

TAKE HOME EXAMINATION IN AGGREGATE CLAIMS DISTRIBUTIONS

Consider a portfolio of term insurances with single premium (rene dødsfaldsforsikringer mod engangspræmie ved tegning). At the time of consideration (now) there are N policies in the portfolio, and their distribution w.r.t. sum insured and current age of the insured is as follows:

sum insured in 100000:

	1	5	10
age: 30	1/10	1/5	1/30
50	1/10	1/5	1/30
70	1/10	1/5	1/30

Assume the lives are subject to G82M mortality.

Let S denote the total claim amount (in units of 100000) in respect to this portfolio for the next year.

Calculate the exact values and approximations of

- (a) $P(S=k)$, for integer k ;
- (b) the expectation, the variance, and the third central moment of S ;

- (c) 95% and 5%; 85% and 15%; 75% and 25% percentiles of the distribution of S .

The calculations should be done by using the following technique:

- (a) exact recursion by De Pril [1];
- (b) Normal approximation of the distribution of aggregate claims (see [2], Chapter VII, Section 1);
- (c) Edgeworth approximation with skewness correction, i.e. the Edgeworth expansions containing only one correction term after the leading one, (using the results e.g., in [2], Chapter VII, Section 3);
- (d) Cornish-Fisher expansions for percentiles (see e.g., [3], Section 2.5).

Compare:

- (a) the values obtained by the exact calculations and by the asymptotical techniques;
- (b) the computing time by the exact procedure and by the asymptotic methods.

REFERENCES

1. De Pril N. (1989) The aggregate claims distribution in the individual model with arbitrary positive claims.- ASTIN Bull. 19, p. 9-24;
2. Petrov V.V. (1975) *Sums of Independent Random Variables*, Springer, Berlin etc.
3. Hall P. (1992) *The Bootstrap And Edgeworth Expansions*, Springer, New York, etc.