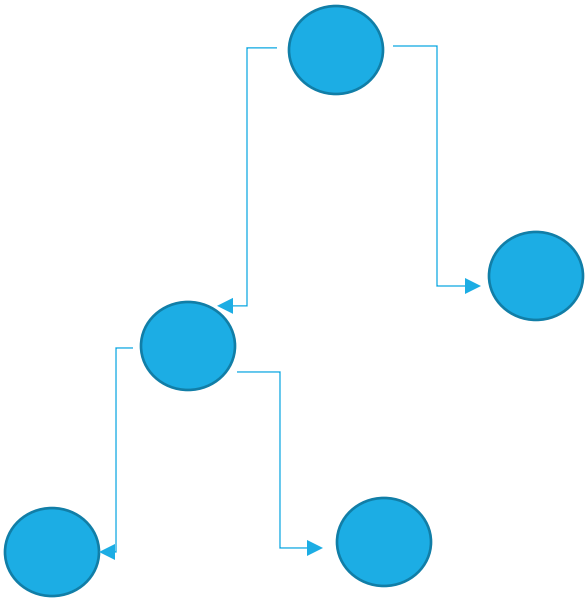
User Manual

Fuzzy Multi-Criteria for Group Decision Making



Índex

1.What is F.M.C.O.G.D.M.

The software, while referring to this manual, is based on a method of group decision making based on fuzzy numbers. In saying group, we say that there are several members of the team or decision group, so the search for the final solution, will be based on the assessments made by each of these Decisors. These have to classified a set of alternatives. One of them will be, according to the evaluations of the members, the most viable option and that is more in line to what is required by the group to solve the problem.

In turn, the connection between the Decision-makers and the Alternatives, are the Decision Criteria. These are make up a group of qualities on which the final decision is made. Suppose, for example, that a group of three members of a company are in charge of selecting a new programmer, that the company is requesting, the problem in this case will be "Choosing a new programmer for the company", the Decisors are the 3 members of the group. Decision criteria, will be based on what the company requires, for example: Work experience with programming languages that is used in the company, necessary courses, university degree, full-time hourly predisposition, etc.

Once these Criteria are established, the members of the group must differentiate each one of them with the others, this is a conclusion test that the method will use to know which Criteria are those of greater weight in the final decision, from these comparisons, the method is responsible for obtaining a consistent weight of each criterion and thus obtain the differences or order of importance of the same in order to obtain the best possible solution.

The Problem Solving Alternatives are the candidates for the post of programmer, who are evaluated by the members of the decision group. The evaluation will be based on the Preset Criteria. For example, for the decision-maker 1, according to the criterion "university degree" candidate 1 has a "Low" weight, in the case that the decision-maker judges the candidate in this way because he does not have a qualification or it seems to need some knowledge to carry out the Function required, that seems not to have it. Each decision maker makes the same classification, and all others that are required. In this case, as the established criteria named were 4, the members of the decision group were 3, and assuming that 4 candidates were submitted to take the post, we have a total of 48 classifications, of which each decision maker has 16 And 4 of them are of a single Alternative.

Having all this information, the method will be responsible for obtaining consistent weights for each alternative.

Other information necessary for the method to make the best possible contribution in the final decision, are the assessments of the weights of the members on the group, that is, by consensus, establish the importance of the decisor makers, since the decision of the HR manager, Does not have the same value as the one of the programmer who evaluates the candidate. In this way the differences that exist between the members of the group also directly affect the final decision.

We can say that the method uses the following information to obtain an ideal solution to a problem of this kind:

- Weights of the members of the group obtained by consensus.
- Differences between Criteria, provided by each member of the group.
- Classification of the Alternatives based on the Criteria, provided by each member of the group.

The method thus obtains the normalized weights (with a value between 0 and 1) of all the variables involved in the search for the most optimal alternative as a solution to the problem.

