TO: Ernest Yanarella, Chair
Senate Council

FROM: Jeannine Blackwell, Chair
Graduate Council

Jeannine Blackwell
Digitally signed by Jeannine Blackwell
DN: cn=Jeannine Blackwell, c=US, o=University of Kentucky, ou=Graduate School, email=jeannine.blackwell@uky.edu
Date: 2006.04.14 15:54:04 -04'00'

TRANSMITTAL

I am transmitting the proposal for a New Graduate Certificate in Applied Statistics. This proposal was approved by unanimous vote of Graduate Council on April 13, 2006.

UNIVERSITY OF KENTUCKY

College of Arts and Sciences
Office of the Dean
213 Patterson Office Tower
Lexington, KY 40506-0027
Fax: (859) 323-1073
www.uky.edu

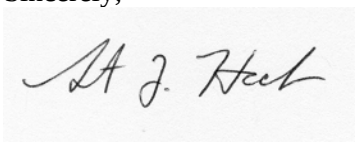
April 21, 2006

Professor Arnold J. Stromberg
DGS, Department of Statistics
817 Patterson Office Tower
CAMPUS 0027

Dear Professor Stromberg:

I am pleased to support the proposed Graduate Certificate in Applied Statistics.

Sincerely,



Steven L. Hoch
Dean

SLH:akh

cc: Philip Harling, Associate Dean
Connie Wood, Professor

UNIVERSITY OF KENTUCKY

College of Arts and Sciences

Department of Statistics
817 Patterson Office Tower
Lexington, Kentucky 40506-0027
Phone: (859) 257-8859
FAX: (859) 323-1973

March 13, 2006

Dr. Jeannine Blackwell
Dean, Graduate School
102 Gillis Building
CAMPUS 0033

Dear Jeannine,

The Department of Statistics proposes the:

Graduate Certificate in Applied Statistics

Description: This certificate will allow students to earn tangible confirmation of their applied statistics skills.

Justification: Data analysis skills are valued in all academic areas. Students with this certificate will be better able to analyze their own data and will be more valued in the job market, regardless of their post graduation plans.

Goals: The goals of the certificate incude:

- Preparing students to properly analyze their own research data, regardless of their mathematical experience.
- Teaching students to identify the appropriate statistical analysis for a given situation
- Teaching students how to validate assumptions on which statistical method are based.

Our proposal is attached. Please contact me if further information is needed.

Sincerely,

Arnold J. Stromberg
Director of Graduate Studies and Statistical Services

Graduate Certificate in Applied Statistics

From: Arnold J. Stromberg, DGS Statistics
To: Graduate School Dean Blackwell
Date: February 1st, 2006. Revised March 13th, 2006

Statistical data analysis is ubiquitous in all areas of science, engineering, medicine, agriculture and education. Research and professional success in these disciplines often depends on using the latest advances in applied statistics. Multidisciplinary research projects involving a substantial component of applied statistics are becoming a frequent venue of expanding the borders of knowledge.

Graduate programs across the United States must recognize this quickly growing role of applied statistics as well as its importance to multidisciplinary projects. This recognition should be reflected in the graduate curriculum. Our objective in this proposal is to develop a curriculum leading to a graduate certificate in Applied Statistics to educate researchers and professionals in multidisciplinary backgrounds and with substantial understanding of the principles and applications of statistics.

This certificate will train graduate and professional degree students in the use of applied statistics in their own fields. The students will be able to use this enrichment to become more productive professionals, to further research in their own areas and to engage in multidisciplinary research relying on applied statistics techniques.

2. Details

2.1 Administration

This program will be administered by the Graduate Certificate in Applied Statistics (GCAS) committee. The committee will be chaired by the director of Graduate Studies (currently Arnold J. Stromberg) in the Department of Statistics, the director of Undergraduate Studies (currently Kert Viele) and the chair of the Department of Statistics (currently Connie Wood) will be members of this committee. The committee will be in charge of the admission, record keeping, oversight and student certification.

2.2 Admission Requirements

To be admitted to this curriculum and work towards an Applied Statistics Certificate students must be associated with the University of Kentucky in one of the following categories: 1. Enrolled post baccalaureate or in a degree program and admitted to the graduate school. 2. Enrolled in a professional degree program. 3. A resident in the medical center. Students must be admitted to the graduate school. Admission to the curriculum will be subject to application and approval of the committee. The committee may establish grade point or other admission standards.

