

FACULTY TEACHING GRANT APPLICATION

1. Name _____ Ewa Misiolek _____ **Signature** _____
2. **Title** __Assistant Professor, Mathematics____ **Department** __Mathematics____
3. **Campus Address** __335 Madeleva Hall____ **Phone** __284-4527____
4. **Home Address** _52494 Old Hickory Ln. Granger, IN_ **Phone** __243-9206_____
5. **Proposal Title** __Redesigning CPSC 315 Simulation: Theory and Application _____

6. **Education:** Indicate the highest degree you hold (and where earned), along with any other information about your education relevant to your project.

- Ph.D. Computer Science and Engineering, University of Notre Dame, in progress.
- M.S.C.S.E. Computer Science and Engineering, University of Notre Dame, December 2003.
- M.A. Mathematics, SUNY at Stony Brook, May 1993.

7. **References:** Please ask at least one person professionally qualified to address the significance of your project and your ability to carry it out to submit a letter of recommendation directly to: **Center for Academic Innovation, 2 Spes Unica Hall, Room 115, Saint Mary's College, Notre Dame, IN 46556.** Applications should ensure that the letter(s) reaches the Committee by Friday, March 20, 2009.

Name of recommender: Mary Connolly, Mathematics Department

8. **Departmental Endorsement:** Please have your department chair sign the following statement:
I have read this proposal and consider that it is consistent with the interests of the department and the College.

Chair

Department

Date

9. **Experience:** Indicate positions you have held, activities you have participated in, prior publications, exhibits, or recitals that are relevant to your project.

- I have been the instructor for CPSC 315 in the spring 2004, spring 2006, and spring 2008.
- I regularly attend the annual SIGCSE Technical Symposium on Computer Science Education.

The annual symposium is organized by the ACM Special Interest Group on Computer Science Education and provides an opportunity to discuss the development, implementation, and

evaluation of computer science programs and courses. During those symposiums I had many discussions with colleagues from other colleges and universities about the current methods and software used in computer simulation courses.

10. **The proposal narrative:** Please write to a general academic audience and limit your proposal to no more than five double-spaced pages. Include the following:

1. A brief, descriptive title

Redesigning CPSC 315 Simulation: Theory and Application

2. An explanation of the project, including,

a. Specific aims

The course has been taught in the Mathematics Department for many years; however, for the course to be the best it can be, there are substantive revisions that need to be made that cannot feasibly be done during the school year. The changes include the following goals:

- To become proficient in a new simulation software used for projects and laboratory work.

It is impossible to teach computer simulation without building simulation models and performing simulation experiments; thus the use of simulation software constitutes a very significant portion of CPSC 315. Over the many years when the course was offered by the department, Visual SLAM simulation language within the AweSim! simulation package was used to implement simulation models in areas ranging from manufacturing, logistics, business and health care to computer and computer networks systems. The SLAM software was developed in the early 1990's by Pritsker Corporation and later purchased by Mapics, Inc. However, it has not been developed further in more than 10 years and has become obsolete. While still viable as a teaching tool, and thus used in the course until spring 2008, due to the lack of updates, it became increasingly incompatible with the changing Windows operating system and created a lot of frustration among students, who often had difficulty saving their work and were forced to re-enter their models to complete assignments. Also,

using a seriously outdated software system is not didactically appropriate for preparing students to enter a modern IT environment. The need for an update in the software became very apparent. After considering and researching several alternative simulation packages, as well as discussing the issue with colleagues at the SIGCSE symposium, I selected ARENA as the best choice for replacing Visual SLAM.

- To adopt a new textbook.

The selection of a textbook is largely influenced by the choice of software. ARENA is a commercial product of Rockwell Automation, Inc. Rockwell provides a free academic version of the software if a textbook using ARENA is used during the course. I examined a variety of textbooks on the subject and narrowed the collection of possible textbooks to three (see [1-3]). The three textbooks that I would like to consider for adoption for the course are all bundled with the academic version of ARENA that can be installed on all campus computers at no charge to the college or students.

- To develop a set of laboratory and projects assignments using the new software.

Lab assignments and projects are a central component of the course. Developing good labs and projects takes time and careful thought. The projects should be challenging yet do-able in terms of students' understanding of course material and their abilities with the computer software. It is also necessary to develop a collection of problems involving realistic and current applications in the areas of interest to students typically enrolled in the course.

- To develop a set of handouts on the theoretical concepts of simulation not covered by the textbook.

CPSC 315 Simulation: Theory and Application, as the title of the course suggests, is a blend of *theory* and *practice* of simulation. After looking through many textbooks over the past five years, I have yet to find a textbook that covers both aspects. It is very unfortunate that most textbooks that

are geared toward specific simulation software deal insufficiently with the theoretical aspects of simulation, as is the case with the textbooks I am considering for ARENA. The textbook I used in the past for CPSC 315 [4] was an excellent theoretical introduction to simulation covering all the topics necessary for the course including the statistical fundamentals of simulation. The practice of statistics was accomplished through Visual SLAM, the manuals provided by Pritsker Corporation, and the lab and project assignments developed for Visual SLAM. Now, with the change of the software, and with adopting a new ARENA-oriented textbook, much of the theoretical material will have to be supplemented. Clearly, one solution would be to require that students purchase two textbooks. This would, however, involve a possible expense of over \$250.00, which I consider excessively high, especially in the current economic situation. Therefore, I plan to supplement the missing theoretical topics with a set of handouts.