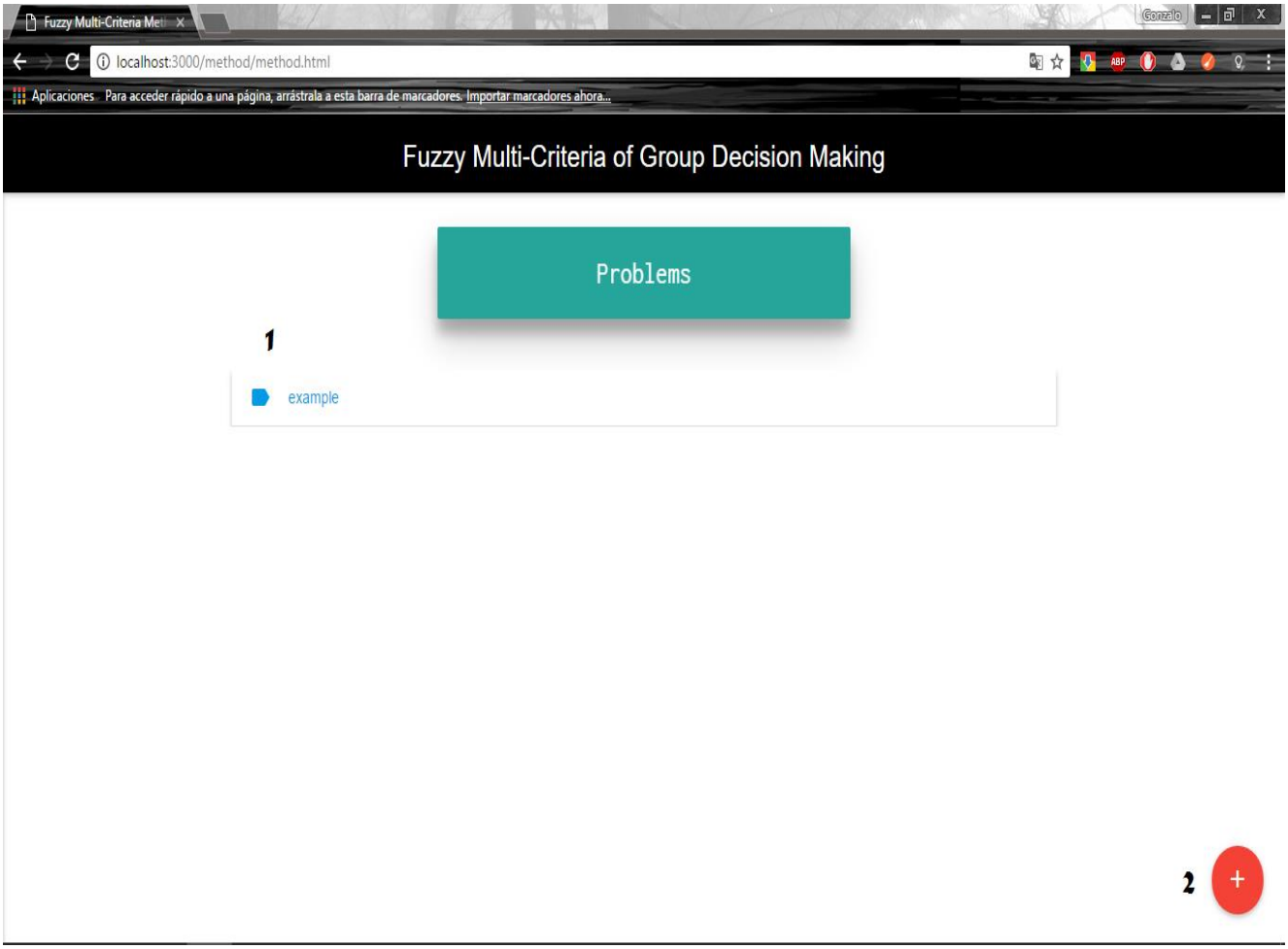
Representing the valuations made in the fuzzy numbers, the method follows a series of processes or steps that lead to the final solution and the ranking of the alternatives.

