Initial Slides for STAT 730 , Spring 2026

Because our first week's classes have been snowed out, I offer these slides as orientation and suggestion for some ideas to think about as you begin reading the Shumway and Stoffer book, topics for discussion in our first class on Monday February 2.

See the course web-site `https://www.math.umd.edu/~slud/s730/` for course mechanics, prerequisites, workload, etc.

Also look at the HW1 assignment (due 2 weeks from tonight) posted on the course web-page as you do the reading in Ch. 1 and Appendix A of Shumway and Stoffer. Email me if anything is unclear.

What Dependence Models do we Know ?

First think about dependence models without time-ordering

Random Function (like random-coefficient sinusoid)

Other shared parameters in a dynamical model (with or without superposed iid noise)

Recursions with/without noise $x_{t+1} = h_t(x_t, \epsilon_{t+1})$

Markov process with update rule $f_{X_{t+1}|X_t}(y|x, \theta)$

Building blocks — iid, random walks, moving averages (special cases of recursions)

More Dependence Mechanisms, without time-ordering

Gaussian processes

Superposed signals with different qualitative properties
(stationary, periodic, trend, 'irregular')

Strictly stationary, wide-sense stationary, stationary increments, 'intrinsic' stationarity: *please review these definitions*

Others ? 'combinations' of models of above types ?

Mixtures . . . , copulas . . .

Dependence Models with Time-ordering

Many examples above do have natural time ordering

Random functions on $\mathbb{R}$

Random time-shifts of random or nonrandom functions

(Functions of) Dynamical Recursions

Statistical Models for Time Series

$$Y_t = Q(\beta^{\mathtt{tr}} \{Y_{t-j}\}_{j=1}^{k}, \gamma^{\mathtt{tr}} \underline{X}(t), \epsilon_t) \qquad \underline{X}(t) \quad \textit{exogenous}$$

Parsimony of parametric description & likelihood –

more difficult for time series, except for special ones

(e,g., Gaussian, parametric recursions)