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Eventological Scoring in the Theory of Fuzzy Events

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The method of binary eventological scoring for the fuzzy event, which interprets of the questionary event is considered. The general formula of the method is formulated and proved. Also the formulas for different internal structures of dependencies of fuzzy base events are presented.Results of the work can be used in systems of decision-making and at research of various social and economic systems.

Keywords: Fuzzy event, eventological scoring method, structures of dependencies of events.

Introduction

The Scoring is a mathematical or statistical classification model of a customer base on various groups. The qualitative characteristic which divides these groups is unknown. But other factors connected with the characteristic of interest to us are known. The methods applied to build scoring models are rather various, and they can be applied in two ways: separately from each other and in various combinations [1–4]. The interest to the problems of artificial intelligence has defined the popularity of three main methods of the constructing of scoring algorithms: on the basis of logistic regression, on the basis of the classification tree (decision tree), on the basis of a neural network. Eventology is a new developing scientific direction. It also has its own approach to the building of scoring models. Eventological technologies differ from many mathematical and probabilistic methods. They allow getting a result on the basis of data, available in the conditions of real economic activity. It is caused by eventological principle of considering of events dependencies structure. Eventological scoring (e-scoring) is a generalization of the classical scoring [2,3] which uses two basic methods: linear multiple-factor regression and logistic regression. The main idea of e-scoring is the following: on an input we have the probability distribution of the questionnaire, and on an output we get a set of conditional probabilities of an

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offensive of a set in advance certain target events. The interest to the research of the e-scoring method is based, on the one hand, on the theoretical interest to a strict scientific analysis of the features of the development of complex socio-economic systems which differ by the complex structure of interrelations between their elements; and on the other hand, the practical interest of analysts to development of rational rules of decision-making in these systems. The method of the classical eventological scoring (E-scoring), based on consideration of events in the classical sense (Kolmogorov's events [5]), was initially determined by O.Yu. Vorobyev in [6] and it was intended for the problems which the purpose was the calculation of conditional probability of the occurrence of the certain event with the object of research under condition of availability of the arbitrary (unique) opinion about the considered object of the research (an example: calculation of the conditional probability of the return of the credit by one client of a bank under the condition of availability of some questionary particulars about the given client). Thus, the usual target event and the usual questionary event are defined on the input of the method, the numerical value of the conditional probability of the occurrence of the stipulated target event(for example, "the client will return the credit") is given on an exit.

The formally method of E-scoring is defined in the following way. Let there is a probabilistic space $(\Omega, \mathfrak{F}, \mathbf{P})$, where Ω is the space of elementary outcomes of an event, $\mathfrak{F} \subseteq \Omega$ is σ–algebra, $\mathbf{P}$ is the probabilistic measure defined on Ω. Let's choose $\mathfrak{X} \subseteq \mathfrak{F}$.

Definition. The method of E-scoring is a method of calculation by known probabilities of events $\mathbf{P}(x),\ x \in \mathfrak{X}$, and known conditional probabilities

$$\mathbf{P}(s \mid x) = \frac{\mathbf{P}(x \cap s)}{\mathbf{P}(x)},\ \mathbf{P}(s^c \mid x) = \frac{\mathbf{P}(x \cap s^c)}{\mathbf{P}(x)},$$

unknown quantities

$$\mathbf{P}(s \mid t_s(X)) = \frac{\mathbf{P}(s \cap t_s(X))}{\mathbf{P}(t_s(X))},\ s \in \mathcal{F},\ X \subseteq \mathfrak{X}, \tag{1}$$

are the conditional probability of the random event $s \in \mathfrak{F}$ provided that there has come the random event

$$t_s(X) = s \cap Ter_X + s^c \cap Ter_{X^c},$$

where

$$Ter_X = \bigcup_{x \in X} x,\ Ter_{X^c} = \bigcup_{x \in X^c} x,$$

are events-terraces in the form of the direct association, generated by set of random events $\mathfrak{X}$.

The events $x \in \mathfrak{X}$ are called as the *basic random events*, the set $\mathfrak{X}$ is called as the *set of basic random events*, the event s is called as the *target random event*, and the event $t_s(X)$, $X \subseteq \mathfrak{X}$ is called as *interpreting random events* in the method of E-scoring.

The E-scoring method allows not only to calculate the conditional probability of the occurrence of the arbitrary the designated (target) event, but also allows to consider the existing structures of dependencies of basic events (both internal, and external). This is its advantage before other methods of a finding of the probability of the occurrence of the arbitrary event. In [6] formulas for the basic structures are defined for dependencies of a random set of basic events $\mathfrak{X}$: for nonintersected, s-independent, embedded structures of dependencies of the set of basic events.

For today the existing formulas of the E-scoring method which applied under the condition of availability of an usual target event is short presented in the Table 1. The authors of the article are working to obtain the missing formulas in Table 1. In the given work we represent to consideration the binary method of E-scoring, based on an usual target event and the fuzzy event which interprets of the questionary event. The binary method of E-scoring we will apply in a case of availability of two conditions: first, it is necessary to allocate a target event s (s^c in the space of elementary target events Ω which is defined as $s^c = \Omega \setminus \{s\}$); secondly, each question of the questionary has a pair of answers of a kind "yes" (favours to occurrence s), "no" (favours to occurrence s^c).

Table 1. Classification of existing methods of E-scoring by kinds of the input data considered at use of the chosen method (the sign "—" means the absence of formulas of the E-scoring method which would allow to consider the corresponding input data)

Types of answers to questionary questions	Target events	The event, which interprets of questionary event	Method for calculation
Binary answers to questionary questions	event s is defined, $s^c = \Omega \setminus \{s\}$	usual $t_s(X)$	Classical method of E-scoring by O.Yu.Vorobyev [6]
		fuzzy $t_s(\check{X})$	—
	aggregate $\{s_1, s_2, \dots, s_n\}$ $s_1 + \dots + s_n = \Omega$	usual $t_s(X)$	Generalised method of E-scoring by K.V.Trofimova [7]
		fuzzy $t_s(\check{X})$	—
The questionary of the expanded type	event s is defined, $s^c = \Omega \setminus \{s\}$	usual $t_s(X)$	Expanded method of E-scoring by K.V.Trofimova [8]
		fuzzy $t_s(\check{X})$	—
	aggregate $\{s_1, s_2, \dots, s_n\}$ $s_1 + \dots + s_n = \Omega$	usual $t_s(X)$	—
		fuzzy $t_s(\check{X})$	—

Binary Method of the Fuzzy E-scoring

This method is an improving modification of the usualy scoring method. We describe the expanded eventological scoring method for the classes of new problems. With the advent of the theory of fuzzy events there was an interest to an E-scoring method with reference to fuzzy events. Besides to working out of the given method promoted requirement of banks to receive the information on credit status of set of the clients who have submitted the demands for crediting, instead of on the credit status of a separately taken client.

