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.

(a) Write down an expression for the net future loss random variable.

(b) Calculate the net annual premium.

(c) 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.

\[

t_{x} t_{x+1} t_{x+2} t_{x+3} t_{x+4} x + 4
\]

<table>
<thead>
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<th>([x])</th>
<th>([t_{x}])</th>
<th>([t_{x+1}])</th>
<th>([t_{x+2}])</th>
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</table>

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

(a) the sum insured, assuming the equivalence principle,

(b) the standard deviation of \(L_0\), and

(c) \(P[L_0 > 0]\).

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.

(a) Write down an expression for the net future loss random variable.

(b) 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.