PhD Prelims in
Actuarial Loss Models (Math 5639)
STUDY GUIDE

May 4, 2020

- **Claim frequency distribution**

  Some common discrete distributions for frequency (e.g. Poisson, Negative binomial, etc.), $(a, b, 0)$ class, creating new distributions (compound, mixture), truncation and modification at zero.

- **Claim severity distribution**

  Some common continuous distributions for severity (e.g. Exponential, Gamma, Pareto, etc.), creating new distributions (transformation, mixture, splicing), tail properties, coverage modifications (e.g. deductible, policy limit, etc.), loss elimination ratio, effect of inflation

- **Aggregate loss models**

  Individual risk models (convolution, De Pril recursion, approximations), collective risk models (compound distributions, Panjer recursion, approximations, compound Poisson), relationship between the two models, coverage modifications, stop-loss reinsurance, Tweedie distributions

- **Risk measures**

  Uses of risk measures, coherent risk measures, premium-based and capital-based risk measures, Vaule-at-Risk, Tail Value-at-Risk, distortion function approach, Wang transform

- **Model estimation and types of data**

  Estimation (e.g. parametric, nonparametric approaches, point estimators, interval estimates), types of data (loss data, duration data, complete, incomplete and grouped data), censoring and truncation

- **Nonparametric model estimation**

  Complete individual data (empirical, kernel), incomplete individual data (Kaplan-Meier, Nelson-Aalen), variances, confidence intervals

- **Parametric model estimation**

  Method of moments, maximum likelihood, Bayesian estimation, models with covariates (e.g. proportional hazards, GLM, accelerated failure time models)

- **Model evaluation and selection**

  Graphical, misspecification tests, diagnostic checks, information criteria

- **Basic Monte Carlo simulation**

  Monte Carlo method, uniform random number generators, general random number generators (e.g. inversion, acceptance-rejection, correlated variables), random generators for specific distributions (discrete, cotniuous), variance reduction techniques (antithetic, control variables, importance sampling)

Recommended textbook

Nonlife Actuarial Models: Theory, Methods and Evaluation, by Yiu-Kuen Tse, Cambridge University Press, 2009. Chapters 1-4, 10-14.

Suggested reference

Loss Models: From Data to Decisions, by S.A. Klugman, H.H. Panjer and G.E. Willmot, 5th ed., Wiley, 2019. Chapters 3, 5-9, 11-15, 19.