For the further statement it is necessary to address to some basic definitions of the theory of fuzzy events. Work on calculation of the set of conditional probabilities of the occurrence of target events occurs within probability space $(\Omega, \mathfrak{F}, \mathbf{P})$. All events which can be demanded, share on two classes: questionary events (occur during questioning) and base events (do not occur during questioning but about which there is a speech in questionary questions).

Let $\mathfrak{M} = \{\mu, \lambda, \dots, \nu\}$ is the set of the agents who are taking part in answers to questions of the questionary: $|\mathfrak{M}| = m$. Let $\mathfrak{X} = \{x, y, \dots, z\}$ is the set of names of events (set of questions of the questionary): $|\mathfrak{X}| = n$.

Let's choose $\mathfrak{X}_{\mathfrak{M}} \subseteq \mathfrak{F}$ — the finite set of random events from algebra $\mathfrak{F}$:

$$\mathfrak{X}_{\mathfrak{M}} = \{x_\mu, x \in \mathfrak{X},\ \mu \in \mathfrak{M}\},$$

where x_μ represents the event describing that the agent μ perceives the event-question x of $\mathfrak{X}$. The set $\mathfrak{X}_{\mathfrak{M}}$ will be considered as a set of base random events. The set defined by thus $\mathfrak{X}_{\mathfrak{M}}$ in the theory of fuzzy events [9] is accepted to name a matrix of the selected events, where $x_\mu \in \mathfrak{F}$

is measurable concerning algebra $\mathfrak{F}$ random events. Thus, each pair $(x, \mu) \in \mathfrak{X} \times \mathfrak{M}$ defines one random event $x_\mu \subseteq \Omega$. Eventology defines the fuzzy event as a set of "usual" Kolmogorov's events and offers a construction method of *the eventological membership function* of a fuzzy event as the average of indicators of events of its components:

$$\mathbf{1}_{\tilde{x}}(\omega) = \frac{1}{|\mathfrak{M}|} \sum_{\mu \in \mathfrak{M}} \mathbf{1}_{x_\mu}(\omega), \tag{2}$$

where $\mathbf{1}_{x_\mu}(\omega)$ is indicators of "usual" events x_μ which makes sets of events $\tilde{x}$.

Let's result the list of the basic definitions of the Kolmogorov's axiomatics, transferred on analogy in eventology of fuzzy events [10].

$\mathfrak{M}$-fuzzy elementary event *(e-event)* is $|\mathfrak{M}|$-set $\tilde{\omega} = \{\omega_\mu,\ \mu \in \mathfrak{M}\}$, consisting of $\mathcal{F}$-measurable events $\omega_\mu \subseteq \Omega$, each of which comes, when comes $\omega \in \Omega$, and represents one of events-terraces

$$\mathrm{ter}_\mu(X_\mu) = \bigcap_{x \in X} x_\mu \bigcap_{x \in X^c} x_\mu^c, \quad X_\mu \subseteq \mathfrak{X}, \tag{3}$$

generating by a set of events $\tilde{\mu} = \{x_\mu,\ x \in \mathfrak{X}\}$:

$$\omega_\mu = \begin{cases} \mathrm{ter}_\mu(\varnothing), & \omega \in \mathrm{ter}_\mu(\varnothing), \\ \dots, & \dots, \\ \mathrm{ter}_\mu(X_\mu), & \omega \in \mathrm{ter}_\mu(X_\mu),\ \varnothing \subset X_\mu \subset \mathfrak{X}, \\ \dots, & \dots, \\ \mathrm{ter}_\mu(\mathfrak{X}), & \omega \in \mathrm{ter}_\mu(\mathfrak{X}), \end{cases}$$

which the come event $\omega \in \Omega$ gets.

Set of elementary of $\mathfrak{M}$-fuzzy events is the $|\mathfrak{M}|$-set

$$\tilde{\Omega} = \{\Omega,\ \mu \in \mathfrak{M}\} = \{\underbrace{\Omega, \dots, \Omega}_{|\mathfrak{M}|}\}$$

consisting of the same set of elementary events Ω.

Certain $\mathfrak{M}$-fuzzy event is the $|\mathfrak{M}|$-set

$$\tilde{\Omega} = \{\Omega,\ \mu \in \mathfrak{M}\} = \{\underbrace{\Omega, \dots, \Omega}_{|\mathfrak{M}|}\}$$

consisting of the same certain events Ω.

Impossible $\mathfrak{M}$-fuzzy event is the $|\mathfrak{M}|$-set

$$\tilde{\varnothing} = \{\varnothing,\ \mu \in \mathfrak{M}\} = \{\underbrace{\varnothing, \dots, \varnothing}_{|\mathfrak{M}|}\}$$

consisting of the same impossible events $\varnothing$.

*Algebra of $\mathfrak{M}$-fuzzy event*is the $|\mathfrak{M}|$-set $\tilde{\mathcal{F}} = \{\mathcal{F}_\mu,\ \mu \in \mathfrak{M}\}$ consisting of the algebras of usual event.

$\mathfrak{M}$-fuzzy event is the $|\mathfrak{M}|$-set consisting of $\tilde{\mathcal{F}}$-measurable events: $\tilde{x} = \{x_\mu,\ \mu \in \mathfrak{M}\}$, where $x_\mu \subseteq \Omega$.

