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MINIMIZING THE RISKS OF THE INSURANCE COMPANY WHEN CONCLUDING CONTRACTS

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Abstract: *In this article a mathematical formulation of the problem of minimizing the risks of the insurance company when concluding contracts. Considered and identified 3 main groups of survey parameters: CONTRACT, FINANCE, HEALTH.*

Keywords: *minimization, risk, insurance company, contract, finance, health.*

An insurance company - a historically defined public form of an insurance fund functioning - is a separate structure that carries out concluding insurance contracts and their service.

The demand for insurance services depends on the constantly existing threat caused by some unfavourable or even more catastrophic events that any economic entities (legal entities and individuals) can face and those that can lead to significant financial losses (death, illness or dismissing a family member from work which was the main source of income; property loss from fire; car accident, etc.). Such losses can't be practically covered from current income on the one hand. On the other hand, to accumulate funds for this on deposit accounts is very difficult as well. Insurance is the most profitable compensation of such losses, since its amount could be greater than the insurance premiums.

Each insurance company tries to improve the concept of customers service; reduce the processing time of a customer questionnaires; make the conclusion of insurance contracts comfortable for both the insurance agent and the client. The other side of this concept is, of course, the desire of the insurance company to protect itself from material losses in the form of numerous insurance payments. As a result, there is a need to study potential customers before insurance contracts are concluded.

For this purpose, the insurance company conducts a survey of the client to find out possible risks of the of insured events frequency. Such a questionnaire includes a large number of questions, to which ambiguous and contradictory answers can be obtained. Thus there arises the task of developing a decision-making system for the possibility to conclude contracts with potential customers.

The questionnaire questions are grouped into 3 basic groups: CONTRACT, FINANCE, and HEALTH.

The FINANCE group of factors determines the information parameters that characterize the financial well-being of the client: a salary, a number of cars, total amount of loans, their own real estate (or share), whether the client is married, the number of children, the capability to pay the annual insurance obligation (annual client payment).

Group HEALTH determines the current state of physical health, whether the customer's current activities are safe and whether he/she has hobbies that are dangerous for his/her life: HIV-disease, a number of surgeries, a number of cigarettes smoked daily, alcohol drinking, chronological age, physical age, risky for life profession, dangerous hobbies (climbing, motor racing etc.).

Group CONTRACT determines the components of the insurance contract: the insured amount, a number of years under insurance, type of insurance, the insurance cases covered.

The parameters of the client's characteristics are represented as the vector RISK = {FINANCE, HEALTH, CONTRACT}.

Each element of the RISK vector is also a vector:

FINANCE = {salary, count_auto, count_credits, count_houses, is_married, count_children, Annual_Client_payment};
HEALTH = {is_aids +, count_operations, count_cigarets, count_alco, passport_age, fithness_age, risk_profession, risk_hobby, driving_experience};
CONTRACT = {SUM, YEARS, TYPE, insured_losses}.

According to the database information, the clients of the insurance company are divided into clusters by the probability of insured events in a particular type of insurance. The cluster center is calculated using the formula:

$$C = \sum_{i=1}^{3} W_i \frac{\sum_j^n \text{index\_RISK}_{ji}}{n} \text{score},$$

where W_i – is the coefficient of importance of the" I"- group of the customer characteristics for this type of insurance;

$\sum_j^n \text{index\_RISK}_{ji}$ – the sum of the points of "I"- group of characteristics of "j"- client, which is calculated basing on the rules of the database.

n – the number of elements (clients) in the cluster.

For example, the simplified rules can be described as follows:

If FINANCE = HIGH тоindex_RISK [1] = 0;
If FINANCE = MIDDLE тоindex_RISK [1] = 1;

If FINANCE = LOW toindex_RISK [1] = 3.
If AGE.passport_age<AGE.fithness_agetoindex_RISK [3] = 3;
If AGE.passport_age>AGE.fithness_agetoindex_RISK [3] = 0;
If AGE.passport_age = AGE.fithness_agetoindex_RISK [3] = 1.

The client is assigned to a specific cluster based on the distance to the cluster center, which is calculated from the target function:

$$\min_k(\sum_{i=1}^{3} W_i * indx\_RISK[i] - C_k),$$

Where $indx\_RISK[i]$ - the sum of the points of the "I" - group of characteristics of the new client;

C_k – the value of the center of the k-th cluster.

Parameter constraints are also taken into account:

1) $0 \leq AGE \leq 60$.

2) IfFINANCE.Annual_Client_payment ≥ (0.1 * FINANCE.Salary), then increase TOTAL_RISK.

The assignment of the client to a specific risk group will allow the policy holder to determine the probability of possible losses of the company when insuring. The above presented mathematical model can be used in the system of decision - making support about insuring a particular person and the choice of the type of insurance policy.

The system should provide for the possibility of forming questionnaire questions in such a way as to exclude, if possible, untruthful answers.

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Аннотация: *В данной статье была определена математическая постановка задачи минимизации рисков страховой компании при заключении договоров. Рассмотрены и определены 3 основных группы параметров анкетирования: CONTRACT, FINANCE, HEALTH.*

Ключевые слова: *минимизация, риск, страховая компания, договор, финансы, здоровье.*

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