New Course Request

Indian University
Indianapolis Campus

Check Appropriate Boxes: Undergraduate credit □ Graduate credit X Professional credit □

1. School/Division: Science
2. Academic Subject Code: STAT
3. Course Number: 52800 (must be cleared with University Enrollment Services)
4. Instructor: TBA
5. Course Title: Advanced Statistical Inference
   Recommended Abbreviation (Optional) (Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Fall 2010
7. Credit Hours: Fixed at 3 or Variable from _______ to _______
8. Is this course to be graded S-F (only)? Yes ___ No X
9. Is variable title approval being requested? Yes ___ No X
10. Course description (not to exceed 50 words) for Bulletin publication: P: STAT 51900 and STAT 52800
    C: STAT 61900; This course will cover basic measure theory and probability
    statistics and subfields, conditional expectations and probability
    distributions, asymptotic theory of estimation and likelihood based
    inference, optimal statistical tests, confidence sets and U-statistics.
    Other topics that might be covered include invariance, Edgeworth
    expansions, and saddle point method.
11. Lecture Contact Hours: Fixed at 3 or Variable from _______ to _______
12. Non-Lecture Contact Hours: Fixed at N/A or Variable from _______ to _______
13. Estimated enrollment: 15 of which 100 percent are expected to be graduate students.
14. Frequency of scheduling: Annually Will this course be required for majors? Yes— as option
15. Justification for new course: New course for Ph.D. Biostatistics program
16. Are the necessary reading materials currently available in the appropriate library? Yes
17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other
    materials.
18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is
    necessary, desirable, or unimportant.
19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be
    overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments
directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus
consulted.

Submitted by: __________________________ Date: 10-9-2009
Department Chairman/Division Director

Approved by: __________________________ Date: 10/30/2009
Dean

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining
four copies and attachments to the Campus Chancellor or Vice-President.

University Enrollment Services Final—White; Chancellor/Vice-President—Blue; School/Division—Yellow;
Department/Division—Pink; University Enrollment Services Advance—White

UPS 724
PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF A GRADUATE COURSE
(500-600 LEVEL)

DEPARTMENT: Mathematical Sciences
EFFECTIVE SESSION: Fall 2010

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

1. New course with supporting documents (complete proposal form)  
2. Add existing course offered at another campus  
3. Expiration of a course  
4. Change in course number  
5. Change in course title  
6. Change in course credit/type  
7. Change in course attributes  
8. Change in instructional hours  
9. Change in course description  
10. Change in course requisites  
11. Change in semesters offered  
12. Transfer from one department to another

PROPOSED:

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<tr>
<th>Subject Abbreviation</th>
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<th>Course Number</th>
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Long Title: Advanced Statistical Inference
Short Title:

Abbreviated title will be entered by the Office of the Registrar if omitted. (22 CHARACTERS ONLY)

CREDIT TYPE

1. Fixed Credit: Cr. Hrs.: 3
2. Variable Credit Range: Minimum Cr. Hrs.: (Check One) To Or
3. Equivalent Credit: Yes No
4. Thesis Credit: Yes No

COURSE ATTRIBUTES: Check All That Apply

1. Pass/Not Pass Only
2. Satisfactory/Unsatisfactory Only
3. Repeatable
4. Credit by Examination
5. Designator Required
6. Special Fees
7. Registration Approval Type: Instructor
8. Variable Title
9. Remedial
10. Honors
11. Full Time Privilege
12. Off Campus Experience

COURSE DESCRIPTION (INCLUDE REQUISITES):
P: STAT 51900 and STAT 52800, C: STAT 61900
This course will cover basic measure theory and probability, statistics and subfields, conditional expectations and probability distributions, asymptotic theory of estimation and likelihood based inference, optimal statistical tests, confidence sets and U-statistics. Other topics that might be covered include invariance, Edgeworth expansions, and saddle point method.