2.Who is the user.

The Software is intended to solve problems of the nature: Decisors-Criteria-Alternatives, no care the theme of it and use fuzzy numbers in order to represent the prices of real judgments, which are not precise and that need in a mathematical way to be manipulated, interpreted and processed by the method.

In this way we can say that the user can be anyone who needs to solve a problem of these characteristics.

3.Start Screen.

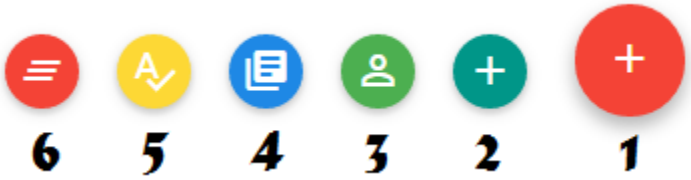


On this screen we found:

- 1.Problems list.
- 2.Action button.

1. Problems list: it lists the current problems stored in the database.
2. Action button: to access to actions with adrop-left button.

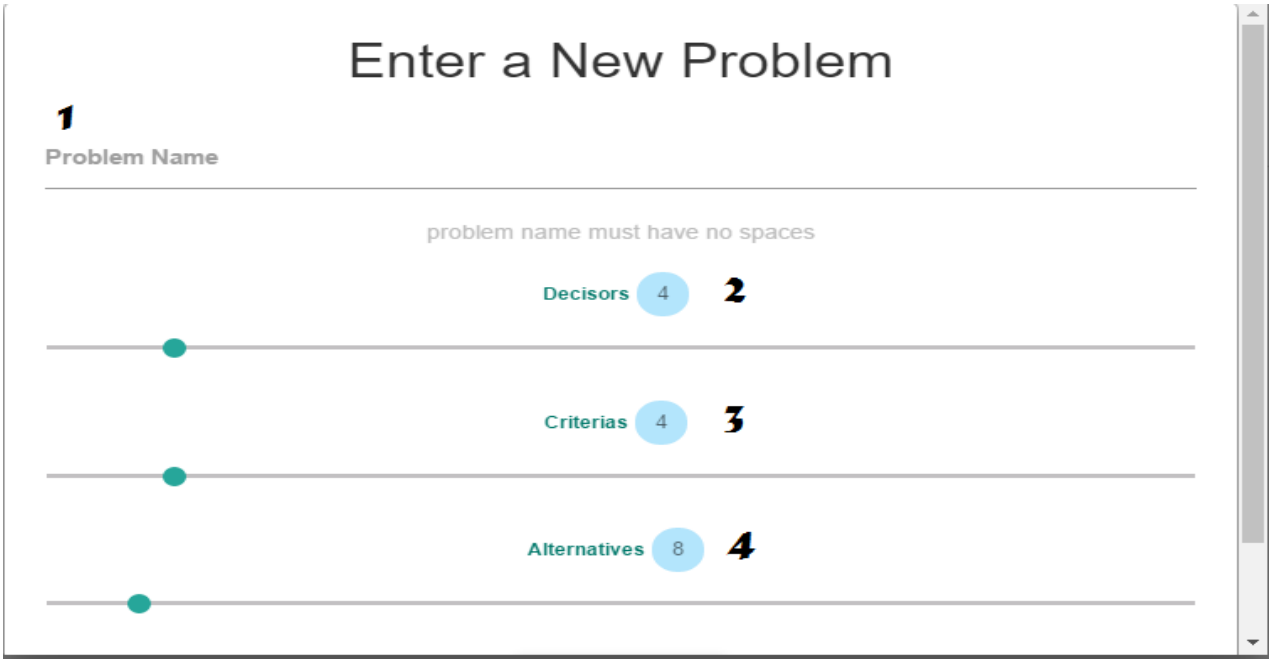
4.Drop Button.