2.3 Certificate Requirements

Objectives:

- To prepare students to perform statistical data analysis needed for their research.
- To educate students concerning assumptions behind each statistical method and how to check those assumptions.
- To educate students concerning identification of the appropriate statistical analysis in any particular situation

Students will ~~generally~~ be required to complete 12-15 hours of class work with no grade lower than a B to complete the curriculum. Required courses are:

1. STA 570 (4 hrs) or 580 (3 hrs)
   STA 570 BASIC STATISTICAL ANALYSIS. (4)
   STA 580 BIOSTATISTICS I. (3)

2. STA 671 (2 hrs) or STA 681 (3 hrs)
   STA 671 REGRESSION AND CORRELATION. (2)
   STA ~~580~~ BIOSTATISTICS II. (3)
   681

3. STA 672 (2 hrs) or STA 673 (2 hrs) or STA 675 (2 hrs)
   STA 672 DESIGN AND ANALYSIS OF EXPERIMENTS. (2)
   STA 673 DISTRIBUTION-FREE STATISTICAL INFERENCE AND ANALYSIS OF CATEGORICAL DATA. (2)
   STA 675 SURVEY SAMPLING. (2)

4. STA 677 (3 hrs) or STA 679 (3 hrs)
   STA 677 APPLIED MULTIVARIATE METHODS. (3)
   STA 679 DESIGN AND ANALYSIS OF EXPERIMENTS II. (3)

5. One Additional 2-3 hr course in applied statistics, but not necessarily in the Department of Statistics approved in advance by the committee.

Courses officially transferred to UK will be allowed as substitutions with the approval of the committee.

2.4 Resources

At this time, no additional resources are required.

2.5 Course Descriptions

STA 570 BASIC STATISTICAL ANALYSIS. (4)
Primarily in biological, behavioral and social sciences. Introduction to methods of analyzing data from experiments and surveys; the role of statistics in research, statistical concepts and models; probability and distribution functions; estimation; hypothesis testing; regression and correlation; analysis of single and multiple classification models; analysis of categorical data. Lecture, three hours; laboratory, two hours. Prereq: MA 109 or equivalent. For graduate students; undergraduates must have consent of instructor.

STA 580 BIOSTATISTICS I. (3)
Descriptive statistics, hypothesis testing, paired and unpaired tests, ANOVA, contingency tables, log rank test, and regression with biostatistics applications. Prereq: MA 109 or equivalent.

STA 671 REGRESSION AND CORRELATION. (2)
Simple linear regression, elementary matrix algebra and its application to simple linear regression; general linear model, multiple regression, analysis of variance tables, testing of subhypotheses,nonlinear regression, step-wise regression; partial and multiple correlation. Emphasis upon use of computer library routines; other special topics according to the interests of the class. Lecture, three hours per week; laboratory, two hours per week for seven and one half weeks. Offered the first or second half of each semester. Prereq: STA 570 or STA 580.

STA 672 DESIGN AND ANALYSIS OF EXPERIMENTS. (2)
Review of one-way analysis of variance; planned and unplanned individual comparisons, including contrasts and orthogonal polynomials; factorial experiments; completely randomized, randomized block, Latin square, and split-plot designs: relative efficiency, expected mean squares; multiple regression analysis for balanced and unbalanced experiments, analysis of covariance. Lecture, three hours per week; laboratory, two hours per week for seven and a half weeks. Offered the first or second half of each semester. Prereq: STA 671.

STA 673 DISTRIBUTION-FREE STATISTICAL
INFERENCE AND ANALYSIS OF CATEGORICAL DATA. (2)
Inference for population quantiles, sign tests, Wilcoxon tests, Kruskal-Wallis and Friedman tests, Kendall and Spearman rank correlation. Goodness-of-fit tests for completely and partially specified distributions, rxc contingency tables, McNemar and Cochran's Q tests for matched proportions; three dimensional tables and tests of partial and multiple associations. Lecture, three hours per week; laboratory, two hours per week for seven and a half weeks. Offered the first or second half of each semester. Prereq: STA 570 or STA 580.

STA 675 SURVEY SAMPLING. (2)
Simple random sampling and stratified random sampling, ratio and regression estimators, cluster sampling, systemic sampling, and multi-stage sampling. Specific problems associated with running a survey: non-response, call-backs, questionnaire construction, mail questionnaires, and area sampling. Lecture, three hours per week; laboratory, two hours per week for seven and a half weeks. Offered the first or second half of each semester. Prereq: STA 570 or STA 580.

