

Chapter 6

Mean-Variance Portfolio Theory

1. (Shorting with margin) The money invested is X_0 . The money received at the end of a year is $X_0 - X_1 + X_0$. Hence,

$$R = \frac{2X_0 - X_1}{X_0}$$

2. (Dice product) Let a and b be the outcomes of two dice rolls. Then $Z = ab$. By independence, we know

$$\begin{aligned} E[ab] &= E[a]E[b] \\ \text{and } \text{var}[Z] &= E[a^2]E[b^2] - (E[a]E[b])^2 \\ &= 79.97 \end{aligned}$$

3. (Two correlated assets) For solution method, see solution to problem called Two stocks (below).

(a) α equals $19/23$.

(b) The minimum standard deviation is approximately 13.7%.

(c) The expected return of this portfolio is approximately 11.4%.

4. (Two stocks) Let α, β equal the percent of investment in stock 1 and stock 2, respectively. The problem is

$$\min \alpha^2 \sigma_1^2 + \beta^2 \sigma_2^2 + 2\alpha\beta\sigma_{12}$$

$$\text{subject to } \alpha + \beta = 1.$$

Setting up the Lagrangian, L , we have:

$$L = \alpha^2 \sigma_1^2 + \beta^2 \sigma_2^2 + 2\alpha\beta\sigma_{12} - \lambda(\alpha + \beta - 1)$$

The first order necessary conditions are:

$$0 = \frac{\partial L}{\partial \alpha} = 2\alpha\sigma_1^2 + 2\beta\sigma_{12} - \lambda$$

Luenberger Solution Chapter Answers

Christian G. Meyer



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Handbook of Control Systems Engineering Louis C. Westphal, 2012-12-06 This book is a revision and extension of my 1995 Sourcebook of Control Systems Engineering Because of the extensions and other modifications it has been retitled Handbook of Control Systems Engineering which it is intended to be for its prime audience advanced undergraduate students beginning graduate students and practising engineers needing an understandable review of the field or recent developments which may prove useful There are several differences between this edition and the first Two new chapters on aspects of nonlinear systems have been incorporated In the first of these selected material for nonlinear systems is concentrated on four aspects showing the value of certain linear controllers arguing the suitability of algebraic linearization reviewing the semi classical methods of harmonic balance and introducing the nonlinear change of variable technique known as feedback linearization In the second chapter the topic of variable structure control often with sliding mode is introduced Another new chapter introduces discrete event systems including several approaches to their analysis The chapters on robust control and intelligent control have been extensively revised Modest revisions and extensions have also been made to other chapters often to incorporate extensions to nonlinear systems

Sourcebook Of Control Systems Engineering Louis C. Westphal, 2012-12-06 This book joins the multitude of Control Systems books now available but is neither a textbook nor a monograph Rather it may be described as a resource book or survey of the elements essentials of feedback control systems The material included is a result of my development over a period of several years of summaries written to supplement a number of standard textbooks for undergraduate and early post graduate courses Those notes plus more work than I care right now to contemplate are intended to be helpful both to students and to professional engineers Too often standard textbooks seem to overlook some of the engineering realities of roughly how much things cost or how big of hardware for computer programs for simple algorithms are sensing and actuation of special systems such as PLCs and PID controllers of the engineering of real systems from coverage of SISO theories and of the special characteristics of computers their programming and their potential interactions into systems In particular students with specializations other than control systems are not being exposed to the breadth of the considerations needed in control systems engineering perhaps because it is assumed that they are always to be part of a multicourse sequence taken by specialists The lectures given to introduce at least some of these aspects were more effective when supported by written material hence the need for my notes which preceded this book

State Observers for Linear Systems with Uncertainty Sergey K. Korovin, Vasily V. Fomichev, 2009-09-04 This book presents the basic concepts and recent developments of linear control problems with perturbations The presentation concerns both continuous and discrete dynamical systems It is self contained and illustrated by numerous examples From the contents Notion of state observers Observability Observers of full phase vectors for fully determined linear systems Functional observers for fully determined linear systems Asymptotic observers for linear systems

with uncertainty Observers for bilinear and discrete systems *Introduction to Modern Economic Growth* Daron Acemoglu, 2008-12-15 From Nobel Prize winning economist Daron Acemoglu an incisive introduction to economic growth *Introduction to Modern Economic Growth* is a groundbreaking text from one of today's leading economists Daron Acemoglu gives graduate students not only the tools to analyze growth and related macroeconomic problems but also the broad perspective needed to apply those tools to the big picture questions of growth and divergence And he introduces the economic and mathematical foundations of modern growth theory and macroeconomics in a rigorous but easy to follow manner After covering the necessary background on dynamic general equilibrium and dynamic optimization the book presents the basic workhorse models of growth and takes students to the frontier areas of growth theory including models of human capital endogenous technological change technology transfer international trade economic development and political economy The book integrates these theories with data and shows how theoretical approaches can lead to better perspectives on the fundamental causes of economic growth and the wealth of nations Innovative and authoritative this book is likely to shape how economic growth is taught and learned for years to come Introduces all the foundations for understanding economic growth and dynamic macroeconomic analysis Focuses on the big picture questions of economic growth Provides mathematical foundations Presents dynamic general equilibrium Covers models such as basic Solow neoclassical growth and overlapping generations as well as models of endogenous technology and international linkages Addresses frontier research areas such as international linkages international trade political economy and economic development and structural change An accompanying Student Solutions Manual containing the answers to selected exercises is available 978 0 691 14163 3 24 95 See <https://press.princeton.edu/titles/8970.html> For Professors only To access a complete solutions manual online email us at acemoglusolutions@press.princeton.edu