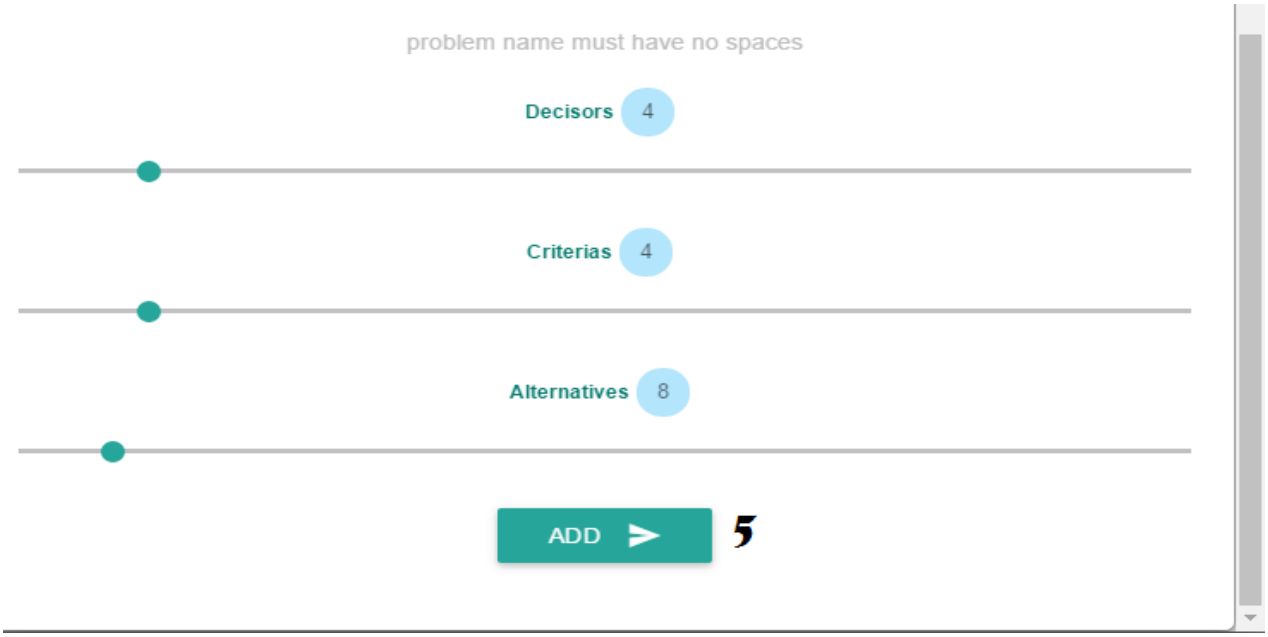


Actions:

1. Drop button (1.2): holding the mouse above this button will display the other buttons on the left.
2. Button to create new problem: select to open new problem form
3. Help Modal Decisors button.
4. Help Modal Criteria button.
5. Help Modal button Alternatives.
6. Help Modal button Results.

. 5.Create a Problem.





