On Extracting Important User Preferences

Sylvia Encheva

Stord/Haugesund University College, Bjørnsonsg. 45, 5528 Haugesund, Norway
sbe@hsh.no

Abstract. User preferences are very important in planning organization's future activities. Involvement of a decision support system can considerably shorten the time used for planing and for cost calculations by presenting what is the current status and what can be expected in relation to new users' preferences. The latter can be further combined with existing quality guidelines and standards for each particular organization.

Keywords: Many valued logics, lattices, decision making.

1 Introduction

Public and private organizations need to follow numerous quality guidelines and standards. One way to improve their performance is by enhancing awareness about users' preferences. This can be done by inviting users to fill in some forms reflecting on their preferences. While such inquiries may reveal sufficient information about current situations they will not provide good indications about preferences of new users or new products.

As a way to improve organizations' planing and performance we suggest use of a decision support system. This can considerably shorten the time used for planing and for cost calculations by presenting what is the current status and what can be expected in relation to new demands.

2 Background

Many valued logics have been applied in solving numerous theoretical and practical problems where uncertainty is involved, [8]. Both possibility theory and possibilistic logic often involve many-valued calculi, [3].

A three-valued logic, known as Kleene's logic is developed in [9] and has three truth values, truth, unknown and false, where unknown indicates a state of partial vagueness. These truth values represent the states of a world that does not change.

The semantic characterization of a four-valued logic for expressing practical deductive processes is presented in [1] and [2]. In most information systems the management of databases is not considered to include neither explicit nor hidden inconsistencies. In real life situation information often come from different contradicting sources. Thus different sources can provide inconsistent data while

James J. (Jong Hyuk) Park et al. (eds.), *Future Information Technology*,
Lecture Notes in Electrical Engineering 276,
DOI: 10.1007/978-3-642-40861-8_14,

deductive reasoning may result in hidden inconsistencies. The idea in Belnap's approach is to develop a logic that is not that dependable of inconsistencies.

The Belnap's logic has four truth values 'T, F, Both, None'. The meaning of these values can be described as follows:

- an atomic sentence is stated to be true only (T),
- an atomic sentence is stated to be false only (F),
- an atomic sentence is stated to be both true and false, for instance, by different sources, or in different points of time (Both), and
- an atomic sentences status is unknown. That is, neither true, nor false (None).

Five valued logic as in [7], [8] is presented in Fig.1. The five-valued logic introduced in [7] is based on the following truth values: unknown or undefined, possibly known but consistent, false, true, and inconsistent.

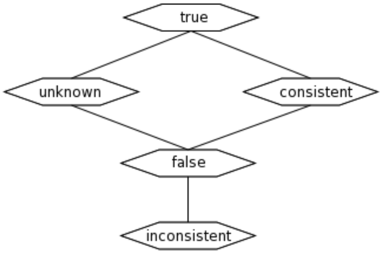

Fig. 1. The five truth values

Fuzzy multiple criteria decision-making methodology was used by [6] to develop a practical model for business purpose. Improved score functions measuring the degree of suitability of a set of alternatives, with respect to a set of criteria based on vague values is discussed in [10]. An algorithm for score functions is also introduced by taking into account the effect of an unknown degree (hesitancy degree) of the vague values on the degree of suitability to which each alternative satisfies the decision makers's requirement. In [4] the authors develop a forecasting framework based on the fuzzy multi-criteria decision making (approach to help organizations build awareness of the critical influential factors on the success of knowledge management implementation, measure the success possibility of knowledge management projects, as well as identify the necessary actions prior to embarking on conducting knowledge management.

A lattice is a partially ordered set, closed under least upper and greatest lower bounds. The least upper bound of x and y is called the join of x and y, and is sometimes written as $x + y$; the greatest lower bound is called the meet and is sometimes written as $x\dot{y}$, [5, 11].

3 Preferences

In this section we are combining different user preferences and illustrating what could be expected with respect to demonstrating preferences in new situations. We consider cases with both complete and incomplete information and draw conclusions based on theories from many valued logics.

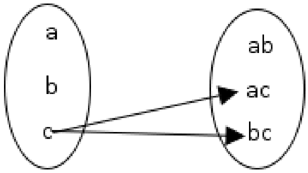

Fig. 2. High level satisfaction in product *c* only

Medium level satisfaction in product *c* and lack of information about products *a* and *b* implies expectation of low level satisfaction in new products having features from either *a* and *c* or from *b* and *c*, Fig. 2.

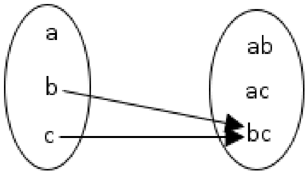

Fig. 3. High level satisfaction in products *b* and *c* only

Medium level satisfaction in products *b* and *c* and lack of information about about product *bc* implies expectation of low level satisfaction in *bc*, Fig. 3.

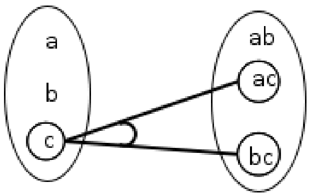

Fig. 4. High level satisfactio in products *ac* and *bc* only

High level satisfaction in products *ac* and *bc* implies expectation of high level satisfaction in product *c*, Fig. 4.

