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Life Contingencies - Exercise Sheet 6

Presentation: Friday, 30th of December.

Exercise 1 Consider a whole life insurance with annual premiums and a 20-year premium paying term issued to a select life aged 30, with sum insured \$200 000 payable at the end of the year of death.

- Write down an expression for the net future loss random variable.
- Calculate the net annual premium.
- Calculate the probability that the contract makes a profit.

Exercise 2

You are given the following extract from a select life table with a four-year select period. A select individual aged 41 purchased a three-year term insurance with a net premium of \$350 payable annually. The sum insured is paid at the end of the year of death.

$[x]$	$l_{[x]}$	$l_{[x]+1}$	$l_{[x]+2}$	$l_{[x]+3}$	$l_{[x]+4}$	$x + 4$
[40]	100 000	99 899	99 724	99 520	99 288	44
[41]	99 802	99 689	99 502	99 283	99 033	45
[42]	99 597	99 471	99 268	99 030	98 752	46

Use an effective rate of interest of 6% per year to calculate

- the sum insured, assuming the equivalence principle,
- the standard deviation of L_0 , and
- $P[L_0 > 0]$.

Exercise 3

A select life aged 45 effects a 20-year endowment insurance with level annual premiums payable throughout the policy term, with sum insured \$100 000 payable at the end of the year of death, or at maturity. Calculate the annual premium allowing for expenses of 10% of the first annual premium and 2% of each subsequent premium, with further initial expenses of \$50 and renewal expenses (at the time of payment of the second and each subsequent premium) of \$8.

Exercise 4

A select life aged 45 effects by a single premium a policy which provides an annuity of \$40 000 per year, payable annually in advance from age 65. In the event of death before age 65, the premium is returned at the end of the year of death.

- Write down an expression for the net future loss random variable.
- Calculate the single premium.

- (c) Now suppose that the annuity is guaranteed to be paid for at least 5 years if the life survives to age 65. Calculate the revised single premium.

Exercise 5

Consider an annual premium with-profit whole life insurance issued to a select life aged exactly 40. The basic sum insured is \$200 000 payable at the end of the month of death, and the premium term is 25 years. Assume a compound reversionary bonus of 1.5% per year, vesting on each policy anniversary, initial expenses of 60% of the annual premium, renewal expenses of 2.5% of all premiums after the first, plus per policy expenses (incurred when a premium is payable) of \$5 at the beginning of the first year, increasing by 6% per year compound at the beginning of each subsequent year. Calculate the annual premium.