STA 677 APPLIED MULTIVARIATE METHODS. (3)
Survey of multivariate statistical techniques. The multivariate normal distribution; the general linear model; general procedures for parameter estimation and hypothesis testing in the multivariate case; Hotelling's T2, multivariate analysis of variance and covariance; structural models for the covariance matrix; utilization of existing computer programs. Prereq: STA 671 and 672.

STA 679 DESIGN AND ANALYSIS OF EXPERIMENTS II. (3)
A continuation of STA 672. review of factorial experiments; partial factorials; confounded factorials; split blocks; split-split plots; repeated measures; Graeco-Latin squares; crossover and switchcback designs; response surface methods; mixture experiments; incomplete block designs; variance component; mixed model methodology; combining analyses of a series of similar experiments. Prereq: STA 671 and 672 or equivalent.

STA 681 BIOSTATISTICS II. (3)
Students will learn statistical methods used in public health studies. This includes receiver operator curves, multiple regression logistic regression, confounding and stratification, the Mantel-Haenzel procedure, and the Cox proportional hazardous model. Lecture, two hours; laboratory, two hours per week. Prereq: STA 580 or equivalent. (Same as SPH 630.)

2.6 Sample Syllabi

Graduate Certificate in Applied Statistics
Electronic Application for Admission

Note: This form must be submitted electronically to the Director of Graduate Studies in the Department of Statistics. A hard copy with signature should be sent via campus mail to DGS, Statistics, 817 Patterson Office Tower, CAMPUS 0027.

Name:

Home Address:

Work Address:

Home Phone:

Work Phone:

Mobile Phone:

Student ID number:

Educational Experience: List all degrees earned or in progress including: Institution, Major, Date, GPA:

When do (did) you anticipate beginning the Graduate Certificate in Applied Statistics?

Do you have any work experience relevant to this application?

Please describe your background in math and/or statistics:

What courses do you tentatively plan to use to qualify for the Graduate Certificate in Applied Statistics? Please Note that any changes to this plan require advance approval of the DGS in Statistics.

Please sign and date here to certify that the statements made in this application are accurate and complete:

Signed:

Date:

Approval of DGS in Statistics:

Signed:

Date:

Application for Awarding of Graduate Certificate in Applied Statistics

Note: This form must be submitted electronically to the Director of Graduate Studies in the Department of Statistics. A hard copy with signature should be sent via campus mail to DGS, Statistics, 817 Patterson Office Tower, CAMPUS 0027.

Name:

Email:

Student ID number:

Courses taken (including grades) that qualify you for the Graduate Certificate in Applied Statistics:

Please comment on the quality of instruction in the courses taken:

Please comment on the appropriateness of the material covered in the courses taken:

How do you plan to take advantage of your Graduate Certificate in Applied Statistics?

Any other comments:

Please sign and date here to certify that the statements made in this application for the Graduate Certificate in Applied Statistics are accurate and complete:

Signed:

Date:

Approval of DGS in Statistics:

Signed:

Date:

STA 677.001
Applied Multivariate Analysis
MWF 11:00-11:50 in CB 307

Instructor: Prof. Bill Rayens rayens@uky.edu 257-7061 (phone)
865 POT 323-1973 (fax)

Office Hours: MW 1:30-2:30

Text: *Analyzing Multivariate Data*, by Lattin, Carroll, and Green (2002).

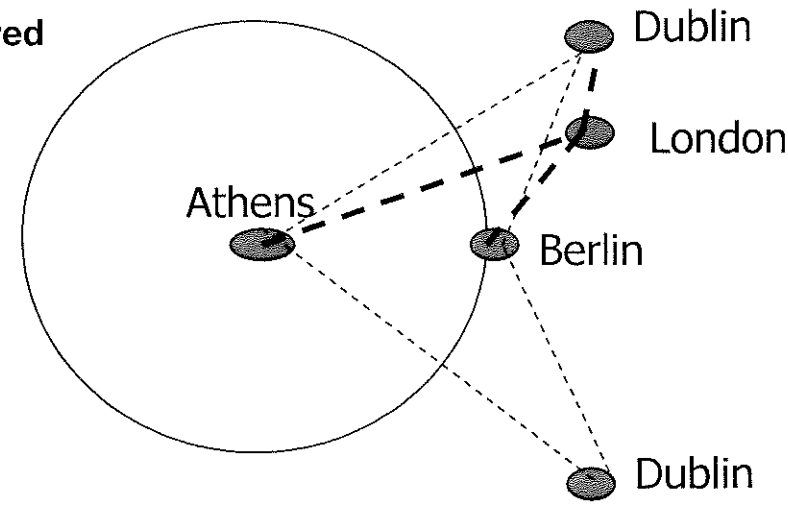
Web: selected class notes, problem set information, data, research applications, etc. will be maintained on-line at http://www.ms.uky.edu/~rayens/teaching/sta677.htm