Measurable space of $\mathfrak{M}$-fuzzy events is the $|\mathfrak{M}|$-set $(\tilde{\Omega}, \tilde{\mathcal{F}}) = \{(\Omega, \mathcal{F}_\mu),\ \mu \in \mathfrak{M}\}$ consisting of the measurable space of events.

Let's consider the probabilistic space $(\Omega, \mathcal{F}, \mathbf{P})$, where Ω is the finite space of elementary events – outcomes "random experiment", and $\mathbf{P}$ is *classical probability*, defined for everyone

$\mathcal{F}$-measurable events $x \in \mathcal{F}$ as "the relation of number of the outcomes favouring x, to the general number of outcomes in Ω", in other words, as $\mathbf{P}(x) = |x|/|\Omega|$ for finite Ω. If there is be a necessity in infinite Ω the classical probability on algebra of its events can be defined as geometrical probability, i.e. as not such relation of a uniform measure (for example Lebeg's measures) of events x and all Ω. As the classical probability is defined as the relation of cardinality it is always defined for any event from algebra of the finite space of e-events. For its definition it is not necessary to make additional assumptions and it is not required to any other information, except the information on event. As soon as event is defined, also its classical probability is defined at once.

Let's look at classical probability $\mathbf{P}$ as on one more characteristic of an event. The probabilistic space $(\Omega, \mathcal{F}, \mathbf{P})$ is called as *classical probabilistic space*. The term *classical* also will appear in a names of all characteristics $\mathcal{F}$-measurable events and the functions defined on classical probabilistic space.

The classical probability of $\widetilde{\mathcal{F}}$-measurable $\mathfrak{M}$-fuzzy event $\tilde{x}$ $(\in)$ $\widetilde{\mathcal{F}}$ is defined by the formula

$$\mathbf{P}(\tilde{x}) = \frac{1}{|\mathfrak{M}|} \sum_{\mu \in \mathfrak{M}} \mathbf{P}(x_\mu). \tag{4}$$

The classical probabilistic space of $\mathfrak{M}$-fuzzy events is the $|\mathfrak{M}|$-set

$$(\widetilde{\Omega}, \widetilde{\mathcal{F}}, \mathbf{P}) = \{(\Omega, \mathcal{F}_\mu, \mathbf{P}),\ \mu \in \mathfrak{M}\},$$

consisting of the classical probabilistic space usual events, which are different only by algebras of events $\mathcal{F}_\mu,\ \mu \in \mathfrak{M}$.

As any *set-operation by Minkovski with the set of fuzzy events $\widetilde{\mathfrak{X}}$* is called $|\mathfrak{X}|$-ary operation by Minkovski $(\mathcal{O})$:

$$\underset{x \in \mathfrak{X}}{(\mathcal{O})}\, \tilde{x} = \{ \underset{x \in \mathfrak{X}}{\mathcal{O}}\, x_\mu,\quad \mu \in \mathfrak{M}\}, \tag{5}$$

generated by any set of power set $\mathcal{S} \subseteq 2^{\mathfrak{X}}$ as $\widetilde{\mathcal{F}}$-measurable fuzzy event:

$$\underset{x \in \mathfrak{X}}{(\mathcal{O})}\, \tilde{x} = \{ \underset{x \in \mathfrak{X}}{\mathcal{O}}\, x_\mu,\quad \mu \in \mathfrak{M}\}, \tag{6}$$

where $\mathcal{O} : \underbrace{\mathcal{F} \times \mathcal{F} \times \cdots \times \mathcal{F} \longrightarrow \mathcal{F}}_{|\mathfrak{X}|}$ is $|\mathfrak{X}|$-ary the set operation generated by set $\mathcal{S} \subseteq 2^{\mathfrak{X}}$ which for everyone $\mu \in \mathfrak{M}$ can be presented as

$$\underset{x \in \mathfrak{X}}{\mathcal{O}}\, x_\mu = \sum_{X \in \mathcal{S}} \mathrm{ter}_\mu(X),$$

where $\mathrm{ter}_\mu(X)$ is defined according to (3).

It is necessary to tell that the row of a matrix of the selected events $\mathfrak{X}_\mathfrak{M}$ represents the event $\tilde{x} = \{x_\mu, \mu \in \mathfrak{M}\} = x_\mathfrak{M}$ and it is called as $\mathfrak{M}$-fuzzy event, and the column of a matrix of the selected events $\mathfrak{X}_\mathfrak{M}$ represents the event $\tilde{\mu} = \{x_\mu, x \in \mathfrak{X}\} = \mathfrak{X}_\mu$ and it is called as $\mathfrak{X}$-fuzzy event. Thus, the matrix of the selected events $\mathfrak{X}_\mathfrak{M}$ represents set of all possible results (events) of questioning of agents [9]. Let's notice that the fuzzy event interpreting of the questioning, represents the fixed subset of names of events $t(\tilde{X})$ of $\mathfrak{X}_\mathfrak{M}$.

Let's consider the following problem: on known probabilities of basic events $x_\mu \in \mathfrak{X}_\mathfrak{M}$ is $\mathbf{P}(x_\mu)$, and on known conditional probabilities of the occurrence of the certain target event s under condition of the occurrence of basic events $x_\mu \in \mathfrak{X}_\mathfrak{M}$ is $\mathbf{P}(s|x_\mu)$[§], it is necessary to

[§]Calculation of probabilities is made on the basis of the data of training sample with use of basic formulas of probability theory [5].

define the value of the conditional probability of the occurrence of the designated target event s under the condition of the occurrence of the fuzzy event $t_s(\tilde{X})$ the interpreting of questioning, –$\mathbf{P}(s|t_s(\tilde{X}))$.

