SCUPI
Sichuan University - Pittsburgh Institute

# IE 1082 – Probabilistic Methods in Operations Research

## Spring 2022

## Course Syllabus

(Subject to change)

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**Instructor**

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Office: Zone 4-220
Office Hours: Tuesday 12:30-15:30

**Teaching Assistant**

Monarch Zhou 周昊鹏 (Email: 2018141523010@stu.scu.edu.cn)
Office: QQ Group (685034147)
Office Hours: By appointment

**Lecture**

Tuesday 8:15-11:00; Location: Zone 4-216

**Course Description**

Introduction to probabilistic methods in Operations Research. Models include game theory; decision analysis; stochastic decision modeling techniques including discrete-time Markov chains, continuous- time Markov chains; and queuing theory. 3 credit hours.

**Course Pre-Requisites**

MATH 0240, MATH 0280, IE 1070, IE 1081.

**Course Objectives**

1. To acquaint students with probabilistic analytical/OR modeling techniques that can be used to support various optimal decision making. Students will be able to solve practical optimization problems.
2. To give students experience in building models, deriving solutions and analyzing results through some case studies and assigned homework exercises.
3. Test students' mastery of knowledge through examinations to help students learn this course.

**Applicable ABET Outcomes**

1. An ability to apply knowledge of mathematical, scientific and engineering to obtain solutions that meet specific needs.
2. An ability to design and conduct experiments, as well as analyze and interpret data.
3. An ability to identify, formulate and solve engineering operations research problems.
4. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
5. An ability to learn new technologies and skills according to the needs of engineering practice and their own knowledge base.

**Textbook**

"Introduction to Operations Research", by Hillier, F.S. and Lieberman, G.J. (2015, 10th Edition), , McGraw-Hill Education, New York, New York, USA.
"Operations Research: Applications and Algorithms", by W. Winston, 4th edition, Brooks/Cole Learning, 2004.

**Other Good References:**

"Introduction to Probability Models", by Sheldon M. Ross, 8th ed. Academic Press, 2002

**Assessments**

Homework assignments, projects, and exam questions related specifically to the objectives above.

| | |
|---|---|
| Attendance: | 10% |
| Homework: | 20% |
| Mid-Semester Examination: | 30% |
| Final Examination: | 40% |
| | 100% |

| Score | Letter Grade |
|---|---|
| 90.00-100.00 | A |
| 85.00-89.99 | A- |
| 80.00-84.99 | B+ |
| 76.00-79.99 | B |
| 73.00-75.99 | B- |
| 70.00-72.99 | C+ |
| 66.00-69.99 | C |
| 63.00-65.99 | C- |
| 61.00-62.99 | D+ |
| 60.00-60.99 | D |
| 0.00-59.99 | F |

**Attendance**

There are 14 lectures in the semester. Attendance will be taken for each lecture period. Each student is allowed **two** absences. Each absence, after the third absence, will result in a **1% deduction** from the attendance grade. After the **tenth** absence, the student will not be allowed to take the final exam.

**Exams**

There will be three exams, all are CLOSED BOOK, CLOSED NOTES, CLOSED COMPUTER. Students are allowed to bring one one-sided A4 page note and it **MUST** be hand-written. Violators will receive a score of "zero" for that exam. If you must miss an exam, you should make alternative arrangements with the instructor before the exam is given. If you miss an exam without prior notification, you will receive a score of "zero" for that exam except under extenuating circumstances. You will need a scientific calculator.

**Make-Up Exams**

Students who have not taken both mid-semester and final exams are not eligible for make-up exams. Make-up exams can only be taken by students who have attained between 50.00 % and 59.99 % (out of 100 %) of the total score. Only 75 % of the make-up exam grade can be used to replace the final exam grade. Students taking make-up exams can only attain at most a "D" grade.

**Assignments and Quizzes**

Homework will be assigned weekly and needed to be finished before the next class. You are encouraged to work on these assignments with your classmates. Late submission will not be accepted. Homework solutions must be submitted to the Blackboard system. No make-up quizzes or in-class activities are allowable except under extenuating circumstances.

**Avoiding Plagiarism**

1. Unacknowledged direct copying from the work of another person, or the close paraphrasing of somebody else's work, is called plagiarism and is a serious offence, equated with cheating in examinations. This applies to copying both from other students' work and from published sources such as books, reports or journal articles.
2. Paraphrasing, when the original statement is still identifiable and has no acknowledgement, is plagiarism. A close paraphrase of another person's work must have an acknowledgement to the source. It is not acceptable for you to put together unacknowledged passages from the same or from different sources linking these together with a few words or sentences of your own and changing a few words from the original text: this is regarded as over-dependence on other sources, which is a form of plagiarism.

**Tentative Course Schedule**

| Lecture | Week | Dates | Topics | Chapter |
|---|---|---|---|---|
| 1 | 1 | Feb 22 | Course Introduction, Review of Probability and Statistics | 24 |
| 2 | 2 | March 1 | Game Theory – Two-Person, Zero-Sum Games; Games with Mixed Strategies | 15 |
| 3 | 3 | March 8 | Game Theory – Graphical Solution; Using Linear Programming | 15 |
| 4 | 4 | March 15 | Decision Analysis – Prototype Example; Decision Making without Experimentation | 16 |
| 5 | 5 | March 22 | Decision Analysis – Decision Making with Experimentation; Decision Trees | 16 |
| 6 | 6 | March 29 | Decision Analysis – Utility Theory | 16 |
| 7 | 7 | April 5 | Queuing Theory – Basic Structure | 17 |
| | 8 | April 12 | Midterm Exam | |
| 8 | 9 | April 19 | Queuing Theory – Role of Exponential Distribution; Birth and Death Process | |
| 9 | 10 | April 26 | Queuing Theory – Priority Discipline; Queuing Networks Mid-term Exam Review 2 | |
| | 11 | May 3 | Holiday for International Worker's Day | |
| 10 | 12 | May 10 | Markov Chains – Introduction, Stochastic Processes; | 29 |
| 11 | 13 | May 17 | Markov Chains –Chapman- Kolmogorov Equations | 29 |
| 12 | 14 | May 24 | Markov Chains – Classification of States; Long-Run Properties | 29 |
| 13 | 15 | May 31 | Markov Chains – First Passage of Times; Absorbing States | 29 |
| 14 | 16 | June 7 | Markov Chains – Continuous Markov Chain<br>Final Exam Review | 29 |
| | 17 | June 14 | Final Exam | |