

AMS 420: Investment Science Foundations

Summer 2023

Credits and Grading: 3 credits, ABCF grading

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Office hours: TBD

Course Web Site and Brightspace: Refer to Brightspace, where course notes, articles, solutions and slides will be posted, and videos of lectures.

Lectures: 65703 LEC 30 MW 1:00-4:55PM; ONLINE Mode: SYNCHRONOUS

Teaching Assistant: TBD

Text: Investment Science, David G. Luenberger, Oxford University Press, 2013, Second Edition. ISBN 0199740089 (or Investment Science, David G. Luenberger, Oxford University Press, 1998. ISBN 0-19-510809-4)

Prerequisites: AMS 311 (B+ or higher grade). Students are supposed to know basic statistics concepts (mean, variance, linear regression). It is not required, but recommended to take AMS 341 covering Linear Programming and elements of Integer Programming. If you do not know these concepts, be ready to catch-up (relevant chapters of standard text books will be provided). Basic knowledge of high-level programming environments: MATLAB or R (or a strong desire to learn).

Technical Requirements

This course uses Brightspace (<https://it.stonybrook.edu/services/brightspace>) to facilitate communications between faculty and students, submission of assignments, and posting grades. If you are unsure of your NetID, visit <https://it.stonybrook.edu/help/kb/finding-your-netid-and-password> for more information. You are responsible for having a reliable computer and Internet connection throughout the term. The following list details a minimum recommended computer set-up and the software packages you will need to access and use:

Hardware:

- PC (Windows 10 or higher) or Macintosh (OS X/macOS 10.10 or higher).
- 4 GB RAM.–A high-speed internet connection.
- Speakers (either internal or external) or headphones. Headphones are strongly recommended to reduce the risk of feedback during communications.
- Microphone (either internal or external).
- WebCam or other camera (interfacing with your computer) for producing video.

Software (additional tools may be needed). Remember to use your Stony Brook email or NetID when configuring specialized software:

- An up-to-date Internet browser, such as Chrome, Firefox, Explorer/Edge (Windows), or Safari (macOS).
- PDF viewer, such as Adobe Reader.
- Zoom. Stony Brook has a site license for Zoom; you can find information on downloading, installing, and using Zoom <https://it.stonybrook.edu/services/zoom/students>

Exams: This class does not have exams. Grading is based on homeworks and attendance.

Homeworks: Homeworks covering main material of the course will be graded. For homework problems, you are expected to write up your solutions *on your own*, **without referring to other students' writeups or to solutions you may find on the web**; you are welcome to discuss the problems with TA, and classmates, but **must do the writeup entirely on your own**.

Pop-quizzes: Students will be given pop-quizzes during class time to provide feedback about learning progress. Pop-quizzes are not graded and solutions are provided.

Grades: 95% of grade is based on homeworks. Two lowest grade homeworks will be automatically skipped (grade is based on the remaining homeworks). 5% of grade is based on class attendance.

List of Course Topics:

DETERMINISTIC CASH FLOW STREAMS

1. The basic theory of interest (principal and interest, present and future value of streams, internal rate of return, applications)
2. Fixed-income securities (CDs, Money Market Instruments, Treasury bills, bonds, mortgages, annuities, yield, duration, immunization, convexity)
3. The term structure of interest rates (yield curve, term structure, forward rates, expectations dynamics, running present value, floating rate bonds, duration, immunization)
4. Applied interest rate analysis (capital budgeting, optimal portfolios, dynamic cash flow processes, optimal management, the harmony theorem, valuation of a firm)

SINGLE PERIOD RANDOM CASH FLOW STREAMS

1. Mean-variance portfolio theory (asset return, random variables, random returns, portfolio mean and variance, the feasible set, the Markowitz model, the two fund theorem, inclusion of risk free asset, the one-fund theorem)
2. The capital asset pricing model (market equilibrium, the capital market line, the pricing model, the security market line, investment implications, performance evaluation, CAPM as a pricing formula, project choice)
3. Models and data (factor models, CAPM as a factor model, arbitrage pricing theory, data and statistics, estimation of parameters, a multiperiod fallacy)
4. General principles (utility function, risk aversion)

MODELS OF ASSET DYNAMICS

1. Lattice models
2. Finite difference models
 - additive models
 - multiplicative models

OPTIMAL PORTFOLIO GROWTH

1. Investment wheel
2. Fixed proportion strategy
3. Log utility approach to growth

Student Accessibility Support Center Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu.

They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Academic Integrity Statement

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Professions, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Critical Incident Management

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.