It is necessary to notice that any formula of the method of E-scoring is based on the definition of the conditional probability [5, 6, 10]. Formulas of the binary method of the fuzzy E-scoring offered to consideration are based on the definition of the conditional probability of the occurrence usual (Kolmogorov's events) events at the occurrence of the fuzzy event:

$$\mathbf{P}(s \mid \tilde{x}) = \frac{\mathbf{P}(s(\cap)\tilde{x})}{\mathbf{P}(\tilde{x})}.$$

Formal Representation of the Method of Binary E-scoring

Definition. *The method of binary E-scoring for the fuzzy event, which interprets of the questionary event is a method of calculation by known probabilities of events* $\mathbf{P}(\tilde{x}),\ \tilde{x} \in \mathfrak{X}_{\mathfrak{M}}$ *and known conditional probabilities*

$$\mathbf{P}(s \mid \tilde{x}) = \frac{\mathbf{P}(\tilde{x}(\cap)s)}{\mathbf{P}(\tilde{x})},\ \mathbf{P}(s^c \mid \tilde{x}) = \frac{\mathbf{P}(\tilde{x}(\cap)s^c)}{\mathbf{P}(\tilde{x})},$$

where

$$\mathbf{P}(\tilde{x}(\cap)s) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\mathbf{P}\left(x_\mu \cap s\right),\ \mathbf{P}(\tilde{x}) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\mathbf{P}\left(x_\mu\right),\quad x_\mu \in \mathfrak{X}_{\mathfrak{M}},$$

the conditional probability of the random event

$$\mathbf{P}(s \mid t_s(\tilde{X})) = \frac{\mathbf{P}(s(\cap)t_s(\tilde{X}))}{\mathbf{P}(t_s(\tilde{X}))},\ s \in \mathfrak{F} \subseteq \Omega, \tag{7}$$

provided that there has come the random $\mathfrak{M}$*-fuzzy event* $t_s(\tilde{X})$*:*

$$\begin{gathered} t_s(\tilde{X}) = s(\cap)Ter_{\tilde{X}} + s^c(\cap)Ter_{\tilde{X}^{(c)}}, \\ Ter_{\tilde{X}} = \{Ter_{X_\mu}, \mu \in \mathfrak{M}\},\ Ter_{\tilde{X}^{(c)}} = \{Ter_{X^c_\mu},\ \mu \in \mathfrak{M}\}, \\ Ter_{X_\mu} = \bigcup_{x_\mu \in X_\mu} x_\mu,\ Ter_{X^c_\mu} = \bigcup_{x_\mu \in X^c_\mu} x_\mu, \\ \tilde{X} = \{X_\mu,\ \mu \in \mathfrak{M}\}, \tilde{X}^{(c)} = \{X^c_\mu,\ \mu \in \mathfrak{M}\}, \\ X_\mu = \{x_\mu, x_\mu \cap s \neq \varnothing, x \in \mathfrak{X}\},\ X^c_\mu = \{x_\mu, x_\mu \cap s^c \neq \varnothing, x \in \mathfrak{X}\}, \mu \in \mathfrak{M}. \end{gathered} \tag{8}$$

The set $\mathfrak{X}_{\mathfrak{M}}$ is the *set of basic fuzzy events*, develops of the set of the fuzzy basic events $\tilde{x}$: $\mathfrak{X}_{\mathfrak{M}} = \{\tilde{x}, x \in \mathfrak{X}\}$, everyone $\tilde{x}$, in turn, develops of the set x_μ *basic random events*: $\tilde{x} = \{x_\mu, x \in \mathfrak{X}_{\mathfrak{M}}\}$.

The event s is called *the target random event*, and the event $t_s(\tilde{X})$ is called *the interpreting random event.*

Let's bring some explanatories. Event $(X_\mu + X^c_\mu)$ represents the result of questioning of one agent μ of $\mathfrak{M}$, thus, the event X_μ is the set of answers of questioning of the agent μ which is favouring to the occurrence of the target event s, the event X^c_μ is the set of answers of questioning of the agent which is favouring to the occurrence of target event s^c.

Each questionary event $\hat{x}_\mu \subseteq \mathfrak{X}_{\mathfrak{M}}$ and each basic event $x_\mu \subseteq \Omega$ can be to present in alternative variants:

$$\hat{x}_\mu = \hat{x}_\mu \cap s + \hat{x}_\mu \cap s^c,\ x_\mu = x_\mu \cap s + x_\mu \cap s^c,$$

where $\hat{x}_\mu \cap s$, $x \cap s$ are the questionary and basic events, favorable to of the target event s, $\hat{x}_\mu \cap s^c = \hat{x}_\mu - \hat{x}_\mu \cap s^c$, $x_\mu \cap s^c = x_\mu - x_\mu \cap s^c$ are the questionary and basic events, adverse of the target event s.

Then, defining the fuzzy event which interprets of the questionary event, as in (8), we will present the general formula for the method of binary E-scoring.

Lemma 1 (on the formula in the method of binary E-scoring for the fuzzy event, which interprets of the questionary event). *The formula (7) in method of binary E-scoring will have for $X_\mu \subseteq \mathfrak{X}_{\mathfrak{M}}$ the following appearance*

$$\mathbf{P}(s \mid t_s(\tilde{X})) = \frac{\sum\limits_{\mu\in\mathfrak{M}} \mathbf{P}\left(\bigcup\limits_{x_\mu\in X_\mu}(s\cap x_\mu)\right)}{\sum\limits_{\mu\in\mathfrak{M}} \mathbf{P}\left(\bigcup\limits_{x_\mu\in X_\mu}(s\cap x_\mu)\right) + \sum\limits_{\mu\in\mathfrak{M}} \mathbf{P}\left(\bigcup\limits_{x_\mu\in X_\mu^c}(s^c\cap x_\mu)\right)} \quad . \tag{9}$$

Proof. Consider the reexpression $s(\cap)t_s(\tilde{X})$ which is part of (7):

$$\begin{aligned} s(\cap)t_s(\tilde{X}) =& s(\cap)\left[s(\cap)Ter_{\tilde{X}} + s^c(\cap)Ter_{\tilde{X}^{(c)}}\right] = s(\cap)s(\cap)Ter_{\tilde{X}} + s(\cap)s^c(\cap)Ter_{\tilde{X}^{(c)}} = \\ =& s(\cap)Ter_{\tilde{X}} + \varnothing = \left\{s\cap Ter_{X_\mu}, \mu\in\mathfrak{M}\right\}. \end{aligned}$$

Thus,

$$\mathbf{P}\left(s(\cap)t_s(\tilde{X})\right) = \mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right) = \mathbf{P}\left(\left\{s\cap Ter_{X_\mu}, \mu\in\mathfrak{M}\right\}\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}} \mathbf{P}\left(s\cap Ter_{X_\mu}\right). \tag{10}$$

