EXPERT EDITOR

Expert Editor of ExpertPRIZ allows to create and update expert knowledge bases, which are used by the Expert subsystem in ExpertPRIZ applications.

1. Basic concepts

Attribute – a factor or feature of the problem under consideration. It has a **name**, e.g. AGE, COLOUR OF EYES, etc. It can also have a related **text**: a question or an explanation, e.g. "How old is the candidate for the job?". In addition to that, attributes have some **values**, e.g. AGE can be "over twenty", "under twenty", "under sixteen" etc. An attribute can also express a solution of a problem, e.g. "Accept the candidate for the job". In this case the attribute is called a **result attribute**.

Example – a condition with a certain conclusion. The condition is a conjunction of attribute values. The conclusion can be a decision, a diagnosis, a piece of advice, etc. Thus, the examples consist of decisions and the factors involved in the decision. Each example describes a particular situation. If in a certain situation there are some factors with no influence to the conclusion, then the appropriate example has special **don't care values** ("-") corresponding to these attributes.

For describing a problem, usually a set of examples is needed. This set of examples is called **expert knowledge base**.

Suppose our problem of selecting candidates for a certain job can be described by means of attributes AGE, COLOUR OF EYES, RESULT. Suppose our expert knowledge base consists of the following examples, which correspond to particular cases:
If he/she is over twenty and has brown eyes, then accept.
If he/she is over twenty and has blue eyes, then don't accept.
If he/she is under twenty and has blue eyes, then accept.
If he/she is under twenty and has brown eyes, then accept.

Here is the same in the form of a table:

	AGE	COLOUR OF EYES	RESULT
1	over twenty	brown	accept
2	over twenty	blue	don't accept
3	under twenty	blue	accept
4	under twenty	brown	accept

Every set of examples has an underlying pattern, or an expert rule hidden in it. This rule is called a **decision tree**. E.g. our set of examples yields the following decision tree:

```
AGE:
-over twenty---COLOUR OF EYES:
                -brown----------RESULT:
                                 -accept
                -blue-----------RESULT:
                                 -don't accept
-under twenty--RESULT:
                -accept
```

Having prepared this expert knowledge base by means of Expert Editor, and having also supplemented the attributes with explanatory texts, you get an **expert system** which can help you in selecting candidates for the job. You can start a **consultation course** with it through ExpertPRIZ. During the consultation, the decision tree is followed from the root node (the attribute AGE) to some leaf node (RESULT). The path is determined by the answers the user selects to the questions of the expert system. In more complicated situations the behaviour of an expert system may also depend on results of computations carried out during the consultation course.

2. Expert Editor main window and menu

Expert Editor allows editing one expert knowledge base file at a time. A new expert knowledge base has one attribute (the result attribute) and an empty example by default.

In the **main window** of Expert Editor there are following child windows:
1) an edit window for the **Title** of expert knowledge base;
2) an edit window for the **Texts** related to the attributes;
3) a listbox for the **Values** of the attributes;
4) **Examples** window for the table of attributes and examples, or **Decision Tree** window for the decision tree generated from the set of examples.
   You can change the input focus between these windows using mouse click or the Tab key.

NB! For better understanding of the facilities of Expert Editor, try to open the CONIFERS.EXP expert knowledge base file from the set of files of demonstration of ExpertPRIZ. For that purpose choose **Open** from the **File** menu. After that choose the DEMO subdirectory and the CONIFERS.EXP filename in the **Open Knowledge Base** dialog box.

In the **Title** window you can see the heading text of this expert knowledge base. The contents of the **Texts** and the **Values**windows depend on the currently selected cell in the table of the **Examples** window, i.e. you can see the text and the list of values of the attribute to which the selected cell (attribute value or name) belongs.

The **main menu** of Expert Editor has three submenus: File, Edit and Help. The **File** and **Help** submenus are standard File and Help submenus of a Windows application. The **Edit** submenu supports standard Cut, Copy and Paste facilities for the edit windows. In addition, it has special features for editing attributes and examples, and also for viewing the decision tree, optimizing and testing the expert knowledge base.

