

# ECON 424/AMATH 462: Computational Finance and Financial Econometrics

<p>Home Syllabus Homework Notes Excel Hints R Hints Announcements Links Project Review Canvas</p>	<h2>Class Syllabus</h2> <p>Spring 2015</p> <p><i>Note 1:</i> In the Reading column below, "ZLM" refers to <i>A Beginner's Guide to R</i> by Zuur, Ieno and Meesters; "R Cookbook" refers to <i>R Cookbook</i> by Teeter; "EZ" refers to book chapters of <i>Introduction to Computational Finance and Financial Econometrics</i> by Eric Zivot; "EG" refers to <i>Modern Portfolio Theory</i> by Elton and Gruber; "Ruppert" refers to <i>Statistics and Data Analysis for Financial Engineering</i> by Ruppert. "*" denotes optional reading.</p> <p><i>Note 2:</i> Recent changes to the reading list are denoted with <b>NEW</b>.</p> <p><i>Note 3:</i> My Book chapters are preliminary and incomplete and are not guaranteed to be free of errors. Also, as the quarter progresses I will be making changes and additions to the notes so check the revision dates to make sure you have the most up to date set of notes. Please let me know if you find typos or other errors.</p> <p style="text-align: right;">Last updated on March 25, 2015</p>
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Week	Topic	Reading	Additional Material
1	<ol style="list-style-type: none"> <li>Course Introduction</li> <li>Computing Asset Returns</li> <li>Getting financial data from Yahoo!</li> <li>Excel calculations</li> <li>Introduction to R</li> <li>Univariate random variables and distributions</li> </ol>	<ol style="list-style-type: none"> <li>Ruppert, <a href="#">chapter 2</a> (Returns).</li> <li>EZ, <a href="#">Book chapter</a> on return calculations.</li> <li>EZ, <a href="#">Book chapter</a> on review of univariate random variables and probability.</li> <li>EZ, <a href="#">class slides</a> on course introduction.</li> <li>EZ, <a href="#">class slides</a> on return calculations.</li> <li>EZ, <a href="#">class slides</a> on probability review: Part I.</li> <li>ZLM, chapters 1-3, 5.</li> <li>R Cookbook, chapters 1 - 5, 10 (sections 1 - 15)</li> <li><a href="#">An Introduction</a></li> </ol>	<ol style="list-style-type: none"> <li><a href="http://finance.yahoo.com">finance.yahoo.com</a> Check out finance/quote section</li> <li><a href="#">returnCalculations.xls</a></li> <li><a href="#">returnCalculations.r</a></li> <li><a href="#">msftPrices.csv</a>, <a href="#">sbuxPrices.csv</a></li> <li><a href="#">returnCalculationsPowerpoint.pdf</a></li> <li><a href="#">returnCalculations.Rmd</a></li> <li><a href="#">Rintro.pdf</a> (introduction to R covered in the Friday TA session)</li> <li><a href="#">probReview.xls</a></li> <li><a href="#">probReview.r</a></li> </ol>

		<p><u>to R</u>, sections 1-3, 6 and 7.</p> <p>10. <u>R for Beginners</u>, sections 1-3.</p> <p>11. *EG, chapters 1-3</p>	
2 & 3	<ol style="list-style-type: none"> <li>1. Characteristics of distributions</li> <li>2. The normal distribution</li> <li>3. Linear function of random variables</li> <li>4. Quantiles of a distribution, Value-at-Risk</li> <li>5. Bivariate distributions</li> <li>6. Covariance, correlation, autocorrelation</li> <li>7. Linear combinations of random variables</li> <li>8. Time Series concepts</li> <li>9. Matrix algebra</li> </ol>	<ol style="list-style-type: none"> <li>1. Ruppert, <u>chapter 5</u> (Modeling Univariate Distributions), <u>chapter 7</u> (Multivariate Statistical Models), <u>chapter 9</u> (Time Series Models: Basics), <u>Appendix</u> (sections 1-10, 12-15, 20)</li> <li>2. EZ, <u>Book chapter</u> on review of univariate random variables and probability.</li> <li>3. EZ, <u>Book chapter</u> on time series concepts.</li> <li>4. EZ, <u>Book chapter</u> on review of matrix algebra.</li> <li>5. EZ, <u>class slides</u> on probability review: Part I.</li> <li>6. EZ, <u>class slides</u> on probability review: Part II.</li> <li>7. EZ, <u>class slides</u> on time series concepts.</li> <li>8. EZ, <u>class slides</u> on matrix algebra.</li> <li>9. ZLM, chapters 3-7.</li> <li>10. R Cookbook, chapter 8 and chapter 14 (sections 1 - 16).</li> </ol>	<ol style="list-style-type: none"> <li>1. <u>probReview.xls</u></li> <li>2. <u>probReview.r</u></li> <li>3. <u>probabilityReviewPowerPoint.pdf</u></li> <li>4. <u>probabilityReview.Rmd</u></li> <li>5. <u>timeSeriesConceptsPowerPoint.pdf</u></li> <li>6. <u>timeSeriesConcepts.r</u></li> <li>7. <u>matrixReviewPowerpoint.pdf</u></li> <li>8. <u>matrixReview.r</u></li> <li>9. tablet PC notes for <u>lecture 3</u></li> <li>10. tablet PC notes for lecture 4</li> <li>11. tablet PC notes for lecture 5</li> <li>12. <u>Working with time series data in R</u></li> </ol>