Consider the reexpression $s \cap Ter_{X_\mu}$:

$$s\cap Ter_{X_\mu} = s\cap\left(\bigcup_{x_\mu\in X_\mu} x_\mu\right) = \bigcup_{x_\mu\in X_\mu}(s\cap x_\mu).$$

Thereby,

$$\mathbf{P}\left(s(\cap)t_s(\tilde{X})\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}} \mathbf{P}\left(\bigcup_{x_\mu\in X_\mu}(s\cap x_\mu)\right). \tag{11}$$

Let's separately consider the probability conclusion $\mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right)$. Firstly,

$$\mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^c}\right) = \mathbf{P}\left(\left\{s^c\cap Ter_{X_\mu^c}, \mu\in\mathfrak{M}\right\}\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}} \mathbf{P}\left(s^c\cap Ter_{X_\mu^c}\right);$$

secondly,

$$s^c\cap Ter_{X_\mu^c} = s^c\cap\left(\bigcup_{x_\mu\in X_\mu} x_\mu\right) = \bigcup_{x_\mu\in X_\mu}(s^c\cap x_\mu).$$

Hence,

$$\mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}} \mathbf{P}\left(\bigcup_{x_\mu\in X_\mu}(s^c\cap x_\mu)\right). \tag{12}$$

Consider the denominator $\mathbf{P}\left(t_s(\tilde{X})\right)$ from (7). Owing to additivity of probability we have

$$\mathbf{P}\left(t_s(\tilde{X})\right) = \mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right) + \mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right).$$

And so

$$\mathbf{P}(t_s(\tilde{X})) = \frac{1}{|\mathfrak{M}|}\left(\sum_{\mu\in\mathfrak{M}}\mathbf{P}\left(\bigcup_{x_\mu\in X_\mu}(s\cap x_\mu)\right) + \sum_{\mu\in\mathfrak{M}}\mathbf{P}\left(\bigcup_{x_\mu\in X_\mu^c}(s^c\cap x_\mu)\right)\right). \tag{13}$$

We substitute (11) and (13) in the formula (7). Further we cancel the general multiplier $\frac{1}{|\mathfrak{M}|}$ out of the numerator and the denominator. And obtain the lemma's formula (9). The lemma is proved. □

As it was told earlier, the set of basic events $\mathfrak{X}_\mathfrak{M}$ can have various structures of dependencies. It is necessary to notice that among structures of dependencies of events is accepted to allocate as external structures of dependences (structure of dependences between $\mathfrak{M}$-fuzzy events $\tilde{x}, \tilde{y}, \ldots, \tilde{z}$ or $\mathfrak{X}$-fuzzy events $\tilde{\mu}$, $\tilde{\lambda}$, ..., ν of $\mathfrak{X}_\mathfrak{M}$), and internal structures of dependencies (in $\mathfrak{M}$-fuzzy event $\tilde{x}$ and to its similar $\tilde{y}, \ldots, \tilde{z}$ or in $\mathfrak{X}$-fuzzy event $\tilde{\mu}$ and to its similar $\tilde{\lambda}$, ..., $\tilde{\nu}$).

In the given article it is supposed that the external structure of dependences of $\mathfrak{X}$-fuzzy events $\tilde{\mu}, \tilde{\lambda}, \ldots, \tilde{\nu}$, each of which represents answers to the questionary questions of one agent, is nonintersected. We will consider the general formula of the method of binary E-scoring (9) for the basic [6] structures of internal dependencies of $\mathfrak{X}$-fuzzy events $\tilde{\mu}, \tilde{\lambda}, \ldots, \tilde{\nu}$, believing thus that all $\tilde{X}$-fuzzy events from $\mathfrak{X}_\mathfrak{M}$ possess the identical internal structure of dependences.

Lemma 2 (on the formula in the method of binary E-scoring for the fuzzy event, which interprets of the questionary event $t_s(\tilde{X})$ for the internal nonintersected structure of the dependence of $\mathfrak{X}$-fuzzy basic events from $\mathfrak{X}_\mathfrak{M}$). *The conditional probability of the occurrence of the usual target event s under the condition of the occurrence of the fuzzy event $t_s(\tilde{X})$ which interprets of the questionary event based on the set of basic events $\mathfrak{X}_\mathfrak{M}$ with the internal nonintersected structure of the dependence of $\mathfrak{X}$-fuzzy events, is calculated under the following formula:*

$$\mathbf{P}(s \mid t_s(\tilde{X})) = \frac{\sum\limits_{\mu\in\mathfrak{M}}\sum\limits_{x_\mu\in X_\mu}\mathbf{P}(s\mid x_\mu)\mathbf{P}(x_\mu)}{\sum\limits_{\mu\in\mathfrak{M}}\sum\limits_{x_\mu\in X_\mu}\mathbf{P}(s\mid x_\mu)\mathbf{P}(x_\mu) + \sum\limits_{\mu\in\mathfrak{M}}\sum\limits_{x_\mu\in X_\mu^c}\mathbf{P}(s^c\mid x_\mu)\mathbf{P}(x_\mu)},$$

where $X_\mu \subseteq \mathfrak{X}_\mathfrak{M}, X_\mu^c \subseteq \mathfrak{X}_\mathfrak{M}$.

