Ph.D. in Applied Management & Decision Sciences
Operations Research Specialization

Specialized Knowledge Area Module VI
Stochastic Operations Research Techniques

Overall Learning Objectives

Students who have been admitted into the operations research specialization should already have a strong background in probability and statistics; completion of FRS seminars (formerly KAM IV) should strengthen that background. KAM VI provides you with an opportunity to combine their probability and statistics experience with a variety of modeling techniques for optimization, analysis, or general decision-making situations. An ability to model a variety of situations under uncertain conditions KAM and be able to apply them is a necessary component of this KAM. Pulling a model out of a software “black box” is not sufficient. Software may be an aid in computation, but you must be able to defend a particular technique, demonstrate an understanding of the assumptions behind the technique and their implications, and interpret the results. So-called “quick and dirty” techniques may be a starting point for the KAM but not a completion.

Breadth Component
Theory of Stochastic Methods

To begin study for the Breadth component, work through a basic textbook in stochastic processes. A good text will discuss the general topic areas of stochastic processes: Markov chains and processes, simulation (both discrete-event and dynamic systems), queuing, inventory theory, reliability and maintainability theory, replacement theory, Brownian motion, and stationary processes. Decide on three or four topics are of interest and work with your faculty assessor to determine the scope.

The demonstration of learning could be an essay of about 30 pages or a complete set of problems with detailed solutions provided and any annotations that might clarify the solution. Another way to demonstrate your learning could be to construct a set of detailed course notes for teaching a graduate-level course or leading a graduate-level seminar.
**Depth Component**

*Current Research in Stochastic Methods*

You are expected to thoroughly research one of the general topic areas considered in the Breadth section in order to become an expert in that topic. Current research abounds in these topic areas. One requirement of the KAM is to produce an annotated bibliography based on at least 15 journal articles. The usual maximum age of the articles (5 years) is specifically relaxed in this KAM, since some of the fundamental articles are more than 5 years old. You must be familiar with these standard articles in the topic area you have chosen. However, not more than 25% of the articles reviewed in the annotated bibliography may be more than 5 years old.

The demonstration of learning could be a publishable paper or an essay of about 30 pages. Given the subject matter, however, such an essay is likely to be heavily peppered with mathematics. You might, instead, choose to demonstrate a thorough understanding of the topic by using a software package to formulate of a set of problems with solutions. In such a case, you should not use a black box, but offer discussion the algorithms the software uses with an explanation of assumptions underlying the algorithms. For example, the use of a linear programming software package (or a spreadsheet optimizer such as that in Excel®) without understanding the foundation on which the program rests is not acceptable. You are not required write code.

**Application Component**

*Professional Practice: Application of Stochastic Methods*

Generally, student have an application in mind when beginning the KAM. The anticipated application determines which topic you study in the Depth section. The application should be a real-world problem that you have solved or will solve using a technique studied in the Depth section. Implementation is desired and results reported; however, sometimes implementation is not feasible.

The demonstration of learning should include a brief discussion of the problem you addressed with an explanation of why the particular technique you chose was appropriate. You are expected to discuss the assumptions and limitations of the technique as they apply to the problem at hand. If the technique was adapted in some way to better fit the situation, you should discuss the validity of that adaptation. Finally, the implementation strategy, analysis, and results should be described in detail. You are encouraged to write a publishable article for submission to a journal such as *Interfaces* or the *Production and Inventory Management Journal*. You are also expected, as a part of the demonstration of learning, to defend the application’s utility.