Fusion for Profit Sharan Jagpal, with the assistance of Shireen Jagpal, 2008-09-26 The corporate world is typically structured in silos Managers urgently need to overcome this silo effect by fusing ideas across different functional areas in the firm In *Fusion for Profit* Sharan Jagpal a well known and highly respected multidisciplinary researcher and business consultant explains in simple language using real world examples how managers can use sophisticated concepts to fuse different functional areas in the firm especially marketing and finance to increase the firm's value

Quantitative Fund Management M.A.H. Dempster, Gautam Mitra, Georg Pflug, 2008-12-22 The First Collection That Covers This Field at the Dynamic Strategic and One Period Tactical Levels Addressing the imbalance between research and practice *Quantitative Fund Management* presents leading edge theory and methods along with their application in practical problems encountered in the fund management industry A Current Snapshot of State of the Art Applications of Dynamic Stochastic Optimization Techniques to Long Term Financial Planning The first part of the book initially looks at how the quantitative techniques of the equity industry are shifting from basic Markowitz mean variance portfolio optimization to risk management and trading applications This section also explores novel aspects of lifetime individual consumption

investment problems fixed mix portfolio rebalancing allocation strategies debt management for funding mortgages and national debt and guaranteed return fund construction Up to Date Overview of Tactical Financial Planning and Risk Management The second section covers nontrivial computational approaches to tactical fund management This part focuses on portfolio construction and risk management at the individual security or fund manager level over the period up to the next portfolio rebalance It discusses non Gaussian returns new risk return tradeoffs and the robustness of benchmarks and portfolio decisions The Future Use of Quantitative Techniques in Fund Management With contributions from well known academics and practitioners this volume will undoubtedly foster the recognition and wider acceptance of stochastic optimization techniques in financial practice *Linear and Nonlinear Programming* David G. Luenberger, Yinyu Ye, 2021-10-31 The 5th edition of this classic textbook covers the central concepts of practical optimization techniques with an emphasis on methods that are both state of the art and popular One major insight is the connection between the purely analytical character of an optimization problem and the behavior of algorithms used to solve that problem End of chapter exercises are provided for all chapters The material is organized into three separate parts Part I offers a self contained introduction to linear programming The presentation in this part is fairly conventional covering the main elements of the underlying theory of linear programming many of the most effective numerical algorithms and many of its important special applications Part II which is independent of Part I covers the theory of unconstrained optimization including both derivations of the appropriate optimality conditions and an introduction to basic algorithms This part of the book explores the general properties of algorithms and defines various notions of convergence In turn Part III extends the concepts developed in the second part to constrained optimization problems Except for a few isolated sections this part is also independent of Part I As such Parts II and III can easily be used without reading Part I and in fact the book has been used in this way at many universities New to this edition are popular topics in data science and machine learning such as the Markov Decision Process Farkas lemma convergence speed analysis duality theories and applications various first order methods stochastic gradient method mirror descent method Frank Wolf method ALM ADMM method interior trust region method for non convex optimization distributionally robust optimization online linear programming semidefinite programming for sensor network localization and infeasibility detection for nonlinear optimization Variable Speed AC Drives with Inverter Output Filters Jaroslaw Guzinski, Haitham Abu-Rub, Patryk Strankowski, 2015-11-23 The advance of variable speed drives systems VSDs engineering highlights the need of specific technical guidance provision by electrical machines and drives manufacturers so that such applications can be properly designed to present advantages in terms of both energy efficiency and expenditure This book presents problems and solutions related to inverter fed electrical motors Practically orientated the book describes the reasons theory and analysis of those problems Various solutions for individual problems are presented together with the complete design process modelling and simulation examples with MATLAB Simulink on the companion website A key focus of

Variable Speed AC Drives with Inverter Output Filters is to examine the state variables estimation and motor control structures which have to be modified according to the used solution filter In most control systems the structure and parameters are taken into account to make it possible for precise control of the motor This methodology is able to include modifications and extensions depending on specific control and estimation structures Highly accessible this is an invaluable resource for practising R D engineers in drive companies power electronics control engineers and manufacturers of electrical drives Senior undergraduate and postgraduate students in electronics and control engineering will also find it of value

Mathematical Methods for Neural Network Analysis and Design Richard M. Golden, 1996 For convenience many of the proofs of the key theorems have been rewritten so that the entire book uses a relatively uniform notion

Geophysical Inverse Theory Robert L. Parker, 2019-12-31 In many physical sciences the most natural description of a system is with a function of position or time In principle infinitely many numbers are needed to specify that function but in practice only finitely many measurements can be made Inverse theory concerns the mathematical techniques that enable researchers to use the available information to build a model of the unknown system or to determine its essential properties In Geophysical Inverse Theory Robert Parker provides a systematic development of inverse theory at the graduate and professional level that emphasizes a rigorous yet practical solution of inverse problems with examples from experimental observations in geomagnetism seismology gravity electromagnetic sounding and interpolation Although illustrated with examples from geophysics this book has broad implications for researchers in applied disciplines from materials science and engineering to astrophysics oceanography and meteorology Parker s approach is to avoid artificial statistical constructs and to emphasize instead the reasonable assumptions researchers must make to reduce the ambiguity that inevitably arises in complex problems The structure of the book follows a natural division in the subject into linear theory in which the measured quantities are linear functionals of the unknown models and nonlinear theory which covers all other systems but is not nearly so well understood The book covers model selection as well as techniques for drawing firm conclusions about the earth independent of any particular model

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