- To develop a set of in-class group activities and “reading” quizzes related to the theoretical concepts of simulation.

One of the primary themes of this course is the improvement of the learning process by practicing learning skills in the study of simulation concepts and methods. Information is increasing exponentially and our students must become experts at acquiring and applying knowledge to solve new problems. Students in CPSC 315 are expected to learn individually as well as work with other students in the class. Developing communication and interaction skills while working in a group are stressed throughout the course. Before each class students are required to do the assigned reading and during each class period work individually on answering quiz questions related to the reading and, with their team, on a learning activity using information from the reading assignment. It is therefore essential to prepare a set of in-class group activities and quizzes for most of the classes for the semester.

- To develop new course syllabus, including students learning outcomes.

I would like to develop a list of learning outcomes that students should accomplish in the course. A part of the current assessment plan for the computer science program in the Mathematics Department is an evaluation of each course at the end of each semester when the course was offered. The assessment is usually based on general impression of the instructor. I plan to develop a more specific list of goals and outcomes so that the assessment is more firmly grounded in specific results.

- To explore the possibility of expanding the areas of applications to biology and chemistry.

I would like to explore the possibility of using ARENA for simulation experimentation in the areas of biology and chemistry. Such an addition could possibly be interesting to students majoring in those disciplines and thus expand the choice of interdisciplinary courses at Saint Mary's.

b. Method

- In order to prepare the lab and project assignments, I first have to become proficient at using the ARENA software package.
- To select a textbook, I have to read substantial portions of the three candidate textbooks, complete many of the homework exercises, and examine any supplementary materials available with each.
- I plan to research the many resources on simulation courses available through the Winter Simulation Conference, SIGCSE resources, other simulation textbooks, in particular:
 - a. Search for current, interesting, and realistic applications that can be used for project and lab assignments.
 - b. Prepare the theoretical handouts.
 - c. Find simulation examples in the areas of biology and chemistry.
- Go over the past project assignments to consider the feasibility of adapting them to the new software.

c. Significance of the project (include how the project will enhance your teaching abilities and how it will contribute to curricular development in your department and at Saint Mary's).

The course CPSC 315 Simulation: Theory and Applications is taught regularly in the Mathematics Department at Saint Mary's and is part of the Computational Mathematics and Management Information Systems majors. It is very important for our computer science program as well as for the Mathematics Department and Saint Mary's College. It involves developing our students' analytical and computer skills, as well as improving problem solving, independent learning, and group cooperation. It is crucial that the content of the courses we offer at Saint Mary's, in particular in the computer science area, is current and prepares our students to be competent members of modern society.

The CPSC 315 course concerns the study of the theory and application of computer simulation. While mathematical theory can solve some applied problems, many must be studied and analyzed using computer simulation. Students in the course are required to model, simulate (implement using computer software), embellish and analyze simulation results. Topics of the course include suitability of simulation to various situations, areas of application, types of models, steps in a simulation study, principles of simulation, input modeling, verification and validation, output analysis, statistical models in simulation, queuing models, random number and random variate generation. The course necessarily includes significant use of simulation software to implement numerous simulation models in areas ranging from manufacturing, logistics, business and health care to computer and computer networks systems.

Most of the students taking CPSC 315 prepare to enter business world where computer simulation is used extensively in developing new products, production systems, and production schedules.

d. Previous work that you have done on this or closely related projects. (Include courses you have taught, positions you have held and activities you have participated in that are relevant to your project.)

I was the instructor of this course during spring 2004, 2006, and 2008. During the spring of 2004, I taught the course together with Don Miller, who also shared with me his experience teaching the course many times before I joined the Mathematics Department. My prior experience with the material will guide me in preparing the new assignments and activities. After teaching CPSC 315 and other upper level computer science courses, I have a fairly good idea of what is the appropriate level of the assignments for our students.

e. If applicable, a list of no more than ten pertinent bibliographical references

- [1] “*Simulation with Arena*” by W. D. Kelton, R. P. Sadowski, D. T. Sturrock, 4ed, McGraw-Hill
- [2] “*Simulation Modeling and Arena*” by Manuel D. Rossetti, published January 2009, Wiley
- [3] “*Simulation Modeling and Analysis with Arena*” by T. Altiok, B. Melamed, Academic Press
- [4] “*Discrete-Event System Simulation*”, by J. Banks, J.S. Carson, B.L. Nelson, D.M. Nicol, 4ed. Prentice-Hall

11. Other funding:

- a. Do you have other financial support for this project?

___ Yes x No

If Yes, please list.

- b. Have you attempted to obtain support for the project from sources other than this fund?

___ Yes x No

If Yes, list with disposition (pending or denied):

- c. Have you previously applied for an SMC Faculty Development Grant?

___ Yes x No

What kind? Research/ Teaching

Date of most recent application _____ Awarded? ___ Yes ___ No

12. Date on which the work will begin: Summer 2009

NOTE: A report on the project is due to the Vice President & Dean of Faculty, with a copy to the Center for Academic Innovation, no later than March 1, 2010.

The Committee wishes to make successful proposals available to serve as models for other faculty interested in applying for development grants. If your proposal is funded, may we use it?

Yes ___ No ___