Prereq: a solid background in regression and basic statistical applications; matrix algebra useful, but not required.

Grading: 100% of the course credit is allocated to a series of problems sets to be assigned throughout the term. Collaboration is allowed on the problem sets.

Tentative List of Topics to be Covered

- Principal Components Analysis
- Factor Analysis
- Discriminant Analysis
- Multidimensional Scaling
- Cluster Analysis
- Canonical Correlations Analysis
- Introduction to Multivariate Analysis of Variance



Learning Objectives

Upon successfully completing this course the student will be able to:

- Articulate the advantages of multivariate analysis over univariate analysis
- Identify appropriate and inappropriate uses for each of the statistical methods studied
- Articulate strengths and weaknesses of each of the statistical methods studied
- Use SAS to implement each of these methods
- Interpret the results of these implementations in the context of real data and form contextually meaningful conclusions

STA 675 Elementary Survey Sampling Fall 2005

Instructor: Dr. Bill Rayens
Office/Hrs: 865 POT/MWF 11:00-11:50

Meeting Times
Class CB 211 on MWF 9:00-9:50
Laboratory CB 307 on R 12:00 – 1:50

Text: Sampling Methods for Applied Research, by Peter Tryfos

Included is a data diskette containing data sets and a sampling calculator. Start getting familiar with this diskette.

Blackboard: This course will be fully organized and administered through Blackboard, U.K.'s course management system. You must have a Blackboard account and should check Blackboard often for announcements. Please go to https://elearning.uky.edu and follow the links to acquire a Blackboard (Bb) logon. Do not rely on the instructor's old STA 675 website. It may not be kept up to date.

Laboratory: Thursday labs will meet in CB 307. Rebecca Rankin will be your TA for the lab. Rebecca will facilitate the discovery exercises that I create and will be available to help you with homework questions. We will also use the laboratory to become proficient with Tryfos' useful, but awkward "sampling diskette".

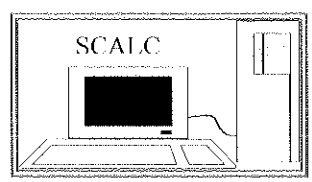
Grading Policies

Take-Home Exams (2)	200 course points (non-collaborative)
Problem Sets	165 course points (collaborative)
Laboratories	35 course points (attendance)

The usual grading scale (90-100 A; 80-89 B; etc) will be used.

Topics

Introduction and Review	Chapters 1,2,10
Simple Random Sampling	Chapter 3
Stratified Random Sampling	Chapter 4
Two-stage Random Sampling	Chapter 5
Systematic Random Sampling	Special Topic
Ratio and Regression Estimation	Chapter 6
Sampling from a Process	Chapter 9



Specify approach or exit program:
1. Randomization (random sampling)
2. Prediction
0. To exit program

Learning Objectives
Upon successfully completing this course the student will be able to:
1) articulate the concept of "random sampling variability" and "standard error"
2) articulate the connection between "standard error" is a product of the sampling design
3) design, implement and analyze the following sampling designs:
   a) simple random
   b) stratified
   c) multistage
4) explain and apply ratio and regression estimates in the context of simple random samples
5) articulate the role of ratio and regression estimation in the new area of "sampling from a process"

