

This syllabus is compliant with [GMU Catalog Policy AP.2.5](#).



**Course Title: Dynamic Programming**

**Course Number: OR 674**

**Number of Credits: 3**

**Recommended Pre-reqs: OR 442 or OR 542 or Permission of Instructor**

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**Instructor Name: Dr. Rajesh Ganesan**

**Semester and Year: Spring 2026**

**Class Meeting Day(s) and Time(s) and Modality: Wed / 4:30-7:10 PM / in-person**

**Instructor Contact Information and Office hours/Location:** Contact via email/ Room 2217  
Engineering Building

**Course Description as per Catalog:** *This is a course on the theory and practice of dynamic programming, i.e. optimal sequential decision making over time in the presence of uncertainties. The course will stress intuition, the mathematical foundations being for the most part elementary. It will introduce the theory, applications (finance, engineering, and biology), and computational aspects of dynamic programming for deterministic and stochastic problems. The course will use some Matlab and spread sheets to solve DP problems, however prior knowledge of Matlab or spread sheet use is not needed.*

**Course Learning Outcomes:** The field of dynamic programming provides alternate approaches to solving many optimization and control problems. Large scale optimization and control has become very important in recent years, which involve complexity and are often model free. Also adaptive systems with sequential decision making powers are sought after for effective real time optimization and control. The above is achievable only via dynamic programming, which is often solved using artificial intelligence (stochastic approximation methods). Many large scale industrial and defense applications such as airline pricing, optimal power flow, helicopter control, and missile control use approximate dynamic programming approaches, which has created a demand for this knowledge.

This course has been designed to provide a wealth of knowledge that is directly applicable to the needs of applications that are complex, adaptable, and large scale. The course compliments the fundamentals learnt in OR441/OR541 and OR442/OR542 and introduces a new and powerful alternate method to solve many optimization problems that involve sequential decision making.

At the conclusion of this course the student will have learned the art of formulating recursive equations, and how and why dynamic programming is the only method that can solve many of the large scale optimization problems involving sequential decision making. The student will also have advanced knowledge of solving optimization problems that involve sequential decision making in both deterministic and stochastic environment.

**Text Book:** Eric Denardo, Dynamic Programming: Models and Applications, Dover, May 2003.

Problems from Operations Research by Winston. W. L. (Chapters 18 and 19). This book is the same book that you have used for OR 541 and OR 542.

**Other References:**

- Applied Probability and Stochastic Processes by Feldman & C. Valdez-Flores
- Dynamic Programming by Richard Bellman
- Dynamic Programming and Optimal Control (Volumes 1 and 2) by Dimitri P. Bertsekas
- Introduction to Stochastic Dynamic Programming by Sheldon M. Ross

**Computing Use:** Students are encouraged to code in the programming language of their choice. MATLAB will be used to demo examples along with MS Excel.

**Canvas Usage:**

This course will have some materials posted to Canvas (Log into [Canvas Login | Instructure](#), select the Courses Tab, and the course can be found in the Course List).

Please visit <http://mason.gmu.edu/~rganesan/class> to check for announcements and notes

**Statement regarding use of Generative AI tools:**

- *Any student use of Generative-AI tools should follow the fundamental principles of GMU's Academic Standards policies.*
- Additional information: Please see recommendations on our [Generative AI Support page](#).

**Student Use of Electronic Devices:**

- *The use of laptop computers is required in this class.*
- *We will frequently be using the internet as a means to enhance our discussions. We will also be using computers for our in-class discussion.*
- *Cell phones and other communicative devices are not to be used during class. Please keep them stowed away and out of sight.*
- *Regarding electronic devices (such as laptops, cell phones, etc.), please be respectful of your peers and your instructor and do not engage in activities that are unrelated to class. Such disruptions show a lack of professionalism.*

**Grading Schema:** Letter grades will be decided as follows:

95% and above A+, 90-94% A, 86-89% A-, 83-85% B+, 80-82% B, 76-79% B-, 70-75% C, at or below 69%-F

