Title: Premium calculation for life-insurance		
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Calculating the premium of life insurance

Calculating the premium is about calculating the chance of having to pay out. For non-life insurance this can be simplified to calculating the chance, multiplied by the costs. For life insurance the premium depends on three factors: costs, interest and mortality.

1.Costs

The insurer's office expenses make up the costs. Think of salaries, computers, and maintenance of buildings. It also includes the commissions to be paid to the agents. It is advisable to base the premium calculation needed for the risk on a fixed percentage of costs in the premium

2.Interest

Especially with regard to life insurance we have to consider interest. When the policy provides for a pay-out for when the insured person dies, then the insurer knows that he will have to pay out at some time. He only does not know when. In the course of the years he will receive insurance premiums that he has to reserve for the pay-out that will happen one day. Suppose that 32 years have lapsed between taking out an insurance policy and the moment of dying, then the insurer will have received interest over 32 years on the first premium payment, over 31 years on the second payment, etc.

If we assume a premium of Rs 100 and a rate of interest of 5% per year, the insurer will receive in premiums and interest: $[100*1.05^{32}]$ + $[100*1.05^{31}]$ + $[100*1.05^{30}]$ + etc. This is 476+454+432+ etc. = 7,906. Especially when it involves a longer period the effects on interest income are huge. In 30 years a 5% rate of interest has more than quadrupled the amount.

3.Mortality

Mortality tables allow the insurer to calculate the average chance of someone dying within one year. This also applies to the person who dies after two years, etc. In the Madurai 2004 statistical handbook we found the following data:

St. No.	Age group	Persons 2001	Percentage of total
1	0-6	279,144	10.9
2	7-14	745,767	29.1
3	15-29	717,438	28.0
4	30-44	486,833	19.0
5	45-59	307,474	12.0
6	60 and above	25,623	1.0
	total	2,562,279	100.0

This data is too limited to immediately draw conclusions, but they do provide an indication. To

not make it unnecessarily difficult we assume a proportionate distribution of age groups[1]. We are also assuming that the future rate of mortality is the same as the past one. The conclusion then is that the group now aged between 30 and 44 will be aged 45 to 59 in 15 years. The chance that the people are the still alive is 307,474 divided by 486,833, or 63%. The rate of mortality for the 30-44 age group is then 100% minus the rate of survival. That is 100% minus 63% is 37%. This is the mortality rate over 15 years. That does not say if the 37% dies at the start of the 15 years or at the end. For that we need more detailed information.

Difference between temporary and lifelong insurance

There is a difference between a **temporary** insurance that leads to pay-out in the case of a death and a **lifelong** insurance in the case of death. With a temporary insurance one only pays premium over the risk that one dies within a year. With a lifelong insurance it is clear that the insurer must always pay. The insurer does not know if this is going to happen within one year or only after 32 years. The insurer does not know if he is going to get one premium payment or 32, and he does not know how much interests he is going to get over these payments. It is clear that for lifelong insurance premiums are much higher than for temporary insurance. The insured sum must one day be paid out. As soon as some one is older than sixty that chance will increase enormously (see table). If one takes out such insurance at the age of 55 then the chance is big that the insurer is going to have to pay out within ten years. The insurer must then have received Rs 20,000 in premiums and interest and also an amount for costs. It is clear that this is impossible with premium payments of around Rs 100. Such insurance is only possible when one takes one out at an early age, or when the turn-around system with non-selection[2] is used.

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[1] In this case there clearly is no proportionate distribution of age groups. There are many more people in the 7-14 age category than in the 0-6 one; they should be roughly equal.
[2] See elsewhere in this course for these concepts.