Tentative Schedule of Events – Subject to Revision Depending on Semester Circumstances		
October	**M17**	Classes Begin – Introduction
	W19	Introduction and Review Continues
	R20	Laboratory 1 - Blackboard; Lab Computers; Means and Proportions
	F21	Simple Random Sampling (Chapter 3)
	M24	Simple Random Sampling (Chapter 3)
	W26	Simple Random Sampling (Chapter 3)
	R27	Laboratory 2 – Sampling Variability and Confidence Intervals
	F28	Stratified Random Sampling (Chapter 4)
	M31	Stratified Random Sampling (Chapter 4)
November	**W2**	Stratified Random Sampling (Chapter 4)
	R3	Laboratory 3 – Issues with Stratified Sampling
	F4	Stratified Random Sampling (Chapter 4)
	M7	**Review and Catch Up. Hand Out First Take Home Exam**
	W9	Two-Stage Sampling (Chapter 5)
	R10	Laboratory 4 – Thinking about Two-Stage Samples
	F11	Two-Stage Sampling (Chapter 5)
	M14	Two-Stage Sampling (Chapter 5)
	W16	Systematic Random Sampling (Special Topic) **First Take-Home Due in Class**
	R17	Laboratory 5 – Philosophy of Systematic Samples
	F18	Systematic Random Sampling (Special Topic)
	M21	Ratio and Regression Estimation (Chapter 6)
	W23	Ratio and Regression Estimation (Chapter 6)
	R24	Thanksgiving Break
	F25	Thanksgiving Break
	M28	Ratio and Regression Estimation (Chapter 6)
	W30	Ratio and Regression Estimation (Chapter 6)
December	**R1**	Laboratory 6 – Ratio and Regression Discoveries
	F2	**Review and Catch Up. Hand Out Second Take Home Exam**
	M5	Sampling From a Process (Chapter 9)
	W7	Sampling From a Process (Chapter 9)
	R8	Laboratory 7 – Issues with Sampling from a Process
	F9	Review and Catch Up
	T13	**Second Take-Home Exam is Due at 8:00 a.m.**

Please understand that this is a tentative schedule. While it is great to have a plan, we also need to be flexible enough to see where the semester takes us!

STA 671.003 Fall 2005 Course Information

Instructor

Prof. Bill Rayens
865 Patterson Office Tower
Office Hours: MWF 11:00-12:00

Phone: 257-7061
rayens@uky.edu

Meeting Times

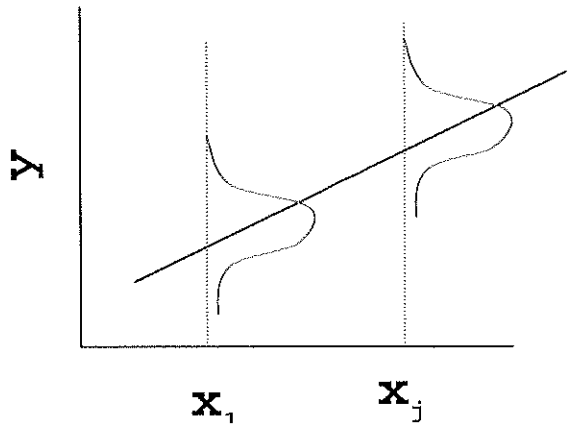
Class CB 211 on MWF 9:00-9:50
Laboratory CB 307 on R 12:00 – 1:50

Text

Applied Regression Analysis for Business and Economics, 4rd Ed. by Terry Dielman

Web

Classroom transparencies and other relevant materials will be available on line at:



Grading Policies

Take-Home Exams (2)	200 course points
Homework	300 course points

Learning Objectives

Upon successfully completing this course you will be able to:

- use SAS to fit a multiple regression model and correctly interpret the output
- identify standard model assumptions, assess the reasonableness of those assumptions in the context of real applications, and be capable of taking appropriate actions if assumptions are violated
- use SAS to fit design models for completely randomized and blocked designs; correctly interpret the output
- identify and assess seriousness of interactions in two-way models and take action if appropriate
- implement in SAS and interpret standard multiple comparison procedures

```
                          The SAS System                          20:31
Tuesday
Model: MODEL1
Dependent Variable: SALES
                        Analysis of Variance

                             Sum of          Mean
  Source           DF       Squares        Square      F Value      Prob>F
  Model             1  16056475.092  16056475.092       14.583      0.0009
  Error            23  25323073.835  1101003.2102
  C Total          24  41379548.927

      Root MSE       1049.28700      R-square       0.3880
      Dep Mean       3374.56760      Adj R-sq       0.3614
      C.V.             31.09397
```