**Grade Weights:** Class project report 20%, Midterm 40% and Final 40%

**Grading-related Policies:** All academic policies as given in the Honor System and code will be strictly followed. Visit URL <https://ulife.gmu.edu/faculty-and-staff/honor-code-violations/> and <https://academicstandards.gmu.edu/academic-standards-code/>

**Important Dates:**

University Calendar: Students must follow university calendar [See <http://registrar.gmu.edu/calendars/> ] including final exam dates. Other dates such as homework due dates, mid-term exam, and/or projects are

as per the dates specified by the instructor.

### **Weekly Course Schedule:**

#### **Deterministic Dynamic Programming:**

Week 1	Course introduction, Finite Decision Trees
Week 2	Dynamic Programming Networks and the Principle of Optimality
Week 3	Formulating dynamic programming recursions, Shortest Path Algorithms, Critical Path Method, Resource Allocation (including Investments)
Week 4	Knapsack Problems, Production Control, Capacity Expansion, and Equipment Replacement
Week 5	Infinite Horizon Optimization including Equipment Replacement over an Unbounded Horizon
Week 6	Infinite Decision Trees and Dynamic Programming Networks
Week 7	Midterm

#### **Stochastic Dynamic Programming**

Week 8	Stochastic Shortest Path Problems with examples in Inventory Control
Week 9	Markov Decision Processes, value and policy iteration for average cost criteria
Week 10	Markov Decision Processes, value and policy iteration for discounted cost criteria
Week 11	Markov Decision Processes, value and policy iteration for discounted cost criteria
Week 12	MDP with examples in Equipment Replacement and inventory problems
Week 13	Semi-Markov Decision Process
Week 14	Intro to Reinforcement Learning
Week 15	Final exam (exam week)

### **Administrative Notes:**

*Closings and cancellations:* In the event of inclement weather or another major event, the university announces class cancellation, delay of classes and changes to administrative office hours through the university switchboard, 703-993-1000; the [George Mason home page](#); GMU-TV; and local radio and television stations.

*Communication Policy:* Mason Email (GMU Email): Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.

Additional Modes of communication include emails to/from the instructor or Canvas or course website.

*Emergency Preparedness:* In the event of an emergency, we will follow GMU procedures. You may want to register with [Mason Alert](#).

*Privacy:* Students must use their GMU email account to receive important University information, including messages related to this class.

## Student Resources:

- Student Support and Advocacy Center (SSAC)
- Counseling and Psychological Services
- The Learning Services Office or field-specific tutoring
- The Center for Culture, Equity, and Empowerment
- LBGTQ+ Resources
- University Career Services
- University Writing Center

Information and links regarding these and other student support offices are available on our [Student Support Resources on Campus](#) page.

### Patriot Pass

Once you sign up for your Patriot Pass, your passwords will be synchronized, and you will use your Patriot Pass username and password to log in to the following systems: Canvas, University Libraries, MasonLive, myMason, Patriot Web, Patriot Connect, Stellic, Virtual Computing Lab, and WEMS. [See <https://password.gmu.edu/index.jsp> ].

### University Policies

Students must follow university policies. [See <http://universitypolicy.gmu.edu> ].

### Responsible Use of Computing

Students must follow the university policy for the Responsible Use of Computing. [See <http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/> ].

### Student Services:

University Libraries: The Mason library provides resources for both in-class [See <http://library.gmu.edu/>] and distance students. [See <http://library.gmu.edu/distance> ].

### Writing Center:

The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing. You can now sign up for an Online Writing Lab (OWL) session or for a face-to-face session in the Writing Center, which means you set the date and time of the appointment! Learn more about the Online Writing Lab (OWL) (found under Online Tutoring).

### Counseling and Psychological Services:

The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops, and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu> ].

