical Science Distribution	One other Biology or Physical Science Distribution	3
Humanities Distribution	Humanities Distribution	3
Fine Arts Distribution	Fine Arts Distribution	3
Social/Behavioral Science	Social/Behavioral Science	3
Discipline Core Requirements:		
MATH 1210	Calculus I	5
MATH 1220	Calculus II	5
MATH 2210	Calculus III	3
MATH 2270	Linear Algebra	3
MATH 3710	Applied Regression and Time Series	4

Course Prefix and Number	Title	Credit Hours
MATH 4710	Mathematical Statistics I	3
MATH 4720	Mathematical Statistics II	3
STAT 2050	Introduction to Statistical Methods	4
STAT 2060	Introduction to Statistical Computing	1
STAT 4100	Design of Experiment	3
STAT 4400	Multivariate Analysis	3
Complete three of the following:		
STAT 4200	Survey Sampling	
STAT 4300	Stochastic Processes	
STAT 4500	Nonparametric Statistics	
STAT 4600	Statistical Process Control	
Complete 9 hours of upper-level MATH or STAT courses		9
Sub-Total		92
Elective Requirements		
Complete 9 credits of upper-division electives		
Complete 18 credits of upper- or lower-division electives		
Sub-Total		28
Total Number of Credits		120

New Courses to Be Added in the Next Five Years

There are no new courses which are not already in the curriculum process.

Program Schedule

Sample recommended class progression:

Semester 1		
Course Prefix and Number	Course Title	Credits
MATH 1050	College Algebra	4
ENGL 1010	Introduction to Writing	3
HIST 1700	American Civilization	3
PHIL 2050	Ethics and Values	3
Biology distribution		3
Semester Total		16
Semester 2		
Course Prefix and Number	Course Title	Credits
MATH 1060 (recommended elective, prerequisite for MATH 1210)	Trigonometry	3
STAT 2050	Introduction to Statistical Methods	4
STAT 2060	Introduction to Statistical Computing	1
Elective		3
ENGL 2020	Intermediate Writing – Science and Technology	3
PES 1097	Fitness for Life	2
Semester Total		16

Semester 3		
Course Prefix and Number	Course Title	Credits
MATH 1210	Calculus I	5
Fine Arts Distribution		3
Humanities Distribution		3
Biology or Physical Science Distribution		3
Elective		3
Semester Total		17
Semester 4		
Course Prefix and Number	Course Title	Credits
MATH 1220	Calculus II	5
PHYS 2210	Physics for Scientists and Engineers I	4
PHYS 2215	Physics for Scientists and Engineers I Lab	1
Behavioral Science Distribution		3
Elective		3
Semester Total		16
Semester 5		
Course Prefix and Number	Course Title	Credits
MATH 2210	Calculus III	3
MATH 2270	Linear Algebra	3
MATH 3710	Applied Regression and Time Series	4
STAT 4100	Design of Experiment	3
Upper-Division Elective		3
Semester Total		16
Semester 6		
Course Prefix and Number	Course Title	Credits
STAT 4400	Multivariate Analysis	3
STAT 4200	Survey Sampling	3
MATH 4710	Mathematical Statistics I	3
Upper-Division Electives		6
Semester Total		15
Semester 7		
Course Prefix and Number	Course Title	Credits
MATH 4720	Mathematical Statistics II	3
STAT 4300	Stochastic Processes	3
Upper-Division MATH or STAT course		3
Elective		3
Semester Total		12
Semester 8		
Course Prefix and Number	Course Title	Credits
MATH 4750 (recommended as part of the 9 credits of upper-division MATH or STAT course requirement)	Life Contingencies	3
STAT 4500	Nonparametric Processes	3

STAT 4600 (recommended as part of the 9 credits of upper-division MATH or STAT course requirement)	Statistical Process Control	3
Elective		3
Semester Total		12
TOTAL		120

Section VII: Faculty

While the greater burden will be on the statistics faculty (the four with statistics doctorates), all full-time faculty in the Mathematics department will teach classes associated with this degree. Below is the current list of full-time faculty (excluding a temporary lecturer):

- Andrist, Kathryn
 - PhD Mathematics
- Bhattacharjee, Debanjan
 - PhD Statistics
- Brandt, David
 - MS Mathematics
- Brinkerhoff, Colin
 - MS Mathematics
- Carlson, Gary
 - MS Mathematics
- Faurot, Donald
 - PhD Mathematics
- Faurot, Vivienne
 - PhD Mathematics Education
- Fearnley, David
 - DPhil Mathematics
- Hamilton, Carolyn
 - MS Mathematics
- Heiny, Erik
 - PhD Statistics
- Hwang, Jong
 - PhD Education
- Ji, Xiaoyi
 - PhD Statistics
- Lewis, Scott
 - PhD Mathematics
- Li, Ya
 - PhD Mathematics
- Ling, Jun
 - PhD Mathematics
- Merrin, Christine
 - PhD Mathematics

- Merrin, Stephen
 - PhD Mathematics
- Palais, Robert
 - PhD Mathematics
- Quinn, Melissa
 - MA Mathematics Education
- Turnquist, R.
 - MS Mathematics
- Van Frankenhuijsen, Machiel
 - PhD Mathematics
- Vasilevska, Violeta
 - PhD Mathematics
- Walker, Christine
 - PhD Mathematics Education
- Zhu, Yingxian
 - PhD Mathematics