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REALIZATION OF WEB BASED ADVISORY SYSTEM FOR DESIGN OF EXPERIMENTS

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ABSTRACT

Advisory systems as a part of the software which user can call when he is unsure about what to do next in a given situation based on collected data, through expert knowledge in certain area of interset for process optimisation. Advisory systems should be the ones which are actively asking questions to the operator, performing computations, and should ultimately provide an answer. In a statistical context they provide some form of statistical strategy.

According to all relevant requirements data base has to be carefully planned and created, especially in areas like statistical analysis in general and experimental design in particular, where knowledge of a strategic nature is hard to acquire and not generally agreed upon.

Concept of an advisory systems is the most difficult phase to write computer support for due to fact that a research problem must be translated into one or more precise research questions and these must then be mapped into more or less "standard questions" approachable with known statistical techniques. Mapping is vital for the whole experiment process. [3]

Keywords: Advisory systems, experimental design, software

1. INTRODUCTION TO DESIGN OF EXPERIMENTS

Design of experiment (DoE) is a powerful technique used for discovering a set of process variables (or factors) which are most important to the process (or system) and then determine at what levels these factors must be kept to optimize process performance (Figure 1). It provides quick and cost-effective methods to understand and optimize any manufacturing processes. It is a direct replacement of the hit or miss approach of experimentation which requires a lot of guesses work and luck for its success in real life situations. Moreover, the hit or miss approach does not take into account interactions among the factors (or variables) and therefore there is always a risk of arriving at false optimum conditions for the process (Figure 1) under investigation [5]

2. WEB BASED ADVISORY SYSTEM FOR DoE

In the architecture of web based advisory system we can have following sub-modules:

- The problem-solving component interprets the expert knowledge for the solution of the problems specified by the user.
- The interviewer component controls the dialog with the user and/or automatically reads in measured data. If no user dialog takes place, the expert system is called an embedded system, otherwise an interactive system.
- The explanation component makes the mode of operation of the expert system transparent. It helps both the user seeking the reasons or justification for the solution suggested and also the expert wishing to localize errors in the knowledge base.

- The knowledge acquisition component enables the expert to enter his knowledge to the expert system and alter it later. Depending upon the quality of the knowledge acquisition component, the expert may need the help of a knowledge engineer or he can be assisted by learning techniques, which evaluate case databases, for example. [2]

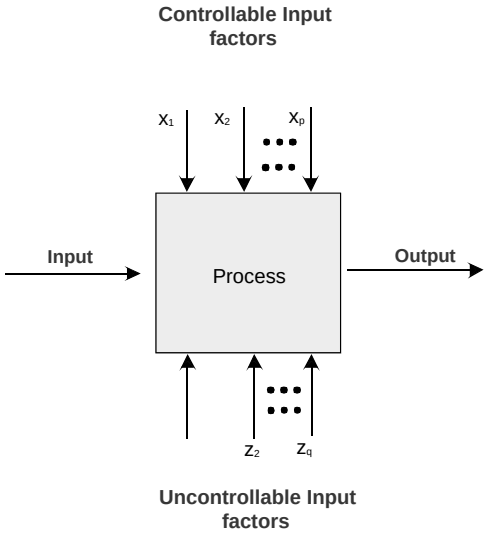

Figure1. Illustrated presentation of process with input/output factors (General model of a process) [1]

Web based advisory system for DoE presented in Figure 2 integrated three modules: Elimination, Expert and Custom. Use depends on operator's knowledge and starting point. According to all relevant requirements data base was carefully planned and created, especially in areas like statistical analysis [4] in general and experimental design in particular, where knowledge of a strategic nature is hard to acquire.

3. EXAMPLE

Practical example of web based advisory system for DoE will be used as Full Factorial 2^n design.
Questions and answers through application will be as follows:

1. Number of factors observed? = 3
2. Number of levels? = 2
3. Is screening important? = Yes
4. Optimization of experiment? = Yes
5. Deviation from linearity? = No
6. Are interactions important? = Yes

After six questions answered application directs user to chosen design for Full Factorial 2^n design with description link. Afterwards user visits matrix in which he has to input relevant data for getting optimized result. Matrix mathematically calculates values and gives final report on factor significances. Following Figure 3 gives an overview of shortened matrix:

