

Problems for the oral exam in the course “Advanced topics in non-life insurance“, 2009

1. Definition, examples of point processes. Simple point processes. Examples (renewal process, the point process of claim arrivals and claim sizes, point process of exceedances,...). Which of them are simple? Laplace functional of a point process. Relation between the distribution of a point process and its Laplace functional. (Section 7.1, without Example 7.1.8)
2. PRM. Definition and examples. When is a PRM simple? (Section 7.2.1, without Example 7.2.4). Laplace functional (main ideas of Lemma 7.2.7(1), not part (2)). Compound Poisson representation of Poisson integral (Corollary 7.2.8).
3. Poisson integrals and their properties, incl. proofs (Section 7.2.3).
4. Construction of new PRMs. Transformation, marking and aggregation, incl. proofs. (Section 7.3, without Example 7.3.4)
5. The basic model and basic decomposition (Section 8.2.1). Basic decomposition of claim number process (Section 8.2.2). Basic decomposition of total claim amount (Section 8.2.3). All incl. proofs.
6. The stationary version of the IBNR claim number process. The expected value and covariance function of the process. (Section 8.2.4)
7. Weak convergence of point processes. Convergence of Laplace functionals. Vague convergence. Weak convergence of PRM.
8. Kallenberg’s theorem. Application to the point process of exceedances and the convergence in distribution of maxima and order statistics. Fisher-Tippett theorem. (Sections 9.2.1 and 9.2.2)
9. ECOMOR and largest claims reinsurance treaties. The joint distribution of the k upper order statistics in a random sample. Extremal variate. Limit distributions for ECOMOR reinsurance treaties for distributions in the maximum domain of attraction of the Gumbel distribution. (Section 9.3).
10. Cluster point processes, definition. The chain ladder and Mack’s model. The rationale of the chain ladder estimators (Section 11.2.3). First moment and variance of chain ladder estimators (Section 11.2.4). 1-step ahead prediction and corresponding prediction error in Mack’s model, basic idea of k -step prediction.