Prof. Dr. E. Spodarev / W. Karcher | SS 2008
29/5/2008

Homework assignment for Risk Theory - #6

(Due Thursday, 5/6/2008, 10:15 a.m., H9)

1. Use the Panjer algorithm to write R functions for calculating the value of the probability density function p_k of the Poisson, the geometric, the negative binomial and the binomial distribution for $k = 0, 1, 2, ...$ (8)

2. Determine the expected value, the variance and the index of dispersion of the negative binomial distribution. (6)
$\left(\text{Hint: Use } \sum_{n=0}^{\infty} \binom{n+\alpha}{n} z^n = \frac{1}{(1-z)^{\alpha+1}} \text{ to calculate the generating function}\right)$

3. For a portfolio of fire insurance contracts on buildings, the following data is given.

k	Number of policies with k claims
0	103705
1	11632
2	1767
3	255
4	44
5	6
6	2
> 7	0
	$\Sigma = 117411$

Table 1

   (a) Estimate the expected value of the number of claims N (per policy) by the mean λ_1 of the empirical distribution and the variance of N by the variance λ_2 of the empirical distribution. Is the Poisson distribution an appropriate model for the number of claims? (3)

   (b) In the following, the result of part (a) will be further analyzed. For this purpose, N is modelled by a Poisson distribution with parameters λ_1 and λ_2, respectively. Compare both distributions with the empirical distribution of the number of claims. (3)

   (c) Use λ_1 and λ_2 to approximate the distribution of the number of claims by a negative binomial distribution and compare the results to those of part (b). (5)

4. Show that a stochastic process $\{X(t), t \geq 0\}$ with independent increments is a Markov process. (6)