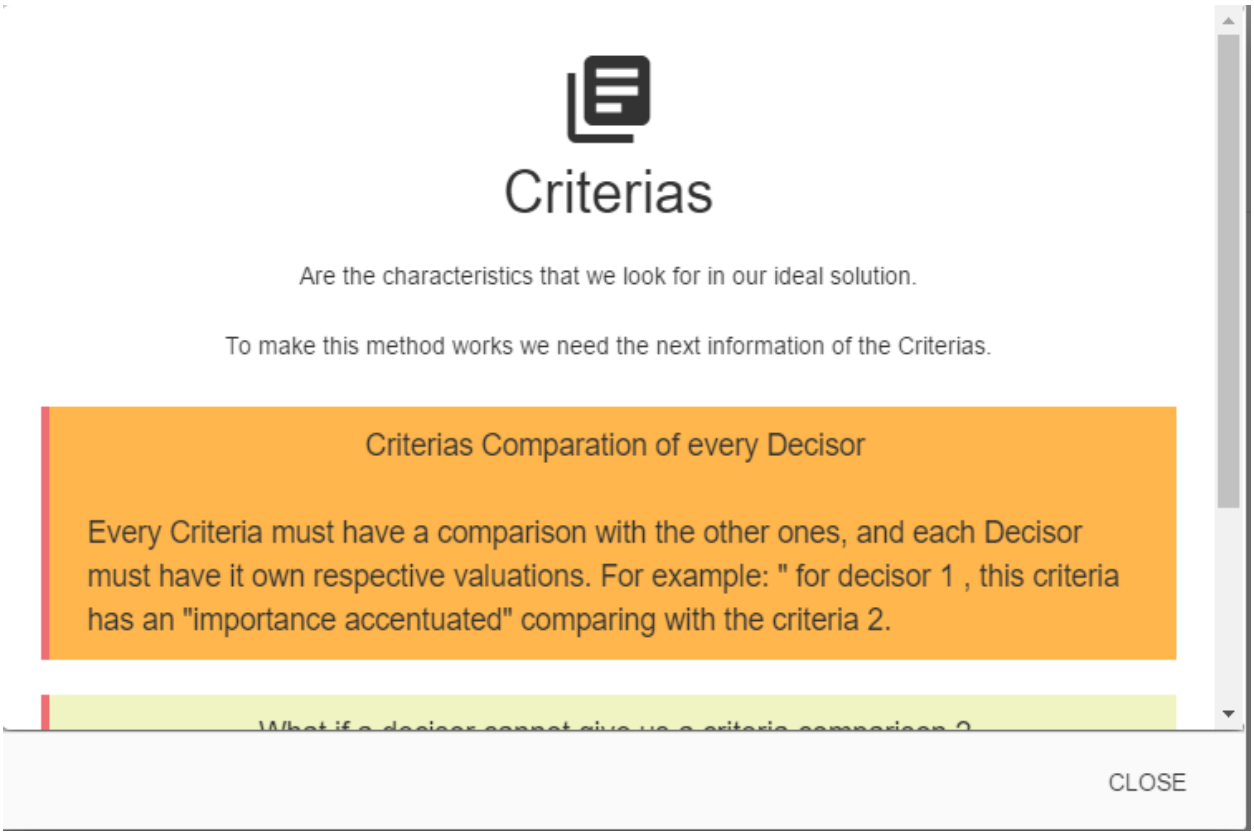
On this screen we found:

- 1.Name of the Problem: when specifying the name that must be taken into account that it can not contain spaces. This field can not be empty. At the bottom of this field, we will see a wrong/right post.
- 2. Number of Decisors: figure in the number inside the celestial circle, to change this amount slides the lower bar to the value we need. A value between 1 and 30 can be specified.
- 3. Number of Criteria: figure in the number inside the celestial circle, to change this amount slide the bottom bar to the value we need. You can specify a value between 1 and 60 for Criteria.
- 4. Number of Alternatives: number in the celestial circle, to change this amount will slide the bottom bar to the value we need. You can specify a value between 1 and 200 for Alternatives.
- 5. ADD button: press this button and then Enter, creates a new problem and store it in database.

6. Obtain info from Help Modals.

The Help Modals are screens containing explanations of the components that comprise the problem, they are accessed through the drop button (1.2).

