GEORGE MASON UNIVERSITY
SCHOOL OF INFORMATION TECHNOLOGY AND ENGINEERING

New Course Proposal

I. CATALOG DESCRIPTION:

A. OR /STAT 719: Computational Models of Probabilistic Reasoning (3: 3: 0)

B. Prerequisites: STAT 652 or SYST/STAT 664 or permission of instructor

C. Catalog Description: This course introduces students to theory and methods for building computationally efficient software agents that reason, act and learn in environments characterized by noisy and uncertain information. The course covers methods based on graphical probability and decision models. The course studies approaches to representing knowledge about uncertain phenomena, drawing inferences about uncertain phenomena, and planning and acting under uncertainty. Topics include knowledge engineering, exact and approximate inference in graphical models, learning in graphical models, temporal reasoning, planning and decision making. Practical model building experience is provided. Students apply what they learn to a semester long project of their own choosing.

II. JUSTIFICATION:

A. Course Objective: Bayesian networks and other graphical probabilistic models have become increasingly popular over the past decade in artificial intelligence, decision support, statistics, machine learning, and operations research. This course provides students with a theoretical understanding of the use of graphical models for causal and evidential reasoning in domains characterized by large numbers of interacting variables. It also provides students with the practical skills to construct models of complex domains and to use these models to perform inference, recommend decisions, and/or learn models from observations. Students will leave this course prepared to understand current literature in the probabilistic reasoning field, and to construct realistically complex models of problems.

B. Desirability of Introducing this Course: The increasing popularity of Bayesian networks and the availability of off-the-shelf modeling software have created the need for Masters level instruction in this material.

C. Relationship to Other Undergraduate Courses: This material is currently offered at the PhD level as IT 819. This course will be cross-listed with IT 819.

III. RECOMMENDATION:
A. This course has been approved by the following:

SEOR Department                          Date: __11/01/02__
ITE Graduate Committee               Date: ________________
ITE Dean                                        Date: ________________

B. Proposed Instructors: Kathryn Laskey will teach the first offering of this course.

IV. SEMESTER AND YEAR FOR PLANNED OFFERING: This course will be offered alternate years in the Fall semester, beginning Fall 2003.

V. COURSE SYLLABUS

Requirements: There are regular homework assignments to reinforce concepts, two take-home exams, and a modeling project of the student’s choosing.

Topic Outline:
- Unit 1: Course Overview and Introduction
- Unit 2: Graph Theory, Conditional Independence and Bayesian Networks
- Unit 3: Building Bayesian Network Models: Knowledge Engineering and Modeling
- Unit 4: Knowledge Representation and Model Construction
- Unit 5: Belief Propagation in Bayesian Networks: Propagation in Junction Trees
- Unit 6: Belief Propagation in Bayesian Networks: Other Inference Algorithms
- Unit 7: Inference in Dynamic Bayesian Networks
- Unit 8: Planning and Decision Making
- Unit 9: Learning Bayesian Networks from Data

Course Text:
- Bayesian Networks and Decision Graphs by Finn Jensen, Springer, 2001
- Students are expected to become proficient in a Bayesian network software package. There are free educational versions of several popular packages.