		<ul style="list-style-type: none"> <li>11. <a href="#">An Introduction to R</a>, section 8.</li> <li>12. <a href="#">R for Beginners</a>, section 4.</li> </ul>	
4-5	<ul style="list-style-type: none"> <li>1. Descriptive statistics: histograms, sample means, variances, covariances and autocorrelations</li> <li>2. The constant expected return model.</li> <li>3. Monte Carlo simulation</li> <li>4. Standard errors of estimates</li> <li>5. Confidence intervals</li> <li>6. Bootstrapping standard errors and confidence intervals</li> <li>7. Hypothesis testing</li> <li>8. <b>Midterm exam: Tuesday May 5th</b></li> <li>9. Midterm solutions</li> <li>10. Grade distribution econ 424</li> </ul>	<ul style="list-style-type: none"> <li>1. Ruppert, chapter 4 (Exploratory Data Analysis), chapter 5 sections 9 and 10 (maximum likelihood estimation), chapter 6 (Resampling), Appendix (sections 11, 16 - 18)</li> <li>2. EZ, <a href="#">Book chapter</a> on descriptive statistics.</li> <li>3. EZ, <a href="#">class slides</a> on descriptive statistics.</li> <li>4. EZ, <a href="#">class slides</a> on CER model.</li> <li>5. EZ, <a href="#">Book chapter</a> on the CER model. <b>Updated February 23, 2015</b></li> <li>6. EZ, <a href="#">Book chapter</a> on estimation of the CER model. <b>Updated February 23, 2015</b></li> <li>7. EZ, <a href="#">class slides</a> on bootstrapping</li> <li>8. EZ, <a href="#">class slides</a> on hypothesis testing in the CER model.</li> <li>9. EZ, <a href="#">class slides</a> on maximum likelihood estimation. <b>Note: will not cover this material this term.</b></li> </ul>	<ul style="list-style-type: none"> <li>1. <a href="#">descriptiveStatisticsPowerPoint.pdf</a></li> <li>2. <a href="#">descriptiveStatistics.r</a></li> <li>3. <a href="#">descriptiveStatisticsDailyPowerPoint.pdf</a></li> <li>4. <a href="#">descriptiveStatisticDaily.r</a></li> <li>5. <a href="#">cerExample.csv</a></li> <li>6. <a href="#">cerModelExamples.r</a></li> <li>7. <a href="#">cerModelPowerPoint.pdf</a></li> <li>8. <a href="#">bootStrapPowerPoint.pdf</a></li> <li>9. <a href="#">bootStrap.r</a></li> <li>10. <a href="#">hypothesisTestingCERpowerpoint.pdf</a></li> <li>11. <a href="#">hypothesisTestingCER.r</a></li> <li>12. <a href="#">maximumLikelihoodPowerpoint.pdf</a></li> <li>13. <a href="#">maximumLikelihood.r</a></li> <li>14. <a href="#">maxLike</a> R package vignette.</li> <li>15. tablet PC notes for lecture 6</li> <li>16. tablet PC notes for lecture 7</li> <li>17. tablet PC notes for lecture 8</li> </ul>