The **File menu** contains the following commands.

New - creates a new (untitled) expert knowledge base. A new expert knowledge base has one attribute (named RESULT) and one empty example by default.

Open - opens an existing expert knowledge base.

Save - saves the expert knowledge base currently open under its previous name. If the name was (untitled), asks for the file name.

Save As - saves the expert knowledge base currently open under a new name.

Print - prints the expert knowledge base currently open. If you have the **Examples** window on the screen, prints the contents of the expert knowledge base in tabular form, in case of the **Decision Tree** window - prints the tree. A tree is printed starting from the node currently selected (i.e. it is possible to print subtrees as well as the whole tree).

Page Setup - allows to format pages for printing.

Printer Setup - allows to set up printing options.

Exit - quits the working session with Expert Editor.

The **Edit menu** contains 9 commands, most of which are standard for the edit windows (**Title** and **Text**), but have special meaning for the **Examples** window (see also p.3. - "The Examples window").

Undo - if an edit window has the input focus, undoes the last change in that window; if the **Examples** window has the input focus - undoes the last deleted attribute or example.

Cut - if an edit window has the input focus, cuts the selected text and copies it to the clipboard. If the **Examples**window has the input focus - cuts an attribute or example and copies it to the clipboard in text format.

Copy - if an edit window has the input focus, copies the selected text to the clipboard. If the **Examples** window has the input focus - copies an attribute or example to the clipboard in text format.

Paste - if an edit window has the input focus, pastes the text from the clipboard to the current position of the caret. If the **Examples** window has the input focus - pastes the text from the clipboard to a new attribute or example.

Delete - if an edit window has the input focus, deletes the selected text. If the **Examples** window has the input focus - deletes an attribute or an example.

Insert - if the **Examples** window has the input focus, inserts a new attribute or a new example.

Optimize - finds the optimal sequence of attributes and reorders the attributes, if necessary.

Decision Tree - displays or hides the decision tree which corresponds to the current set of examples. Changing selected

attribute in the tree will automatically update the contents of the **Text** and **Values** windows similarly to changing the selected attribute in the examples table.

   Test - evokes test of running the consultation course (see also p.4. - "More about attributes. Testing expert knowledge base").

   The **Help menu** contains commands providing some help about using Expert Editor:
   Index,
   Keyboard,
   Commands,
   Procedures,
   Using Help,
   About Expert Editor.

3. The Examples window

   The **Examples window** has standard features for up-down and left-right scrolling. The **selected cell** can be changed by mouse click or using the arrow keys. If you click at the example number or move by the left arrow key to it, the whole example will be selected. The last example is always empty, you can use it for adding new examples.

   If you wish to **edit the text of a selected cell** (attribute name or example value), it can be done after mouse double-click or pressing the Enter key. After editing the text press Enter once again or click mouse outside the editing field.

   The **Values listbox** can be used for **changing an example value** for some other value of the same attribute. The selected value in the Examples window will be changed after you choose the new value in the Values listbox and press Enter, or double-click the mouse button.

   The **Edit menu commands** for the Examples window evoke the following actions:
   Undo - undoes the last deleted attribute or example.
   Cut - cuts an attribute (if the attribute name was selected) or an example (if the whole example was selected). The attribute or example will be copied to the clipboard in text format; the vertical bar "|" is used as a delimiter separating the attribute name and example values.
   Copy - copies an attribute (if the attribute name was selected) or an example (if the whole example was selected) to the clipboard in text format; the vertical bar "|" is used as a delimiter separating the attribute name and example values.
   Paste - pastes the text from the clipboard to a new attribute (if an attribute name was selected) or a new example (if an example was selected). The vertical bar "|" is assumed to be a

delimiter.

Delete - deletes an attribute (if the attribute name or an example value was selected) or an example (if the whole example was selected). It is possible to restore the deleted attribute or example using the Undo command.

