

Diploma

Subject 104 - Assignment 3

①

A life aged x effects a without profit whole life assurance policy by level annual premiums payable for m years, or until earlier death. The sum assured is payable at the end of the year of death.

- (i) Write down expressions for retrospective and prospective net premium policy values of the policy t years after issue assuming that $t < m$, immediately before payment of the premium then due. Assume a sum assured of 1.

- (ii) Show that the two values in (i) are equal.

[12]

②

A life office is investigating the mortality profit or loss in respect of whole life assurances. Part of a schedule which has been prepared reads as follows:

Age on 1 Jan 94	Sum assured in force on 1 Jan 1994 £	Reserves at 31 Dec 1994 of policies in force on 31 Dec 1994 £
66	100,000	52,000
67	80,000	39,000
68	60,000	32,000

The death claims arising during 1994 from this group of policies were as follows:

Date of issue of policy	Age at issue of policy	Sum Assured £
1 Jan 1982	55	2,000
1 Jan 1983	55	2,000
1 Jan 1984	57	1,000

There were no alterations to policies in the above groups, and during 1994 no policy discontinued other than by death. All premiums are payable annually on 1st January throughout life, and sums assured are payable at the end of the year of death. The reserves are calculated using net premium policy values, assuming mortality follows ~~AM92~~ (ultimate), and using a rate of interest of ~~5%~~ ^{4% p.a.}

- (i) Calculate the mortality profit or loss for 1994 in respect of this group of policies. [11]

- (ii) (a) Calculate the amount of expected death claims for 1994 and compare it with the amount of actual claims.

- (b) Suggest a reason for this result compared with that obtained in (i).

[5]

[Total
16]

A life office issues a special 30-year endowment assurance policy to a life aged exactly 35. The death benefit is £25,000 and is payable immediately on death. The survival benefit is £50,000.

The office uses the following basis for all calculations:

Basis: Mortality A_{92}
Interest $3\frac{1}{2}\%$ ultimate 4% pa.

- (i) Calculate the net premium payable. [7 Marks]
- (ii) Calculate the prospective policy value after 10 years. [7 Marks]
- (iii) Calculate the retrospective policy value after 10 years. [8 Marks]
- (iv) Comment on your answers to parts (i) and (iii). [2 Marks]

The following is a schedule showing details of some of the business a life office has in force on 1 January 1995, each for sum assured £25,000.

Sum Assured in Force at 1.1.95	Type of policy	Date when policies first sold	Age of policyholders when policy issued
350,000	25 year endowment assurance	1 January 1985	35
425,000	Whole of life assurance	1 January 1992	40
200,000	20 year pure endowment	1 January 1978	40

All the policies have premiums paid annually in advance throughout their term, and any death benefits are paid at the end of year of death. During 1995, the life office had to pay out £50,000 in death benefits to its endowment policyholders, £25,000 to its whole of life assurance policyholders and one pure endowment policyholder died.

- i) Calculate the mortality profit or loss the life office makes in respect of these policies. You may assume the life office calculates reserves using the net premium method, and uses the following basis for both premiums and reserves:

mortality: A_{92}
interest: 4% per annum. [12]

- ii) Briefly explain the result you found in part (i). [3]

[Total 15]

5

A life office issues a 3 year term assurance policy to a life aged 62, under which the sum assured of £100,000 is paid at the end of the year of death, providing it occurs before the policyholder's 65th birthday. Premiums of £2,867 are payable annually in advance for 3 years or until earlier death.

The company is considering the random future loss, L , at outset under this policy where L is defined to be:

L = present value of future outgo – present value of future income.

- (i) Using English Life Table No. 15 – Males and 6% per annum interest:

(a) Calculate all possible values which can be taken by L .

(b) Calculate the mean and standard deviation of L . [7]

- (ii) Consider a 3-year endowment assurance policy issued to the same person, where the premium is calculated to give the same mean value of L as the policy in section (i) above. Without doing any further calculations, state how you would expect the standard deviation of L for the endowment policy to compare with that for the term assurance, giving reasons for your answer. [3]

[Total 10]