		<p>10. <u>Bootstrap Methods and Permutation Tests</u>, by Tim Hesterberg. Read sections 1 - 5.</p> <p>11. R Cookbook, chapter 9 (General Statistics) chapter 10 (Graphics), chapter 13 (Beyond Basic Numerics and Statistics, section 8 on Bootstrapping).</p> <p>12. <u>An Introduction to R</u>, section 12.</p>	
6-7	<ol style="list-style-type: none"> <li>1. Introduction to portfolio theory</li> <li>2. Optimization</li> <li>3. Markowitz algorithm</li> <li>4. Markowitz Algorithm using the solver and matrix algebra</li> <li>5. Risk budgeting</li> </ol>	<ol style="list-style-type: none"> <li>1. Ruppert, chapter 11 (Portfolio Theory).</li> <li>2. EZ, <u>Book chapter</u> on introduction to portfolio theory.</li> <li>3. <u>Notes</u> on using Excel's solver.</li> <li>4. EZ, <u>class slides</u> on Introduction to Portfolio Theory.</li> <li>5. EZ, <u>class slides</u> on portfolio theory with matrix algebra.</li> <li>6. EZ, <u>Book chapter</u> on portfolio theory with matrix algebra.</li> <li>7. EZ, <u>class slides</u> on portfolio risk budgeting</li> <li>8. R Cookbook, chapter 13 (Beyond Basin Numerics and Statistics, sections 1 - 2)</li> </ol>	<ol style="list-style-type: none"> <li>1. <u>introPortfolioTheory.xls</u></li> <li>2. <u>3firmExample.xls</u></li> <li>3. <u>introductionToPortfolioTheory.r</u></li> <li>4. <u>introductionPortfolioTheoryPowerpoint.pdf</u></li> <li>5. <u>portfolioTheoryMatrixPowerpoint.pdf</u></li> <li>6. <u>portfolioTheoryMatrix.r</u></li> <li>7. <u>portfolio.r</u> (R functions for portfolio analysis with short sales)</li> <li>8. <u>testport.r</u> (Examples of using R functions for portfolio analysis with short sales)</li> <li>9. <u>portfoliofunctions.pdf</u> (description of R functions for portfolio analysis with short sales)</li> <li>10. <u>portfolioFunctionPowerPoint.pdf</u></li> <li>11. tablet PC notes for lecture 9</li> <li>12. tablet PC notes for lecture 10</li> <li>13. tablet PC notes for lecture 11</li> <li>14. tablet PC notes for lecture 12</li> <li>15. tablet PC notes for lecture 13</li> <li>16. tablet PC notes for lecture 14</li> </ol>

		<ul style="list-style-type: none"> <li>9. *EG, chapters 5 and 6</li> </ul>	<ul style="list-style-type: none"> <li>17. tablet PC notes for lecture 15</li> <li>18. <a href="#">portfolioTheoryRpowerPoint.pdf</a>. (updated November 12, 2008)</li> </ul>
8 & 9	<ul style="list-style-type: none"> <li>1. Statistical Analysis of Efficient Portfolios</li> <li>2. Beta as a measure of portfolio risk</li> <li>3. The Single Index Model</li> <li>4. Estimating the Single Index Model using simple linear regression</li> <li>5. Capital Asset Pricing Model (CAPM)</li> </ul>	<ul style="list-style-type: none"> <li>1. Ruppert, chapter 12 (Regression: Basics), chapter 13 (Regression: Troubleshooting), chapter 16 (CAPM)</li> <li>2. EZ, <a href="#">class slides</a> on portfolio theory with no short sales.</li> <li>3. EZ <a href="#">class slides</a> on statistical properties of efficient portfolios.</li> <li>4. EZ <a href="#">class slides</a> on the single index model.</li> <li>5. EZ <a href="#">class slides</a> on estimating single index model using regression.</li> <li>6. EZ <a href="#">class slides</a> on the Capital Asset Pricing Model</li> <li>7. R Cookbook, chapter 11 (Linear Regression and ANOVA)</li> <li>8. *EG, chapters 6, 7 and 9</li> </ul>	<ul style="list-style-type: none"> <li>1. <a href="#">portfolioTheoryNoShortSalesPowerpoint.pdf</a></li> <li>2. <a href="#">portfolioTheoryNoShortSales.r</a></li> <li>3. <a href="#">portfolio_noshorts.r</a> (R functions for portfolio analysis with short sales)</li> <li>4. <a href="#">testport.r</a> (updated examples to include no short sales constraints)</li> <li>5. <a href="#">rollingPortfoliosPowerpoint.pdf</a> (updated August 20, 2013)</li> <li>6. <a href="#">rollingPortfolios.r</a></li> <li>7. <a href="#">bootstrapPortfoliosPowerpoint.pdf</a> (updated August 20, 2013)</li> <li>8. <a href="#">bootstrapPortfolio.R</a></li> <li>9. <a href="#">singleIndex.r</a></li> <li>10. <a href="#">singleIndexPrices.xls</a> (added May 22, 2006)</li> <li>11. <a href="#">singleIndexPowerPoint.pdf</a></li> <li>12. <a href="#">CAPMPowerPoint.pdf</a></li> <li>13. <a href="#">testCAPM.r</a></li> <li>14. tablet PC notes for lecture 16</li> <li>15. tablet PC notes for lecture 17</li> <li>16. tablet PC notes for lecture 18</li> </ul>
9	<p><b>Final Exam:</b> Tuesday June 8 from 10:30-12:20 in SAV 264.</p> <p><b>Final Project:</b> Due Friday June 5 by 8 pm via Canvas or hardcopy in my mailbox or in my office (until 5 pm</p>		

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