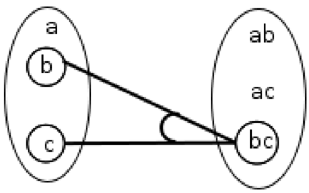

Fig. 5. High level satisfaction in products *b* and *c* only

High level satisfaction in products *b* and *c* and implies expectation of high level satisfaction in product *bc*, Fig. 5.

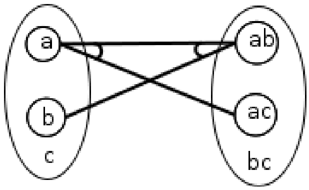

Fig. 6. High level satisfaction in products *b* and *ac* only

High level satisfaction in products *b* and *ac* implies expectation of medium level of satisfaction in products *a* and *ab*, Fig. 6.

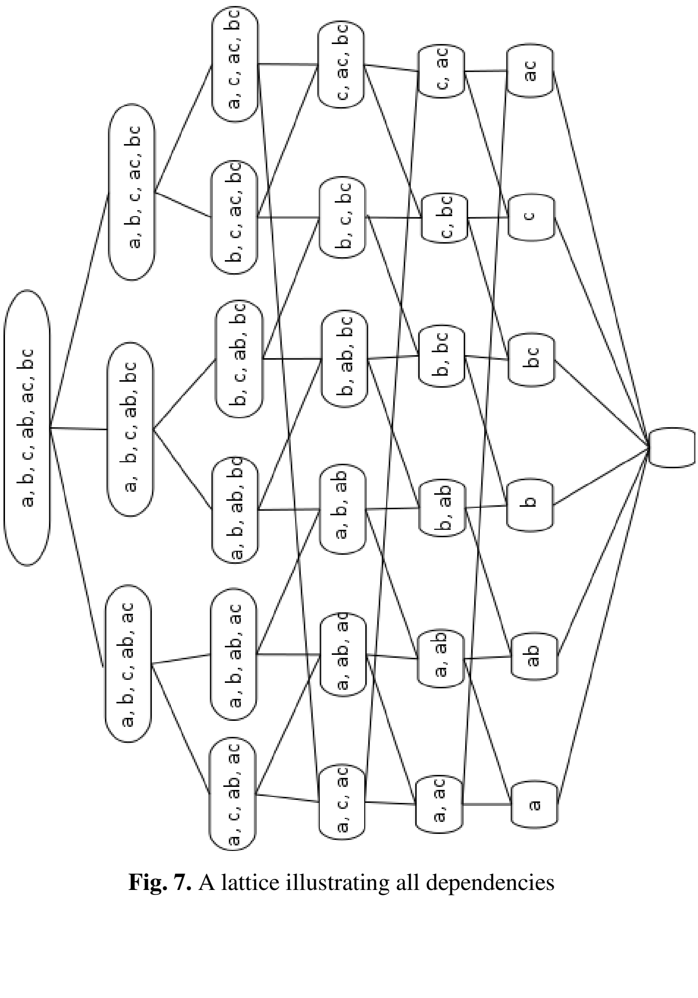

Fig. 7. A lattice illustrating all dependencies

All dependencies are incorporated in Fig. 7. Lattice theory and higher-order logic can be applied for developing a functional decision support system.

4 Conclusion

The aim of this work was to address the problem of drawing conclusions about users' preferences. In order to complete the task we have been relaying on som available information and applying rules from the theory of many valued logics. In future work we plan to address problems related to development of user preferences' testing.

References

1. Belnap, N.J.: How a computer should think. In: Contemporary Aspects of Philosophy. Proceedings of the Oxford International Symposia, Oxford, GB, pp. 30–56 (1975)
2. Belnap, N.J.: A useful four.valued logic. In: Dunn, J.M., Epstain, G. (eds.) Modern Uses of Multiple-valued Logic, pp. 8–37. Reidel Publishing Co., Dordrecht (1977)
3. Bolc, L.: Many-Valued Logics 2: Automated Reasoning and Practical Applications. Springer (2003)
4. Chang, T.H., Wang, T.C.: Using the fuzzy multi-criteria decision making approach for measuring the possibility of successful knowledge management. Information Sciences 179, 355–370 (2009)
5. Davey, B.A., Priestley, H.A.: Introduction to lattices and order. Cambridge University Press, Cambridge (2005)
6. Ding, J., Liang, G.: Using fuzzy MCDM to select partners of strategic alliances for liner shipping. Inf. Sciences, 197–225 (2005)
7. Ferreira, U.: A Five-valued Logic and a System. Journal of Computer Science and Technology 4(3), 134–140 (2004)
8. Fitting, M., Orlowska, E.: Beyond Two: Theory and Applications of Multiple-Valued Logic. STUDFUZZ, vol. 114. Springer, Heidelberg (2003)
9. Kleene, S.: Introduction to Metamathematics. D. Van Nostrand Co., Inc., New York (1952)
10. Ye, J.: Improved method of multicriteria fuzzy decision-making based on vague sets. Computer-Aided Design 39, 164–169 (2007)
11. Wille, R.: Concept lattices and conceptual knowledge systems. Computers Math. Applications 23(6-9), 493–515 (1992)