1. Criteria Help Modal.



2. Results Help Modal.

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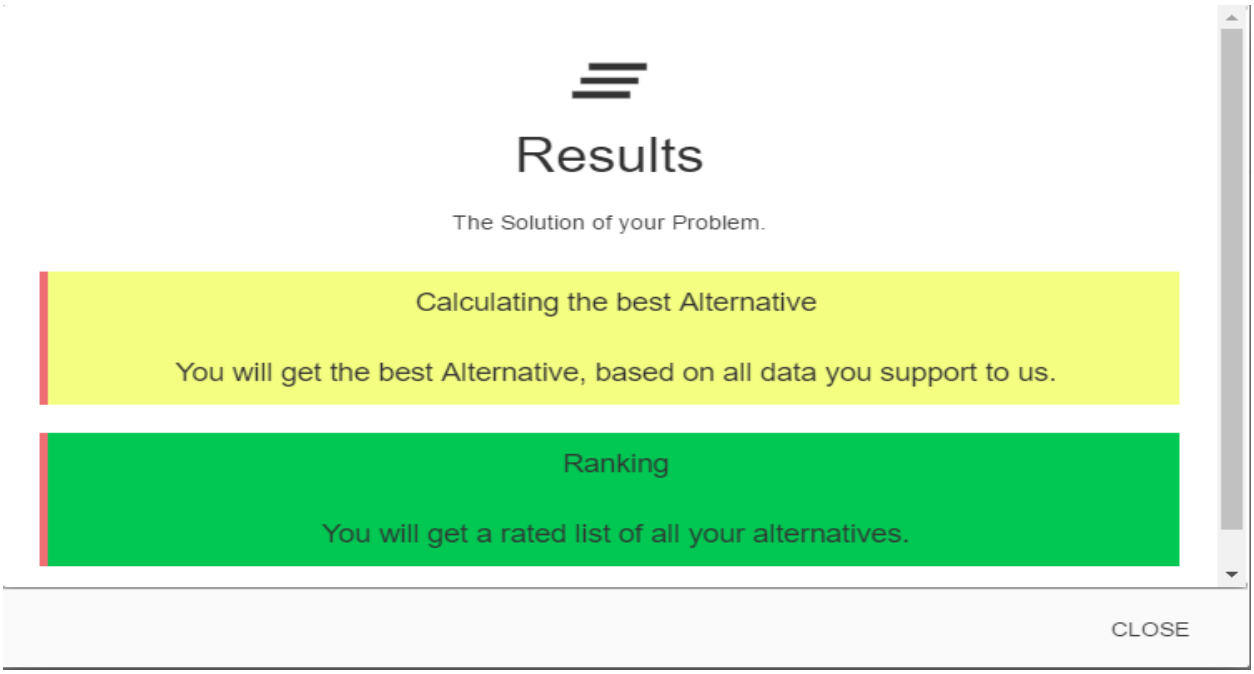
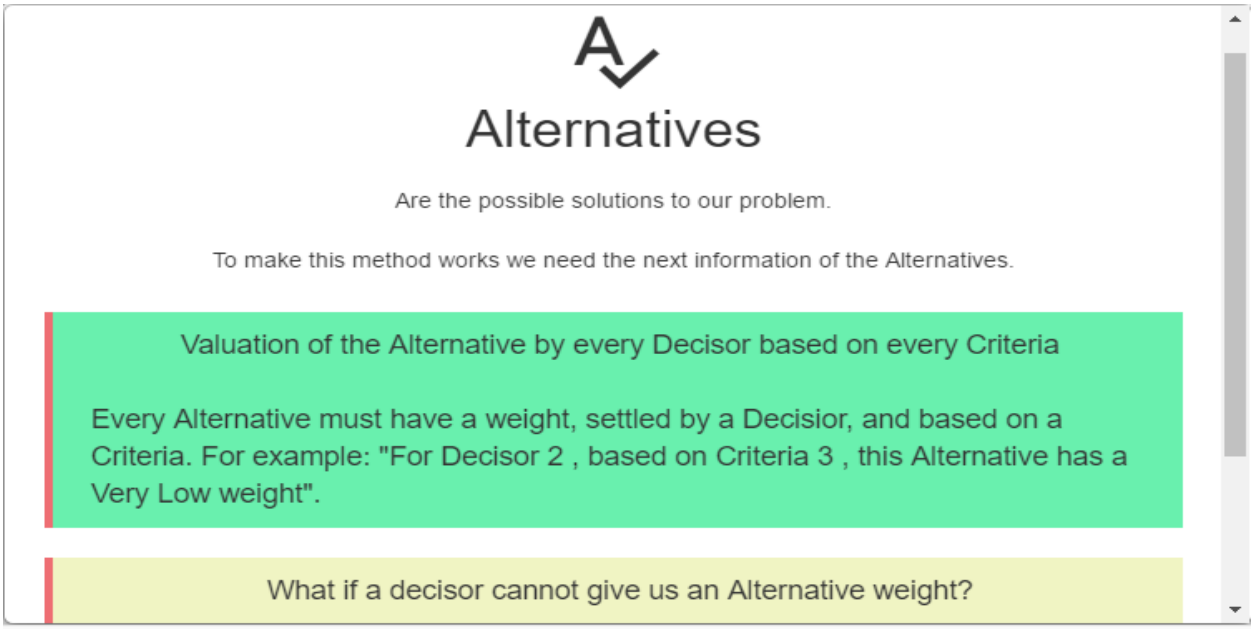
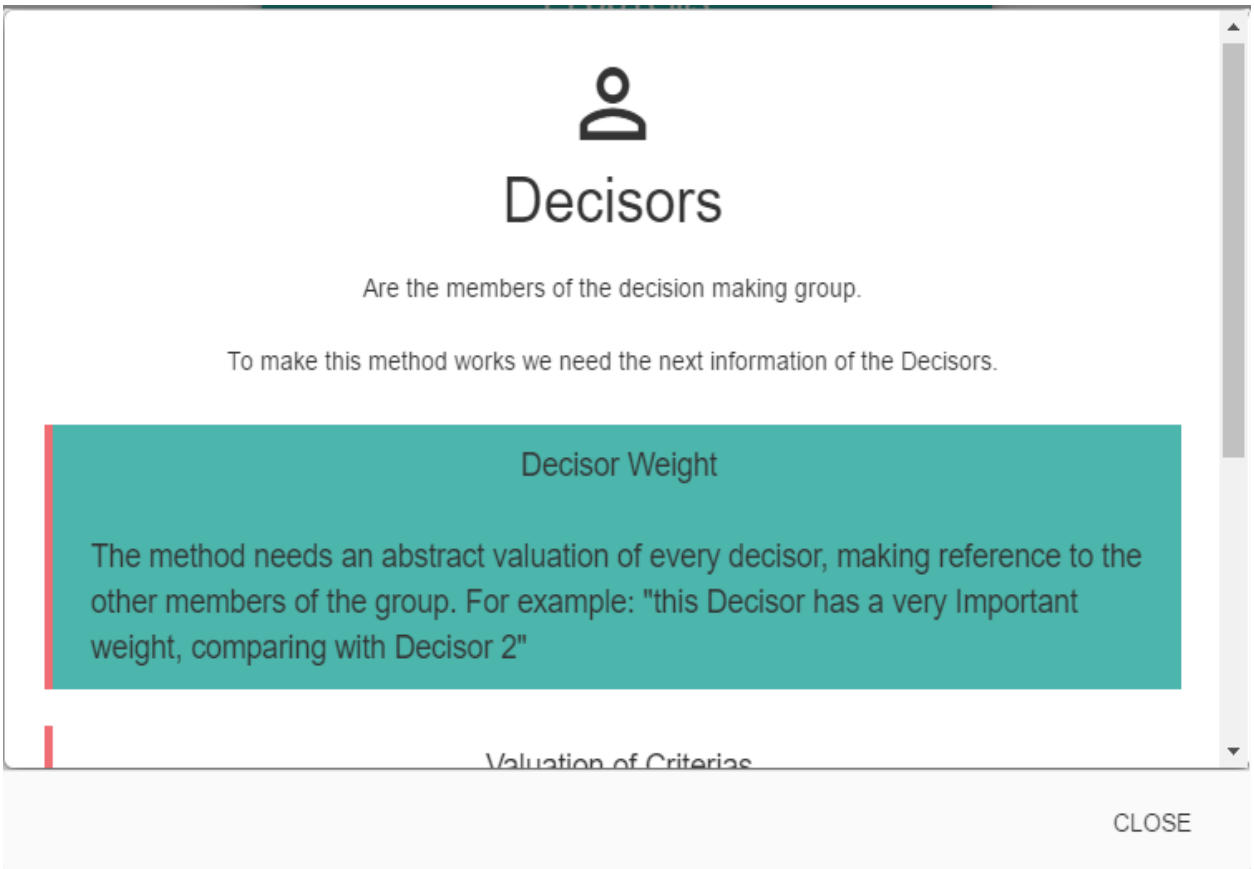