Proof. For any subsets of events $X_\mu \subseteq \mathfrak{X}_\mathfrak{M}$ and $X_\mu^c \subseteq \mathfrak{X}_\mathfrak{M}$, we consider the transformation of expressions $s \cap Ter_{X_\mu}$ and $s^c \cap Ter_{X_\mu^c}$, given that (10) and (12) are true, and also that $\forall x, y \in X$ for fixed μ from $\mathfrak{M}$ events x_μ and y_μ are nonintersecting (by definition of the internal nonintersected structure of the X-dependence of the basic events $\mathfrak{X}_\mathfrak{M}$).

$$s\cap Ter_{X_\mu} = s\cap\left(\bigcup_{x_\mu\in X_\mu} x_\mu\right) = s\cap\left(\sum_{x_\mu\in X_\mu} x_\mu\right) = \sum_{x_\mu\in X_\mu} s\cap x_\mu. \tag{14}$$

$$s^c\cap Ter_{X_\mu^c} = s^c\cap\left(\bigcup_{x_\mu\in X_\mu^c} x_\mu\right) = s^c\cap\left(\sum_{x_\mu\in X_\mu^c} x_\mu\right) = \sum_{x_\mu\in X_\mu^c} s^c\cap x_\mu. \tag{15}$$

Thereby, in respect that (10) and (12),

$$\mathbf{P}\left(s(\cap)t_s(\tilde{X})\right) = \mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\mathbf{P}\left(\sum_{x_\mu\in X_\mu} s\cap x_\mu\right),$$

$$\mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\mathbf{P}\left(\sum_{x_\mu\in X_\mu^c} s^c\cap x_\mu\right).$$

Owing to additivity of probability

$$\mathbf{P}\left(\sum_{x_\mu\in X_\mu} s\cap x_\mu\right) = \sum_{x_\mu\in X_\mu}\mathbf{P}\left(s\cap x_\mu\right),$$

$$\mathbf{P}\left(\sum_{x_\mu\in X_\mu^c} s^c\cap x_\mu\right) = \sum_{x_\mu\in X_\mu^c}\mathbf{P}\left(s^c\cap x_\mu\right).$$

Hence,

$$\mathbf{P}\left(s(\cap)t_s(\tilde{X})\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\sum_{x_\mu\in X_\mu}\mathbf{P}\left(s\cap x_\mu\right),$$

and, owing to additivity of probability

$$\mathbf{P}\left(t_s(\tilde{X})\right) = \mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right) + \mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right),$$

we have

$$\mathbf{P}(t_s(\tilde{X})) = \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\sum_{x_\mu\in X_\mu}\mathbf{P}\left(s\cap x_\mu\right) + \frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\sum_{x_\mu\in X_\mu^c}\mathbf{P}\left(s^c\cap x_\mu\right).$$

In respect that (7), we obtain the formula of the lemma 2 in which was canceled the general multiplier $\frac{1}{|\mathfrak{M}|}$ out of the numerator and the denominator. And also use the equalities which are true for all basic events $x_\mu \in \mathfrak{X}_\mathfrak{M}$:

$$\mathbf{P}(s\cap x_\mu) = \mathbf{P}(s|x_\mu)\mathbf{P}(x_\mu), \quad \mathbf{P}(s^c\cap x_\mu) = \mathbf{P}(s^c|x_\mu)\mathbf{P}(x_\mu). \tag{16}$$

Thus, the lemma is proved. □

Lemma 3 (on the formula in the method of binary E-scoring for the fuzzy event, which interprets of the questionary event $t_s(\tilde{X})$ for the internal embedded structure of the dependence of $\mathfrak{X}$-fuzzy base events from $\mathfrak{X}_\mathfrak{M}$). *The conditional probability of the occurrence of the usual target event s under the condition of the occurrence of the fuzzy event $t_s(\tilde{X})$ which interprets of the questionary event based on the set of basic events $\mathfrak{X}_\mathfrak{M}$ with the internal embedded structure of the dependence of $\mathfrak{X}$-fuzzy events, is calculated under the following formula:*

$$\mathbf{P}(s \mid t_s(\tilde{X})) = \frac{\sum\limits_{\mu\in\mathfrak{M}}\max\limits_{x_\mu\in X_\mu}\mathbf{P}\left(s|x_\mu\right)\mathbf{P}\left(x_\mu\right)}{\sum\limits_{\mu\in\mathfrak{M}}\max\limits_{x_\mu\in X_\mu}\mathbf{P}\left(s|x_\mu\right)\mathbf{P}\left(x_\mu\right) + \sum\limits_{\mu\in\mathfrak{M}}\max\limits_{x_\mu\in X_\mu^c}\mathbf{P}\left(s^c|x_\mu\right)\mathbf{P}\left(x_\mu\right)},$$

where $X_\mu \subseteq \mathfrak{X}_\mathfrak{M}, X_\mu^c \subseteq \mathfrak{X}_\mathfrak{M}$.

Proof. In accordance with the fact that the equalities (10) and (12) are true, we transform expression $s\cap Ter_{X_\mu}$ and $s^c\cap Ter_{X_\mu^c}$, taking into account the fact that in each X_μ for a fixed μ we can select the maximum event x_μ (an event, which contains in itself all events from X_μ), according to definition of the internal embedded structure of the X-dependence of the set of basic events $\mathfrak{X}_\mathfrak{M}$ and [6]. So, $s\cap Ter_{X_\mu} = s\cap\left(\bigcup_{x_\mu\in X_\mu} x_\mu\right) = s\cap\max\limits_{x_\mu\in X_\mu} x_\mu = \max\limits_{x_\mu\in X_\mu}(s\cap x_\mu)$.

Similarly $s^c \cap Ter_{X_\mu^c} = s^c \cap \left(\bigcup_{x_\mu \in X_\mu^c} x_\mu\right) = s^c \cap \max_{x_\mu \in X_\mu^c} x_\mu = \max_{x_\mu \in X_\mu^c} (s^c \cap x_\mu)$.

Thus, taking into account (10) and (12) and the monotonicity property of the probability, the probabilities $\mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right)$ and $\mathbf{P}\left(s^c(\cap)Ter^{(c)}_{\tilde{X}}\right)$ are defined as follows:

$$\mathbf{P}(s(\cap)Ter_{\tilde{X}}) = \frac{1}{|\mathfrak{M}|}\sum_{\mu \in \mathfrak{M}} \mathbf{P}\left(\max_{x_\mu \in X_\mu} (s \cap x_\mu)\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu \in \mathfrak{M}} \max_{x_\mu \in X_\mu} \mathbf{P}\left(s \cap x_\mu\right),$$

$$\mathbf{P}(s^c(\cap)Ter_{\tilde{X}^{(c)}}) = \frac{1}{|\mathfrak{M}|}\sum_{\mu \in \mathfrak{M}} \mathbf{P}\left(\max_{x_\mu \in X_\mu^c} (s^c \cap x_\mu)\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu \in \mathfrak{M}} \max_{x_\mu \in X_\mu^c} \mathbf{P}\left(s^c \cap x_\mu\right).$$

