AMIS 3600H
Introduction to accounting information systems      Professor D. Schroeder
Fall 2022                                           Office:  Fisher 424
3:55-5:15 TR                                        10:00-11:00 MW
319 SB                                              schroeder.9@fisher.osu.edu
                                                    phone:  292-6427

Description: Accounting information systems are subject to technological advances. This course explores foundations of information science including classical and quantum computation as well as causal inference. These topics are at the forefront of modern information science. Consequently, our studies are open-ended and necessarily incomplete.

Objectives: The course aims to build strong foundations for the study of accounting as an information science.

Textual materials: Suggested readings and example problems are posted on the course web page.
http://u.osu.edu/schroeder.9/amis-3600h/ and Carmen

Recommended but optional texts include
Cover and Thomas. *Elements of information theory*, Wiley, 1991.
Fellingham, *Accounting: An information science* (F).
Luenberger, *Information science*, Princeton University Press, 2006.
Nielsen and Chuang, *Quantum Information and Quantum Computation*, Cambridge University Press, 2000.
Pearl, Glymour, and Jewell, *Causal Inference in Statistics: A Primer*, Wiley & Sons, 2016.
Strang, *Introduction to Linear Algebra*, Wellesley-Cambridge Press, 2009.
Lloyd, *Programming the Universe: A quantum computer scientist takes on the cosmos*, Vintage Books, 2017.
Poundstone, *Fortune's Formula: The untold story of the scientific betting system that beat the casinos and Wall Street*, Hill and Wang, 2005.

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.

A two to four page, typed, double-spaced paper on the student's topic of choice related to information theory (for example, error correction, cryptography, quantum information) is due at the time of the in-class final exam.
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 (paper 10%, in-class exam 10%) | 20% |

tentative outline:

| week | Topic | Assignment/Reference |
|---|---|---|
| | **Coding and entropy** | |
| 1 | Introduction – Shannon entropy | Ralph's mutual information/ Cover and Thomas ch. 2,9; Luenberger ch. 2,5 |
| 1,2 | Shannon's channel theorems | Ralph's channel/ Cover and Thomas ch. 5,8; Luenberger ch.3,5; Nielsen and Chuang ch. 12 |
| 2,3 | von Neumann entropy | Ralph's density operator; Ralph's quantum mutual information Ralphs' teleportation; Ralph's inequality/ Nielsen and Chuang ch. 1,2 |
| 3 | introduction to quantum computing | Ralph's quantum search/ Grover |
| 4 | Classical coding: error detection and correction | F 9-1,2; F 9-3,4,7,8,10/ Fellingham ch. 9; Luenberger ch. 6 Ralph's accounting code/ Fellingham ch. 3; Arya, Fellingham, Schroeder, and Young |
| 5 | Quantum coding: error detection and correction | Ralph's quantum error correction/ notes; Nielsen and Chuang ch. 10 |
| 6 | Classical encryption: private key | F 10-1,3,4,6/ Fellingham ch. 10; Luenberger ch. 11,12 |
| 7 | Classical encryption: public key | F10-5,8,10/ Fellingham ch. 10; Luenberger ch. 13,14 |
| 8 | Classical encryption: elliptical curve cryptography | Ralph's elliptical curve cryptography/ notes; Luenberger ch. 13,14 |
| 9 | Quantum factoring algorithm | Ralph's quantum factoring/ Shor; Nielsen and Chuang ch. 5 |
| 9-10 | Quantum discrete log algorithm | Ralph's quantum discrete log/ Shor; Nielsen and Chuang ch. 5; Lin |
| 10 | Quantum cryptography | Ralph's quantum encryption/ Nielsen and Chuang ch. 12; Fellingham ch. 11 |

| Session | Topic | Assignment/Reference |
|---|---|---|
| | **Structural causal modeling (SCM)** | |
| 11 | DAGs; Simpson's paradox; counterfactuals | Ralph's technology/ Pearl et al ch. 1,2, 4 |
| 11,12 | Intervention and do-calculus | Ralph's back-door adjustment; Ralph's front-door adjustment/ Pearl et al ch. 3 |
| 13 | Instrumental variable adjustment | Ralph's instrumental variables / Pearl et al, ch. 3 |
| 13 | Berkson's paradox | Ralph's "kitchen sink" fallacy / Pearl et al ch. 3 |
| 14 | Linear models and path coefficients | Ralph's path coefficients/ Pearl et al ch. 3 |
| 14 | DAG construction and testing; Sampling selection bias | Ralph's DAG/Pearl et al ch. 1,2; Ralph's technology selection/ notes; Bareinboim, Tian, and Pearl |

**Final exam**
**Wednesday, 12/14/22**
**4:00-5:45 pm**