

SPRING 2021

SySc 551 / 651 4 credits

## DISCRETE MULTIVARIATE MODELING (DMM)

Mon/Wed 4:40 – 6:30 pm, online

*MODEL almost ANY DATA!*

<http://www.pdx.edu/sysc/research-discrete-multivariate-modeling>

Professor M. Zwick [zwick@pdx.edu](mailto:zwick@pdx.edu)

In this course, **information theory** is used as a framework for modeling and data mining: for analyzing static or dynamic relations among discrete (typically, nominal) variables, for detecting complex **interaction effects**, and for discovering **nonlinearities** in continuous variables made discrete by binning.

In the systems literature, these information-theoretic and related set-theoretic methods, used together with **graph theory** techniques, are called “**Reconstructability Analysis**” (RA). RA overlaps with and extends log-linear modeling in the social sciences, Bayesian networks and graphical models in **machine learning**, decomposition techniques in multi-valued logic design, Fourier methods for compression, and other modeling approaches. It can be used for confirmatory and exploratory statistical modeling as well as for non-statistical applications.

Because of their applicability to **both qualitative and quantitative variables**, RA methods are very general. They are usable in the natural sciences, social sciences, engineering, business, and other professional fields. RA ideas define “structure,” “complexity,” and “holism,” and are **foundational** for systems science.

This is the theory course for the **Occam open source software**:  
<https://www.occam-ra.io/>

### Texts:

1. Krippendorff, Klaus. *Information Theory: Structural Models for Qualitative Data*. Paper # 62, Sage Publications (*major text*)
2. Knoke, David and Burke, Peter J. *Log-Linear Models*. Series: Paper # 20. Sage Publications