Calumet Department Head: Date
Calumet School Dean: Date
Calumet Undergrad Curriculum Committee: Date

Fort Wayne Department Head: Date
Fort Wayne School Dean: Date
Fort Wayne Chancellor: Date

Indianapolis Department Head: Date
Indianapolis School Dean: Date
Undergrad Curriculum Committee: Date

North Central Department Head: Date
North Central Chancellor: Date
Date Approved by Graduate Council:

West Lafayette Department Head: Date
West Lafayette College/School Dean: Date
Graduate Council Secretary: Date

Graduate Area Committee Convener: Date
Graduate Dean: Date
West Lafayette Registrar: Date

OFFICE OF THE REGISTRAR
To: Purdue University Graduate Council
From: Faculty Member: Ben Boukai
Department: Mathematical Sciences
Campus: Indianapolis
Date: 10-7-09

Subject: Proposal for New Graduate Course - Documents Supporting Registrar’s
Form 40
Contact information if questions arise
Name: Ben Boukai
Phone Number: 317-274-6926
E-mail: bboukai@math.iupui.edu

Course Number: STAT 62800
Campus Address: 402 N. Blackford St., LD 270

Course Title: Advanced Statistical Inference

A. Justification for the Course
   X Explain how this course relates to other courses offered in the department or other departments and how this course fulfills a recognized need.

   X This course is intended primarily for students Choose one: from within this department

B. Level of the course:
   X Justify request for graduate course level by indicating anticipated enrollments of undergraduate and graduate students.
   Anticipated Undergraduate Student Enrollment:
   Anticipated Graduate Student Enrollment: 100%

C. Prerequisites: (If none, please explain reasons for absence)
   X STAT 51900, STAT 52800, C: STAT 61900

D. Course Instructor:
   □ Instructor’s Name TBA

E1. Course Outline:
   X (An outline of topics to be covered and an indication of the relative emphasis or time devoted to each topic is necessary. If laboratory or field experience is involved, the nature of this component should be explained as well).

E2. X Method of Evaluation or Assessment:

F. Reading List:
   X A reading list or bibliography should be limited to material the students will be required to read in order to successfully complete the course. It should not be a compilation of general reference material.
A. Justification for the course:
This is an advanced statistics course for the biostatistics PhD program. The purpose of the course is to help graduate students build solid background in theory and methods of statistical inference. It is fundamentally important for students to study other advanced statistical courses and to carry out methodological research in the field of Biostatistics. This course will cover basic large sample theorems including laws of large numbers and central limit theorems, M-estimates in particular maximum likelihood estimates and the consistency and asymptotic normality, optimal hypothesis testing, density estimates, edgeworth expansion and saddle point expansion, high dimensional inference and false discovery rate, U-statistics and the asymptotic distributions, robust statistics including breakdown point and influence function. Other topics that might be covered include re-sampling theory and semiparametric efficiency.

B. Learning Outcomes and Method of Evaluation or Assessment:
As a result of having completed the proposed course, the students are expected to be familiar with commonly used distributions, understand and be able to apply the asymptotic theorems to study the asymptotic properties of estimators, be able to compute MLE’s in numerical methods, understand the concept of efficient estimators and be able to construct efficient estimates, know how to estimate densities, understand and be able to apply optimal tests, understand the concept of robust statistics, understand U-statistics and able apply them to derive asymptotic distributions of U-statistics.

Evaluation is based on one mid-term examination (40 points), a comprehensive final examination (80 points) and 12 homework assignments (120 points total). Some of the homework assignments might require programming in SAS, S-plus/R. Grades will be assigned using an absolute scale based on attained percentage score: A[95, 100], A+[90, 94], A-=[85, 89], B+[80, 84], etc.

C. Prerequisites:
Pre-requisites: STAT 519 or STAT 51900, and STAT 528 or STAT 52800
Co-requisite: STAT 61900

D. Course Instructor(s):
TBA

E. Course Outline

Convergence Modes and Limit Theorems: Important modes of convergence including almost sure convergence, convergence in probability, convergence in moments, and convergence in distribution, laws of large numbers, Slutsky's theorem, the delta method.
Hypotheses Testing: Sufficiency and completeness, uniformly most powerful tests and uniformly most powerful unbiased tests. Commonly used tests including likelihood ratio test, score test and Wald tests, and Wilks’ theorem,
Density estimation and Approximation: Histogram density estimates, kernel density estimates and the asymptotic behaviors, Edgeworth expansion, and saddle-point expansion.