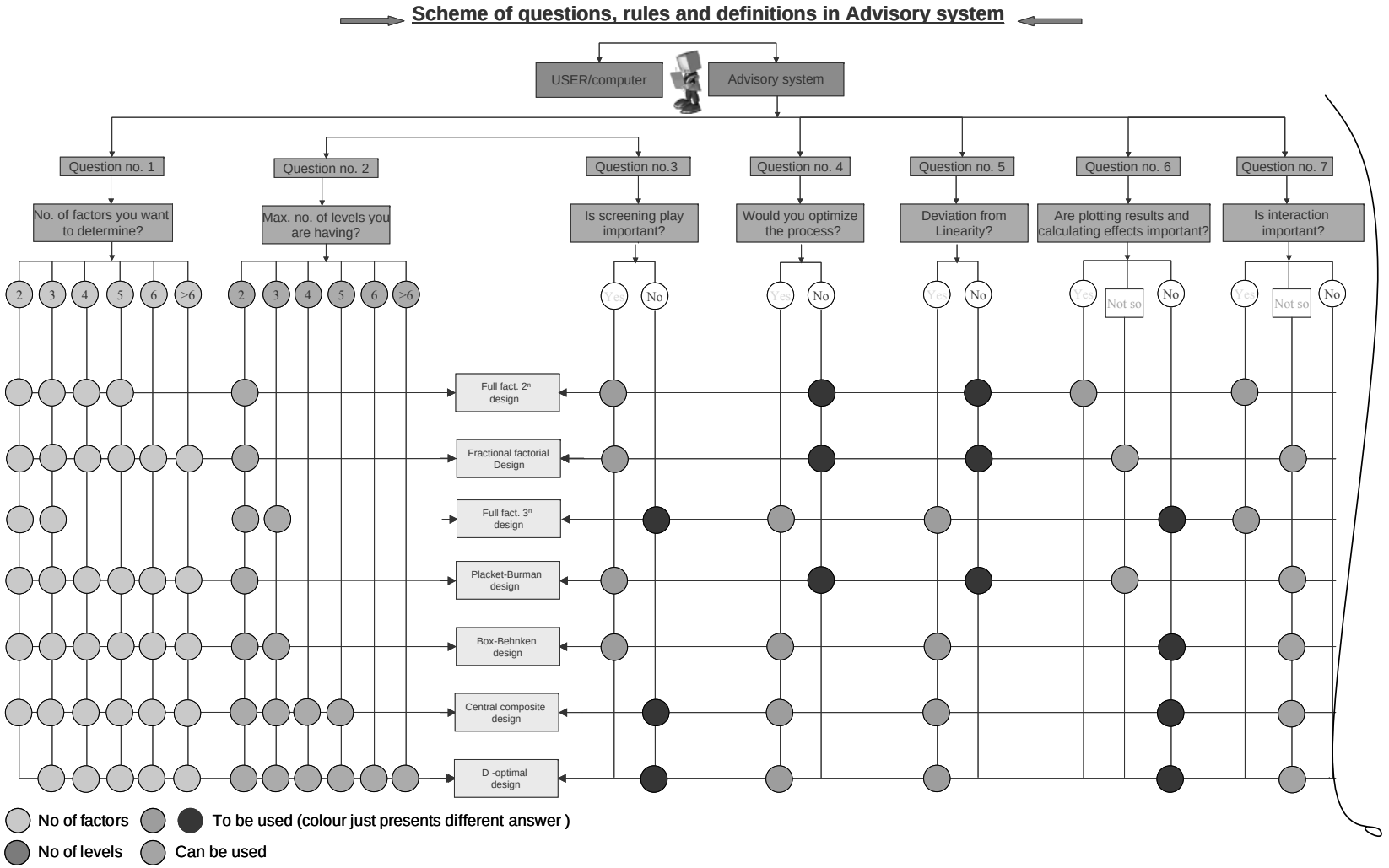

Figure 2. Schema of questions rules and definitions in web advisory system (shortened) [5]

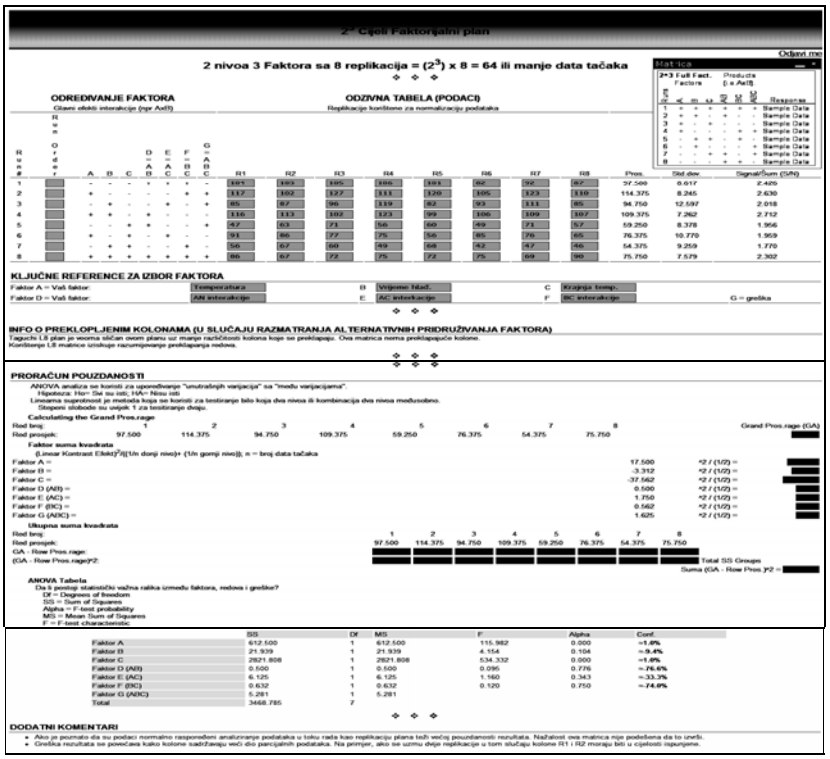

Figure 3. Section of matrix overview for Full Factorial 2^n design processed in Web based advisory system for DoE

4. CONCLUSION

Key parameters for web based advisory system are simple for knowledge acquisition and update with possibility of helping user to find best possible solution for a given problem. Process as it is ensures growth of knowledge in advisory system by its use. Quality and effectiveness of industrial processes, nowadays, is possible to achieve with detailed design of experiments. Industrial engineers should be aware of all positive influences of such experiments on production process and problems of quality control which have as a permanent aim to reduce number of defected products, reduction of expenses, process variability, product development time, liability, and increasing profit and customer satisfaction.

5. REFERENCES

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