### Name and Pronouns Statement:

If you wish, please share your name and gender pronouns with me and how best to address you in class via email or during class introductions. You may address me as Dr./Prof. Lastname or just Professor in emails and verbally.

### All-inclusive Diversity, Access and Engagement:

The programs and services offered by George Mason University are open to all who seek them. George Mason does not discriminate on the basis of race, color, religion, ethnic national origin (including shared ancestry and/or ethnic characteristics), sex, disability, military status (including veteran status), sexual orientation, gender identity, gender expression, age, marital status, pregnancy status, genetic information, or any other characteristic protected by law. After an initial review of its policies and practices, the university affirms its commitment to meet all federal mandates as articulated in federal law, as well as recent executive orders and federal agency directives. <https://oacc.gmu.edu/>  
<https://hr.gmu.edu/all-inclusive-diversity-access-and-engagement/>

### Anti-Racism Statement:

As a member of the George Mason University community, the Volgenau School of Engineering plays an integral role in building an educational environment that is committed to anti-racism and inclusive excellence. An anti-racist approach to higher education acknowledges the ways that individual, interpersonal, institutional, and structural manifestations of racism against Black individuals and other people of color contribute to inequality and injustice in our classrooms, on our campuses, and in our communities and it strives to provide our community members with resources to interrupt cycles of racism so as to cultivate a more equitable, inclusive, and just environment for all of our students, staff, faculty, alumni, and friends, regardless of racial background.

To be anti-racist means:

- To make constant, conscious decisions to interrupt racism and cultivate equity, inclusion, and justice for people of all racial backgrounds, and in particular those from Black communities and other communities of color, who are most likely to bear the direct and indirect costs of systems of white supremacy;
- To interrogate histories of white supremacy and white-dominant culture, and to examine the ways in which these histories have impacted our individual beliefs, our interpersonal relationships, our institutional and structural policies and processes, and our entire society;
- To make a commitment to being responsible for our own relationships to, and actions within, systems of white supremacy; and
- To cultivate a practice of self-awareness and self-reflection that allows us to critically evaluate our own role in upholding white supremacy and identify the ways we can interrupt cycles of racism at the individual, interpersonal, institutional, and structural levels.

We believe that the work of anti-racism starts with each individual and that in cultivating an anti-racist approach to research, scholarship, and practice, our students will build a skill set rooted in principles of equity, inclusion, and justice that they will carry with them throughout their lives.

For more information on how to continuously cultivate the practice of anti-racism, see this guide from the National Museum of African American History and Culture on how to be anti-racist:

<https://nmaahc.si.edu/learn/talking-about-race/topics/being-antiracist>



## Common Policies Affecting All Courses at George Mason University

## Updated August 2024

These four policies affect students in all courses at George Mason University. This Course Policy Addendum must be made available to students in all courses (see [Catalog Policy AP.2.5](#)).

**Additional policies** affecting this course, and additional resources or guidance regarding these policies, may be provided to students by the instructor.

### Academic Standards

Academic Standards exist to promote authentic scholarship, support the institution's goal of maintaining high standards of academic excellence, and encourage continued ethical behavior of faculty and students to cultivate an educational community which values integrity and produces graduates who carry this commitment forward into professional practice.

As members of the George Mason University community, we are committed to fostering an environment of trust, respect, and scholarly excellence. Our academic standards are the foundation of this commitment, guiding our behavior and interactions within this academic community. The practices for implementing these standards adapt to modern practices, disciplinary contexts, and technological advancements. Our standards are embodied in our courses, policies, and scholarship, and are upheld in the following principles:

- **Honesty:** Providing accurate information in all academic endeavors, including communications, assignments, and examinations.
- **Acknowledgement:** Giving proper credit for all contributions to one's work. This involves the use of accurate citations and references for any ideas, words, or materials created by others in the style appropriate to the discipline. It also includes acknowledging shared authorship in group projects, co-authored pieces, and project reports.
- **Uniqueness of Work:** Ensuring that all submitted work is the result of one's own effort and is original, including free from self-plagiarism. This principle extends to written assignments, code, presentations, exams, and all other forms of academic work.