Owing to additivity of probability $\mathbf{P}\left(t_s(\tilde{X})\right) = \mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right) + \mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right)$, we obtain that

$$\mathbf{P}(t_s(\tilde{X})) = \frac{1}{|\mathfrak{M}|}\sum_{\mu \in \mathfrak{M}} \max_{x_\mu \in X_\mu} \mathbf{P}\left(s \cap x_\mu\right) + \frac{1}{|\mathfrak{M}|}\sum_{\mu \in \mathfrak{M}} \max_{x_\mu \in X_\mu^c} \mathbf{P}\left(s^c \cap x_\mu\right).$$

We obtain the formula of the lemma 3, canceling the general multiplier $\frac{1}{|\mathfrak{M}|}$ out of the numerator and the denominator and we apply the equalities (16) which are true for all basic events $x_\mu \in \mathfrak{X}_\mathfrak{M}$. Thus, the lemma is proved. □

Lemma 4 (on the formula in the method of binary E-scoring for the fuzzy event, which interprets of the questionary event $t_s(\tilde{X})$ for the internal s-independent structure of the dependence of $\mathfrak{X}$-fuzzy base events from $\mathfrak{X}_\mathfrak{M}$). *The conditional probability of the occurrence of the usual target event s under the condition of the occurrence of the fuzzy event $t_s(\tilde{X})$ which interprets of the questionary event based on the set of basic events $\mathfrak{X}_\mathfrak{M}$ with the internal s-independent structure of the dependence of $\mathfrak{X}$-fuzzy events, is calculated under the following formula:*

$$\mathbf{P}(s \mid t_s(\tilde{X})) = \frac{\sum\limits_{\mu \in \mathfrak{M}}\left(1 - \prod\limits_{x_\mu \in X_\mu}\left(1 - \mathbf{P}\left(s \cap x_\mu\right)\right)\right)}{\sum\limits_{\mu \in \mathfrak{M}}\left(1 - \prod\limits_{x_\mu \in X_\mu}\left(1 - \mathbf{P}\left(s \cap x_\mu\right)\right) + 1 - \prod\limits_{x_\mu \in X_\mu^c}\left(1 - \mathbf{P}\left(s^c \cap x_\mu\right)\right)\right)},$$

where $X_\mu \subseteq \mathfrak{X}_\mathfrak{M}, X_\mu^c \subseteq \mathfrak{X}_\mathfrak{M}$.

Proof. In accordance with the fact that the equalities (10) and (12) are true, we transform expression $s \cap Ter_{X_\mu}$ and $s^c \cap Ter_{X_\mu^c}$, using the following law of De Morgan: $A \cup B = \Omega \setminus (A^c \cap B^c)$. So, $s \cap Ter_{X_\mu} = s \cap \left(\bigcup_{x_\mu \in X_\mu} x_\mu\right) = \bigcup_{x_\mu \in X_\mu} (s \cap x_\mu) = \Omega \setminus \left(\bigcap_{x_\mu \in X_\mu} (s \cap x_\mu)^c\right)$.Similarly $s^c \cap Ter_{X_\mu^c} = s^c \cap \left(\bigcup_{x_\mu \in X_\mu^c} x_\mu\right) = \bigcup_{x_\mu \in X_\mu^c} (s^c \cap x_\mu) = \Omega \setminus \left(\bigcap_{x_\mu \in X_\mu^c} (s^c \cap x_\mu)^c\right)$.

In accordance with (10), we obtain that

$$\mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right) = \frac{1}{|\mathfrak{M}|}\sum_{\mu \in \mathfrak{M}} \mathbf{P}\left(\Omega \setminus \left(\bigcap_{x_\mu \in X_\mu} (s \cap x_\mu)^c\right)\right). \tag{17}$$

Let's consider the calculation of probabilities, standing under the sums in expression (17), using the one of the properties of the probability.

$$\mathbf{P}\left(\Omega \setminus \left(\bigcap_{x_\mu \in X_\mu} (s \cap x_\mu)^c\right)\right) = 1 - \mathbf{P}\left(\bigcap_{x_\mu \in X_\mu} (s \cap x_\mu)^c\right). \tag{18}$$

Further we transform the probability from the righthand of the expression (18) using the fact that the set of basic events $\mathfrak{X}_{\mathfrak{M}}$ has an internal s-independent in totality structure of the X-dependence.

Thus,

$$\mathbf{P}\left(\bigcap_{x_\mu\in X_\mu}(s\cap x_\mu)^c\right)=\prod_{x_\mu\in X_\mu}\mathbf{P}\left((s\cap x_\mu)^c\right)=\prod_{x_\mu\in X_\mu}\left(1-\mathbf{P}\left(s\cap x_\mu\right)\right). \qquad (19)$$

In respect that (17) – (19), we obtain the following:

$$\mathbf{P}(s(\cap)Ter_{\tilde{X}})=\frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\left(1-\prod_{x_\mu\in X_\mu}\left(1-\mathbf{P}\left(s\cap x_\mu\right)\right)\right). \qquad (20)$$

Calculating the probability $\mathbf{P}(s^c(\cap)Ter_{\tilde{X}^{(c)}})$ similarly, we find the following:

$$\mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right)=\frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\left(1-\prod_{x_\mu\in X_\mu^c}\left(1-\mathbf{P}\left(s^c\cap x_\mu\right)\right)\right). \qquad (21)$$

By virtue of the additivity of the probability we find that

$$\mathbf{P}\left(t_s(\tilde{X})\right)=\mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right)+\mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right)=$$

$$=\frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\left(1-\prod_{x_\mu\in X_\mu}\left(1-\mathbf{P}\left(s\cap x_\mu\right)\right)\right)+\frac{1}{|\mathfrak{M}|}\sum_{\mu\in\mathfrak{M}}\left(1-\prod_{x_\mu\in X_\mu^c}\left(1-\mathbf{P}\left(s^c\cap x_\mu\right)\right)\right). \qquad (22)$$

Considering (7), (20) and (22) and also canceling the general multiplier $\frac{1}{|\mathfrak{M}|}$ out of the numerator and the denominator, we obtain the formula of the lemma 4. Thus, the lemma is proved. □