Tentative Schedule of Events – Subject to Revision Depending on Semester Circumstances		
August	**W24**	Classes Begin – Introduction
	R25	Laboratory 1 - Blackboard; Lab Computers; SAS
	F26	Simple Regression (Chapter 3)
	M29	Simple Regression (Chapter 3)
	W31	Multiple Regression (Chapter 4)
September	**R1**	Laboratory 2 – Basic Inference Intuition; Elementary Regression
	F2	Multiple Regression (Chapter 4)
	M5	**Labor Day Holiday**
	W7	No class. (Dr. Rayens at Conference)
	R8	Laboratory 3 – Discovery Exercise (Motivation of Assumptions)
	F9	TA may meet class and go over homework. (Dr. Rayens at Conference)
	M12	Multiple Regression (Chapter 4)
	W14	Fitting Curves (Chapter 5)
	R15	Fitting Curves (Chapter 05) and Assessing Assumptions (Chapter 6) **Makeup Class**
	F16	Assessing Assumptions (Chapter 6)
	M19	Assessing Assumptions (Chapter 6)
	W21	Assessing Assumptions (Chapter 6)
	R22	Laboratory 4 – Practice, Review "Good Regression Hygiene"
	F23	**Review and Catch Up - Hand out First Take Home Exam**
	M26	Indicator and Interaction Variables; ANCOVA (Chapter 7)
	W28	Indicator and Interaction Variables; ANCOVA (Chapter 7)
	R29	Laboratory 5 – When ANCOVA Goes Wrong!
	F30	Indicator and Interaction Variables; ANCOVA (Chapter 7)
October	**M3**	Analysis of Variance (Chapter 9) **First Take Home Exam is Due in Class**
	W5	**Review and Catch Up - Hand out Second Take Home Exam**
	R6	Laboratory 6 – Motivating Block Designs; ANCOVA or ANOVA?
	F7	**Fall Break**
	M10	Analysis of Variance (Chapter 9)
	W12	Analysis of Variance (Chapter 9)
	R13	Laboratory 7 – Discovery Exercise (Multiple Comparisons)
	F14	Multiple Comparisons
	M17	Last Day of Classes **Second Exam is Due in Class**

Please understand that this is a tentative schedule. While it is great to have a plan, we also need to be flexible enough to see where the semester takes us!

Brothers, Sheila C

From: Robert B. Grossman [robert.grossman@uky.edu]
Sent: Thursday, September 21, 2006 8:38 AM
To: Brothers, Sheila C
Cc: Mattacola, Carl; Arnold J. Stromberg
Subject: Re: Proposals in Academic Programs

At 10:08 AM -0400 9/19/06, Brothers, Sheila C wrote:

> Could you please tell me if the new grad cert in Applied Statistics and the new MS in Athletic Training have been reviewed yet by AP? They are/were holdovers from late last semester.

Both have been unanimously approved.

-- Bob

UNIVERSITY OF KENTUCKY

Dream • Challenge • Succeed

PROVOST BUDGET OFFICE

December 8, 2006

Dr. Kaveh Tagavi, Chair
Senate Council
201 Main Building
CAMPUS 0032

Dear Professor Tagavi:

I am writing on behalf of the Provost concerning the feasibility of establishing a graduate certificate in Applied Statistics, to be offered by the Department of Statistics. I understand the proposal has been approved by the Graduate Council, which has forwarded its recommendation to the Senate Council.

The Department of Statistics notes the premium academic programs across the university place on having their students develop competency in data analysis. An ability to perform quantitative analyses is a requisite skill for the successful completion of many degrees programs and is increasingly becoming part of the skill set employers require of their employees. The goals of the certificate include:

- Preparing students to properly analyze their own research data, regardless of their mathematical experience;
- Teaching students to identify the appropriate statistical analysis for a given situation;
- Teaching students how to validate assumptions on which statistical methods are based.

The program will be administered by the Graduate Certificate in Applied Statistics (GCAS) Committee. The director of graduate studies in the department will chair the committee, on which several other faculty members of the Department of Statistics will serve. The proposal for this program has been carefully planned. The Department of Statistics has sufficient resources to implement this graduate certificate without requiring an infusion of new funding. Therefore, I am certifying this program as administratively feasible within the existing fiscal and personnel resources of the department.

Sincerely,

Karen T. Combs
Vice Provost for Budget and Administrative Services

Cc: Kumble Subbaswamy
Heidi Anderson
Jeannine Blackwell
Connie Ray
Phil Kraemer

Provost Budget Office
355 Patterson Office Tower • Lexington, Kentucky 40506-0025
(859) 257-6499 • *fax* (859) 257-1797
www.uky.edu