Violations of these standards—including but not limited to plagiarism, fabrication, and cheating—are taken seriously and will be addressed in accordance with university policies. The process for reporting, investigating, and adjudicating violations is [outlined in the university's procedures](#). Consequences of violations may include academic sanctions, disciplinary actions, and other measures necessary to uphold the integrity of our academic community.

The principles outlined in these academic standards reflect our collective commitment to upholding the highest standards of honesty, acknowledgement, and uniqueness of work. By adhering to these principles, we ensure the continued excellence and integrity of George Mason University's academic community.

**Student responsibility:** Students are responsible for understanding how these general expectations regarding academic standards apply to each course, assignment, or exam they participate in; students should ask their instructor for clarification on any aspect that is not clear to them.

## Accommodations for Students with Disabilities

Disability Services at George Mason University is committed to upholding the letter and spirit of the laws that ensure equal treatment of people with disabilities. Under the administration of University Life, Disability Services implements and coordinates reasonable accommodations and disability-related services that afford equal access to university programs and activities. Students can begin the registration process with Disability Services at any time during their enrollment at George Mason University. If you are seeking accommodations, please visit <https://ds.gmu.edu/> for detailed information about the Disability Services registration process. Disability Services is located in Student Union Building I (SUB I), Suite 2500. Email: [ods@gmu.edu](mailto:ods@gmu.edu). Phone: (703) 993-2474.

**Student responsibility:** Students are responsible for registering with Disability Services and communicating about their approved accommodations with their instructor *in advance* of any relevant class meeting, assignment, or exam.

## FERPA and Use of GMU Email Addresses for Course Communication

The [Family Educational Rights and Privacy Act \(FERPA\)](#) governs the disclosure of [education records for eligible students](#) and is an essential aspect of any course. **Students must use their GMU email account** to receive important University information, including communications related to this class. Instructors will not respond to messages sent from or send messages regarding course content to a non-GMU email address.

**Student responsibility:** Students are responsible for checking their GMU email regularly for course-related information, and/or ensuring that GMU email messages are forwarded to an account they do check.

## Title IX Resources and Required Reporting

As a part of George Mason University's commitment to providing a safe and non-discriminatory learning, living, and working environment for all members of the University community, the University does not discriminate on the basis of sex or gender in any of its education or employment programs and activities. Accordingly, **all non-confidential employees, including your faculty member, have a legal requirement to report to the Title IX Coordinator, all relevant details obtained directly or indirectly about any incident of Prohibited Conduct** (such as sexual harassment, sexual assault, gender-based stalking, dating/domestic violence). Upon notifying the Title IX Coordinator of possible Prohibited Conduct, the Title IX Coordinator will assess the report and determine if outreach is required. If outreach is required, the individual the report is about (the "Complainant") will receive a communication, likely in the form of an email, offering that person the option to meet with a representative of the Title IX office.

For more information about non-confidential employees, resources, and Prohibited Conduct, please see [University Policy 1202: Sexual and Gender-Based Misconduct and Other Forms of Interpersonal Violence](#). Questions regarding Title IX can be directed to the Title IX Coordinator via email to [TitleIX@gmu.edu](mailto:TitleIX@gmu.edu), by phone at 703-993-8730, or in person on the Fairfax campus in Aquia 373.

**Student opportunity:** If you prefer to speak to someone *confidentially*, please contact one of Mason's confidential employees in Student Support and Advocacy ([SSAC](#)), Counseling and Psychological Services ([CAPS](#)), Student Health Services ([SHS](#)), and/or the [Office of the University Ombudsperson](#).

This document is updated annually and maintained by the [Stearns Center for Teaching and Learning](#), in cooperation with GMU Faculty Senate Academic Policies Committee.