# IOE 543 – Scheduling
# Syllabus
# Winter, 2016

**Instructor:**
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University of Michigan
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Office Hours: Tues 1:00-2:00pm, Thurs 3:00-4:00pm, and by appointment

Class Room: IOE 1680
Class Hours: 10:30am – 12:00pm, Tuesday and Thursday

**Course Description:**
*Scheduling* is an activity involving decisions about the sequence and time of events to achieve a goal. Important applications of scheduling arise in most areas of science and engineering including biology, computer science, energy, manufacturing, medicine, and transportation systems. This class will cover fundamental topics that form the foundation of scheduling theory and practice. There will be an emphasis on classifying problems on the basis of their difficulty, theoretical properties of scheduling models, mathematical proofs, and computational methods for solving models that arise in many contexts.

**Prerequisites:**
This course will assume a level of maturity in mathematics consistent with advanced undergraduate mathematics courses in linear algebra, calculus, probability theory, and the following important prerequisites: IOE310 (Linear Programming), IOE316 (Introduction to Markov Processes).

**Textbook**:
We will use the following textbook for this course which is available free online through the library:

Michael L. Pinedo, Scheduling: Theory, Algorithms, and Systems, Fourth Edition, Springer, New York, ISBN: 978-1-4614-1986-0

We will also read journal articles during the latter part of this course. Specific articles will be identified as the class progresses. You will have the opportunity to choose a topic related to your specific interest and present it in class.

**Learning Objectives:**

- To build a thorough understanding of the theory and methodologies identified with the field of Scheduling including complexity, integer programming, dynamic programming, and approximation methods
- To apply the theory and methods of Scheduling to applications in science and engineering including: manufacturing, transportation, medicine, computer science, and sports
- To set a foundation for future research in Scheduling and related topics

**Course Expectations:**

The following grading scheme will be used to compute the final grade for this course:

Homework Assignments: 15%
Midterm: 30%
In-Class Participation: 15%
Final Exam (in class, closed book): 40%

**Note: Any re-grade requests must be made in writing within 7 days. The complete assignment or test will be re-graded.**

The following grading scheme will be used to determine a grade for the course:

97 <= A+ <= 100
93 <= A < 97
90 <= A- < 93
87 <= B+ < 90
83 <= B < 87
80 <= B- < 83
77 <= C+ < 80
73 <= C < 77
70 <= C- < 73
67 <= D+ < 70
63 <= D < 67
60 <= D- < 63
F < 60

**Important Note:** The midterm exam will be a 48 hour take home exam during the week of February 24. The final exam will be given according to the university schedule for final exams.

**Summary of Specific Topic Areas:**

- Introduction to scheduling: tools, methods, applications
- Complexity Theory
- Deterministic Models:
    - Single machine models
    - Parallel machine models
    - Multi-stage (flow and job shop) scheduling models
- Stochastic Scheduling Models
    - Single machine models
    - Parallel machine models
    - Multi-stage (flow and job shop) scheduling models
- Project scheduling
- Applications: manufacturing, medicine, project planning, sports, transportation, workforce scheduling, and others to be determined

**Computing Requirements:**

You will apply what you learn in class through the implementation of algorithms. Access to a fast PC with Matlab and AMPL will be necessary.

**Assignment Format:**

The answers you provide are important, however, <u>you must show complete details of how you solved each problem</u>. You may talk to others about your approach, but the assignments are not collaborative and you must hand in your own work. Assignments are due at the start of class and those handed in after that time are considered late. Following are requirements for composing and writing your assignments:

- Show <u>all of the work</u> leading to the solution of each problem. Points are awarded for all steps of the solution process.
- If you write code to solve any problem <u>provide a carefully commented version</u> of the code in an appendix of the assignment. Note that your <u>code is not a substitute for a carefully written explanation of your approach and your results for a problem</u>.
- Include a title page with assignment number and your contact information
- Leave enough space for comments

<u>Important Note:</u> Assignments are due at the start of class on the due date. A deduction of 20% will be applied to the grade for late assignments and an additional 20% will be deducted per day late.

**University of Michigan Disability Statement:**

The University of Michigan is committed to providing equal opportunity for participation in all programs, services and activities. Request for accommodations by persons with disabilities may

be made by contacting the Services for Students with Disabilities (SSD) Office located at G 664 Haven Hall. The SSD phone number is 734-763-3000. Once your eligibility for an accommodation has been determined you will be issued a verified individual services accommodation (VISA) form. Please present this form to me at the start of the term or at least two weeks prior to the accommodation date (test, project, etc…)

## Tentative Course Outline (note this may be revised during the semester)

| Week | Dates | Topic | Readings |
|---|---|---|---|
| 1 | Jan 7 | Introduction to Scheduling | Chapters 1 |
| 2 | Jan 12, 14 | Introduction to Complexity and Single Server Scheduling | Chapter 2 |
| 3 | Jan 19, 26 (No, class Jan 21) | Single Server Scheduling | Chapter 3 |
| 4 | Feb 2 | Advanced Single Server Scheduling | Chapter 4 |
| 5 | Feb 4,9 | Parallel Server Scheduling | Chapter 5 |
| 6 | Feb 11 | Project Scheduling | Chapter 5 |
| 6/7 | Feb 16, 18 | Flow shops | Chapter 6 |
| 7 | Feb 23 | Midterm Exam | Due by start of class Feb 25 |
| 8 | Feb 25 | Introduction to Job Shops | Chapter 7 |
| 9 | Mar 1, 3 | March Break! | |
| 10 | Mar 8,10 | Job Shops | Chapter 7 |
| 11 | Mar 15, 17 | Jobs Shops and Stochastic Models | Chapter 9 |
| 12 | Mar 22, 24 | Stochastic Models | Reading TBD |
| 13 | Mar 29, Mar 31 | Stochastic Models | Reading TBD |
| 14 | Apr 5, 7 | Stochastic Models | Reading TBD |
| 15 | Apr 12, 14 | Class Presentations on Applications | |
| 15 | Apr 27 | Final Exam, 10:30-12:30 | |