High-Dimensional Inference and False Discovery: Chisquare tests with many cells and sparse multinomials, regression models with many parameters, multiple testing and false discovery.


Robust statistics: breakdown point, influence function, Huber estimator, L-And R-estimator, Theil-Scn estimator.

F. Reading List


G. Library Resources:


H. Example of Course Syllabus: See Attached
STAT 62800 Advanced Statistical Inference

Instructor: TBA
Pre-requisites: STAT 519 or STAT 51900, and STAT 528 or STAT 52800
Co-requisite: STAT 61900

COURSE DESCRIPTION AND RATIONALE: This is an advanced statistics course for the biostatistics PhD program. The purpose of the course is to help graduate students build solid background in theory and methods of statistical inference. It is fundamentally important for students to study other advanced statistical courses and to carry out methodological research in the field of Biostatistics. This course will cover basic large sample theorems including laws of large numbers and central limit theorems, M-estimates in particular maximum likelihood estimates and the consistency and asymptotic normality, optimal hypothesis testing, density estimates, edgeworth expansion and saddle point expansion, high dimensional inference and false discovery rate, U-statistics and the asymptotic distributions, robust statistics including breakdown point and influence function. Other topics that might be covered include re-sampling theory and semiparametric efficiency.

EDUCATIONAL OBJECTIVES: As a result of having completed the proposed course, the students are expected to be familiar with commonly used distributions, understand and be able to apply the asymptotic theorems to study the asymptotic properties of estimators, be able to compute MLE’s in numerical methods, understand the concept of efficient estimators and be able to construct efficient estimates, know how to estimate densities, understand and be able to apply optimal tests, understand the concept of robust statistics, understand U-statistics and able apply them to derive asymptotic distributions of U-statistics.

COURSE CONTENTS:

A. Convergence Modes and Limit Theorems: Important modes of convergence including almost sure convergence, convergence in probability, convergence in moments, and convergence in distribution, laws of large numbers, Slutsky’s theorem, the delta method.


C. Hypotheses Testing: Sufficiency and completeness, uniformly most powerful tests and uniformly most powerful unbiased tests. Commonly used tests including likelihood ratio test, score test and Wald tests, and Wilks’ theorem.

D. Density estimation and Approximation: Histogram density estimates, kernel density estimates and the asymptotic behaviors, Edgeworth expansion, and saddle-point expansion.

E. High-Dimensional Inference and False Discovery: Chi square tests with many cells and sparse multinomials, regression models with many parameters, multiple testing and false discovery.

G. **Rouyst statistics**: breakdown point, influence function, Huber estimator, L-And R-estimator, Theil-Sen estimator.

**RECOMMENDED TEXTBOOKS:**

**EVALUATION AND GRADING:**
Evaluation is based on one mid-term examination (40 points), a comprehensive final examination (80 points) and 12 Homework assignments (120 points total). Some of the homework assignments might require programming in SAS, S-plus/R. Grades will be assigned using an absolute scale based on attained percentage score: A+=[95, 100], A=[90, 94], A−=[85, 89], B+=[80, 84], etc.

**CHEATING AND PLAGIARISM:**
Academic misconduct will *not* be tolerated and all cases will be reported. Examine the IU Code of Student Rights, Responsibilities, and Conduct at http://life.iupui.edu/help/code.asp and in particular examine the rules regarding academic misconduct at http://life.iupui.edu/help/docs/Part_3all.html. Violations of these rules will result in a grade of "F" (or 0%) for the assignment in question, and may result in an "F" for the course or even expulsion from the university (see http://life.iupui.edu/help/docs/Part_4all.html#sanction).

**Americans with Disabilities Act:**
If you need any special accommodations due to a disability, please contact Adaptive Educational Services at (317)-274-3241. The office is located in CA 001E.