Life Insurance Mathematics I
Tutorial 1

Please prepare the following questions for discussion in the week commencing Monday 15 January.

1. A 5-year endowment assurance issued to a life aged 60 has a sum assured, S, of £25,000 payable at the end of the year of death. Level premiums are payable annually in advance.

   (a) Calculate the annual premium.

   Premium basis:
Mortality:	AM92	Select
Interest:	4%	
Expenses:	Initial:	£100 plus 40% of the first premium
	Renewal:	5% of the second and each subsequent premium

   Profit criterion: $E[PV \text{ profit}] = 250$.

   (b) Starting from the gross premium reserve $V_5 = 25000$, calculate the values for the gross premium prospective reserves at times 4, 3, 2, 1 and 0 using the recursive formula.

   The reserve basis is the same as the premium basis.

   (c) Comment on the value of V_0.

2. A man aged 55 effects a 5-year term assurance with sum assured £50,000 payable immediately on death. Level monthly premiums are payable throughout the term.

   (a) Calculate the monthly premium.

   (b) Calculate the net premium reserve after 2 years just before the payment of the premium then due.

   (c) Calculate the net premium reserve after 2 years just after the payment of the premium then due.

   (d) Comment briefly on the difference between your answers to parts (b) and (c) above.

Mortality	AM92 Ultimate
Interest:	6% p.a.
Expenses:	Nil.

3. A special type of policy provides that the death benefit at the end of the year of death is the sum assured increased by the reserve that would have been held if the death had not occurred.

   (a) Find the annual premium for such a five-year endowment policy with sum insured £100,000 for a life aged 40.

   Mortality: A1967-70   Ultimate
   Interest: 4%
   Expenses: none

   (b) How does this compare to the premium without the special benefit?

4. A life office issued a with profits whole of life policy to a life aged 20 on 1 July 2002. The basic sum assured of £100,000 and attaching bonuses are payable at the end of the year of death. The company declares simple reversionary bonuses at the start of each year. Level premiums are payable annually in advance.

   (a) Calculate the annual premium on the following basis.
   Mortality: AM92 select
   Interest: 6%
   Bonus Loading: 3% simple per annum
   Expenses: Initial £200
                    Renewal 5% of each premium from second year.

   (b) On 30 June 2005 the policy is still in force. A total of £10,000 has been declared as a simple bonus to date.

   The company calculates reserves using gross premium prospective basis, with the following assumptions:
   Mortality: AM92 ultimate
   Interest: 4%
   Bonus Loading: 4% simple per annum
   Renewal Expenses: 5% of each premium.
   Calculate the provision for the policy as at 30 June 2005.

5. A life office is to issue a 5-year term assurance policy to a life aged 35. The sum assured is £150,000 payable at the end of the year of death within 5 years and premiums are payable annually in advance for 5 years.

   Premium basis = reserve basis:
   Mortality: A1967-70   Ultimate
   Interest: 4%
   Expenses: none
   Profit criterion: $E[PV \text{ profit}] = £200$.

   (a) Calculate the amount of the annual premium.
   (b) Calculate recursively the amount of the prospective and retrospective reserves at each of times $0, 1, \ldots, 5$.