31E99906 Capstone Microeconomic Policy
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Return method: through mycourses by the deadline

## Problem Set 2: Question 5

I would like to introduce something that supplements the recording of Lecture 7: the relationship between the size of the risk pool and the cost of the insurance. This is particularly important in health care. Consider a market with the following primitives:

- Each year, there is a $1 / 250$ chance that one's house will burn down. If it does, the loss is 250,000 euros.
- Each consumers wealth is 500,000 euros, and there are 100,000 of such consumers.

1. We consider a zero-profit insurance contract. It would be straightforward to obtain the expected loss as a premium. In this case, the pool would have 100 million euro to spend on payouts for burned houses, which is also the exact expected sum to be paid during the contract term. However, in reality, even in a pool of this big, the actual number of houses burning down deviates from the expectation. We assume that the insurance company insuring this pool of customers must hold enough capital to be able to tolerate a certain variation in the number of houses burning down. We may think that the financial market regulators set this tolerance level: Any realized annual loss in the $95 \%$ confidence interval for losses must be covered. With this information, you should be able to calculate how much capital the insurance market must hold. Let us assume that the cost of capital comes in the form of $5 \%$ interest to be paid annually.

What is the price of a zero-profit contract now? To get started, note that the variance of the loss is $\frac{p(1-p)}{n}$ where $p$ is the prob of the event
and $n$ is the number of events. You can approximate this binomial distribution by normal distribution for obtaining the confidence interval.
2. Assume now that $50 \%$ of the customers are more careful and their house burns down with frequency $1 / 1000$. Suppose these customers risk-neutral, which means that they only compare the expected loss and the cost of the contract. Would they buy the contract? What happens to the cost of the contract to the remaining $50 \%$ of the market?