Insert - inserts a new attribute (if an attribute name or an example value was selected) or a new example (if an example was selected). The values of the new attribute or example will be "don't care" values ("-") by default.

Optimize - finds the optimal sequence of attributes and reorders the attributes, if necessary.

Decision tree - displays the decision tree which corresponds to the current set of examples. Changing selected attribute in the tree will automatically update the contents of the Text and Values windows similarly to changing the selected attribute in the examples table.

Test - evokes test of running the consultation course.

4. More about attributes. Testing expert knowledge base

In order to organize the **interaction** of the expert system and other parts of ExpertPRIZ, special attributes - **message and comparison attributes** - have to be used in expert knowledge.

Values of the **message attributes** are sent to Solver when the expert system is in action. They are interpreted as statements in the input language of ExpertPRIZ. Message attributes do not generate different paths in decision tree - they are just interruptions to ask questions to follow the decision tree for the purpose of carrying out necessary actions by Solver.

Comparison attributes are intended for control of the expert system according to results of computations. Values of comparison attributes are interpreted as logical conditions on the objects from the problem model. These conditions specify different paths in decison tree.

In short, there are four different types of attributes in the Expert subsystem of ExpertPRIZ. The **type of attribute** determines the **action** carried out during the consultation.

NB! As far as Expert Editor is concerned, there is no difference between the types of attributes (except in the test mode). The following is included for better understanding of the contents of the other .EXP files belonging to the set of files of the demonstration of ExpertPRIZ.

The **types of attributes** are following:

1) Choice attributes

The **name** of choice attribute may be **any text** except "?", "<", ">".

In the consultation course the user is asked the question related to this attribute, and a list of possible answers is displayed. After the user's choice, the corresponding path of the decision tree will be followed.

2) Message attributes

The **name** of message attribute is question mark ("?").

The **values** corresponding to the message attributes in the examples are statements in the input language of Solver.

In the consultation course ExpertPRIZ executes the different statements which belong to the path of the decision tree currently followed.

3) Comparison attributes

The **name** of comparison attribute is either ">" or "<".

The **values** corresponding to the comparison attribute are conditions in the following form:

   i)   **A @ B**,
where @ belongs to {=, <, >, <=, >=, <>}; A and B may be either constants or names of objects having values in the moment of comparison.

   ii)   **< object name >** - is considered to be valid, if the object has got a value.

   iii)   **! < object name >** - is considered to be valid, if the object exists in the problem model but has got no value.

In case of comparison attributes the system checks whether the conditions are fulfilled and follows the paths for which the condition is valid.

4) Result attribute

The **last attribute** in expert knowledge base is always considered to be the result attribute.

If the **value** of the result attribute begins with the sign "#" followed by an expert knowledge base name, then during the consultation the system automatically switches to that knowledge base. This facility, called **chaining expert knowledge bases**, allows to build expert systems with quite complicated structures.

A result value not beginning with "#" may be a decision, a diagnosis, or an answer, and is output as the result of the consultation.

In Expert Editor it is possible to test the expert knowledge base currently open. You can check how the expert system that you have just created or updated will behave during the consultation course. For that purpose choose **Test** from the **Edit** menu. It starts a dialog which leads you through the decision tree from

the root node to some leaf node, corresponding to the result of consultation.

NB! In the **test mode** it is not possible to interact with Solver or other parts of ExpertPRIZ, neither is there an underlying problem model!

In the test mode, while processing **message attributes**, you can only view the statements which should be sent to Solver, in a listbox. While processing **comparison attributes**, you have to indicate the valid conditions yourself - choose from the multiple-selection listbox those comparison conditions which have to be considered true.
There is also a difference in processing **result attributes**. Since Expert Editor works with one expert knowledge base at a time, it does not switch to another expert knowledge base while testing. In the case of chaining expert knoledge bases you can only see the chaining command as a result of consultation.

In the case of **choice attributes** the test mode corresponds exactly to the consultation course you can evoke through ExpertPRIZ. Check it testing the CONIFERS.EXP expert knowledge base!