Remark. In the case of couples presence which are complementary each other in space of elementary events Ω, the target events s and s^c, the following identity is obvious:

$$\mathbf{P}(s|t_s(\tilde{X}))+\mathbf{P}(s^c|t_s(\tilde{X}))=1. \qquad (23)$$

Proof. Let's prove the equality (23). Owing to that

$$\mathbf{P}(s|t_s(\tilde{X}))+\mathbf{P}(s^c|t_s(\tilde{X}))=\frac{\mathbf{P}(s(\cap)t_s(\tilde{X}))}{\mathbf{P}(t_s(\tilde{X}))}+\frac{\mathbf{P}(s^c(\cap)t_s(\tilde{X}))}{\mathbf{P}(t_s(\tilde{X}))}=\frac{\mathbf{P}(s(\cap)t_s(\tilde{X}))+\mathbf{P}(s^c(\cap)t_s(\tilde{X}))}{\mathbf{P}(t_s(\tilde{X}))},$$

let's consider separately each summand in the numerator $\mathbf{P}(s(\cap)t_s(\tilde{X}))$ и $\mathbf{P}(s^c(\cap)t_s(\tilde{X}))$, using the additivity property of the probability.

Firstly, we will transform expression $s(\cap)t_s(\tilde{X})$:

$$s(\cap)t_s(\tilde{X})=s(\cap)\left(s(\cap)Ter_{\tilde{X}}+s^c(\cap)Ter_{\tilde{X}^{(c)}}\right)=$$

$$=s(\cap)s(\cap)Ter_{\tilde{X}}+s(\cap)s^c(\cap)Ter_{\tilde{X}^{(c)}}=s(\cap)Ter_{\tilde{X}}+\varnothing=s(\cap)Ter_{\tilde{X}}.$$

Further, similarly we transform $s^c(\cap)t_s(\tilde{X}^{(c)})$:

$$s^c(\cap)t_s(\tilde{X})=s^c(\cap)\left(s(\cap)Ter_{\tilde{X}}+s^c(\cap)Ter_{\tilde{X}^{(c)}}\right)=$$

$$= s^c(\cap)s(\cap)Ter_{\tilde{X}} + s^c \cap s^c(\cap)Ter_{\tilde{X}^{(c)}} = \varnothing + s(\cap)Ter_{\tilde{X}^{(c)}} = s^c(\cap)Ter_{\tilde{X}^{(c)}}.$$

Thus, we obtain that $\mathbf{P}(s(\cap)t_s(\tilde{X})) + \mathbf{P}(s^c(\cap)t_s(\tilde{X})) = \mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right) + \mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right)$.Using the additivity property of probability and taking into account the system of equalities (8) we obtain that $\mathbf{P}\left(s(\cap)Ter_{\tilde{X}}\right) + \mathbf{P}\left(s^c(\cap)Ter_{\tilde{X}^{(c)}}\right) = \mathbf{P}\left(s(\cap)Ter_{\tilde{X}} + s^c(\cap)Ter_{\tilde{X}^{(c)}}\right) = \mathbf{P}\left(t_s(\tilde{X})\right)$.

Thus, $\mathbf{P}(s|t_s(\tilde{X})) + \mathbf{P}(s^c|t_s(\tilde{X})) = \dfrac{\mathbf{P}(s(\cap)t_s(\tilde{X})) + \mathbf{P}(s^c(\cap)t_s(\tilde{X}))}{\mathbf{P}(t_s(\tilde{X}))} = \dfrac{\mathbf{P}(t_s(\tilde{X}))}{\mathbf{P}(t_s(\tilde{X}))} = 1$, hence, the assertion of remark is true for any $\tilde{X} \subseteq \mathfrak{X}_{\mathfrak{N}}$. □

It is necessary to notice that at use of the E-scoring fuzzy method there is a possibility of the consideration of more complex structures of dependences of the events defining the set of basic events: On the basis of this set there is a calculation of the conditional probability of the occurrence of the arbitrary target event. For the reason that the E-scoring fuzzy method is based on the consideration of fuzzy events there is a possibility of the account as external structures of dependences of events (i.e. between fuzzy events) and internal structures of dependences of events (separately in each fuzzy event, i.e. between usual events (Kolmogorov's events) which form the fuzzy event). The given fact is an advantage of work with fuzzy events, and, as consequence, the use of the E-scoring fuzzy method before the method of usual E-scoring. However, in the connection with presence of more the complex structure of the dependence of events, it is necessary to consider the data of a large quantity of statistical inquiry. It follows the labor-intensive process of performing calculations. Necessity of the periodic updating of a training sample and, as consequence, the recalculation of parameters.

Conclusion

The method of fuzzy E-scoring had been considered by the authors of the given article. It allows to make calculations of probabilities of the occurrence of the arbitrary target event which the occurrence does not depend on opinions of the set of individual minds. The offered method fuzzy scoring can be considered as a certain way of an estimation of occurrence of the arbitrary target event which can happen with studied object of research without dependence from behaviour of questioned agents. As a result of the application of the given the E-scoring method we are received the defuzzyfication probability of that there will be the arbitrary event with one object of research. Thus, the interpretation of the received result can be the following: according opinion of the group of agents the designated target event will occur to the object of the research with the received probability independently of the behaviour of agents. The offered method of E-scoring can be applicable in various areas of life activity of the person: in economy (an example: a problem of an estimation of the risk of bankruptcy of the enterprise [11]), in ecology (an example: an estimation of change of the number of population depending on various natural changes), in seismology (an example: forecasting of the seismological activity of a surface of the Earth), in geophysics and others.

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Эвентологический скоринг в теории нечетких событий

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Рассматривается бинарный метод эвентологического скоринга для нечеткого события, которое интерпретирует анкетное событие. Сформулирована и доказана общая формула метода. Представлены также формулы для различных внутренних структур зависимостей базовых нечетких событий. Результаты работы могут быть использованы в системах принятия решений и при исследовании различных социально-экономических систем.

Ключевые слова: нечеткое событие, метод эвентологического скоринга, структуры зависимостей событий.