AMIS 2700H Quantitative analysis in accounting
Spring 2017
2:20-3:40 TR
210 Gerlach

Office: Fisher 424
10:00-11:00 MW
schroeder.9@fisher.osu.edu
phone: 292-6427

Description: Accounting information system applications of linear algebra are explored including a subspaces representation of double entry accounting structure, a probability assignment description of a decision maker's uncertain state of knowledge, and Bayesian belief updating description of information processing including projections for the case of linear or Gaussian conditional expectations.

Accounting structure is modeled as a linear system composed of four fundamental subspaces: rowspace, columnspace, nullspace, and left nullspace. Efficient information system design draws on nonlinear and/or linear optimization. Consistent information analysis is predicated on probability theory (Bayes theorem). Accounting accruals are statistics whose properties merit study.

Objectives: The course aims to build strong foundations for the study of accounting as an information science. Linear and nonlinear modeling are valuable tools for disciplining and deepening our understanding of accounting; in other words, the pursuit of accounting information science.

Textual materials: Notes and example problems are posted on the course web page. https://fisher.osu.edu/~schroeder.9/AMIS2700H/index.htm or if this fails try https://osu.instructure.com/courses/9842/pages/amis-2700h-accounting-and-linear-algebra

Recommended but optional texts include
Christensen and Demski (CD), Accounting Theory: An Information Content Perspective, McGraw-Hill Irwin, 2003.
Demski (D), *Managerial Uses of Accounting Information*, Springer, 2008.
Strang, *Introduction to Linear Algebra*, Wellesley-Cambridge Press, 2009.

Classroom approach: Students are expected to actively engage in discussion of topics with an emphasis on recognizing the intersection of the various topics. That is, we will attempt to reinforce commonalities across topics and not start from scratch with each topic. Each session tests our understanding and active participation is expected.
The course concludes with a final written exam during the university exam period.

Evaluation:

Classroom participation, positive contribution to learning environment, quizzes, homework	80%
Final exam	20%

tentative outline:

Session	Topic	Assignment
1	Introduction – incidence matrix, directed graph, aggregate accounts	Ralph's structure; Appendix A
2	Introduction – optimization	Ralph's probability assignment; ch. 4, appendix H.2
3	Linear systems of equations – fundamental theorem of linear algebra; matrix operations (addition, multiplication, vector inner & outer products, transposition)	Ralph's subspaces; appendix A.2
4	Identities & inverse operations	Ralph's inverse; appendix A.3
5	Triangularization – LU factorization	Ralph's decomposition; appendix A.3, A.4
6	Diagonalization – eigenvalues & eigenvectors	Ralph's equilibrium; appendix A.4
7-8	Diagonalization – Cholesky & spectral decomposition	Ralph's symmetry; appendix A.4
9-11	Singular value decomposition & pseudo-inverse and QR decomposition	Ralph's row component; appendix A.4, A.5
12-13	Optimization – linear regression & projections	Ralph's estimate; Ralph's optimal accruals; ch. 2, appendix D.1
14-15	Optimization – linear regression, projections & conditional expectations, GLS & Cholesky decomposition	Ralph's double residual regression; Ralph's GLS; ch. 2.7, appendix D.2
16-17	Unconstrained optimization	Ralph's MLE accruals; Ralph's Bayesian accruals; Appendix C
18	Unconstrained optimization	Ralph's discrete choice; appendix G, notes on random utility model
19	Optimization – Lagrangian, Karush-Kuhn-Tucker conditions	Ralph's binomial probability assignment; Ralph's density assignment; ch. 4, appendix H.2, Maxent and binomial assignment
20-21	Optimization – fundamental theorem of linear programming, duality theorems, framing, theorem of the separating hyperplane	Ralph's bounds; Ralph's aggregate accounts; D ch. 8, appendix A.1, H.1
22-22	Optimization – duality & theorem of the separating hyperplane (fundamental theorem of finance)	Ralph's derivatives; Ralph's Kelly-Ross Investments; appendix H.3, Information synergy 1

Session	Topic	Assignment
24	Bayes theorem (sum & product rules, law of total probability, iterated expectations, variance decomposition)	Bayesian Ralph; CD ch. 5; appendix B, C
25	Classical information analysis – Bayes normal	Ralph's accounting information; appendix C, notes
26	Quantum information – vector spaces; superposition, transformation, combination & measurement	Ralph's teleportation; appendix I
27	Quantum information – Bell's inequality & quantum entanglement	Ralph's inequality; appendix I
28	Quantum information – unitary operators & measurement, observables & measurement, quantum entanglement	Ralph's synergy; appendix I

Final exam
Wed, 4/26
2:00-3:45 pm