3. Alternatives Help Modal.



4. Decisors Help Modal.



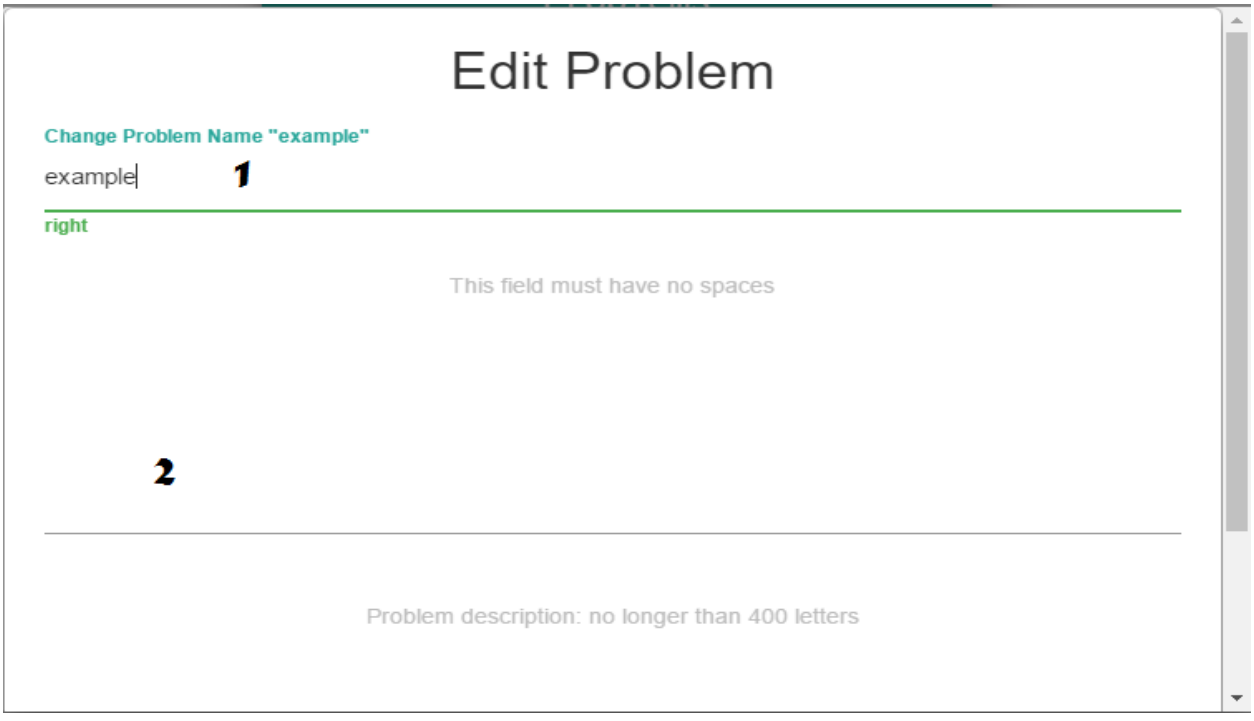
7.See Problem Structure.

Within the list of problems (1.1), clicking on a problem displays the structure of these one, showing the following:

1. Name the problem.
2. Problem edit button.
3. Remove the problem button.
4. Decisors Indicator.
5. Criteria Indicator.
6. Alternatives Indicator.
7. See Results.

8.Edit Problem Name.

In case of wanting to edit the name of a problem, select the button to edit the problem (7.2) and we will see the following screen:



On this screen we found:

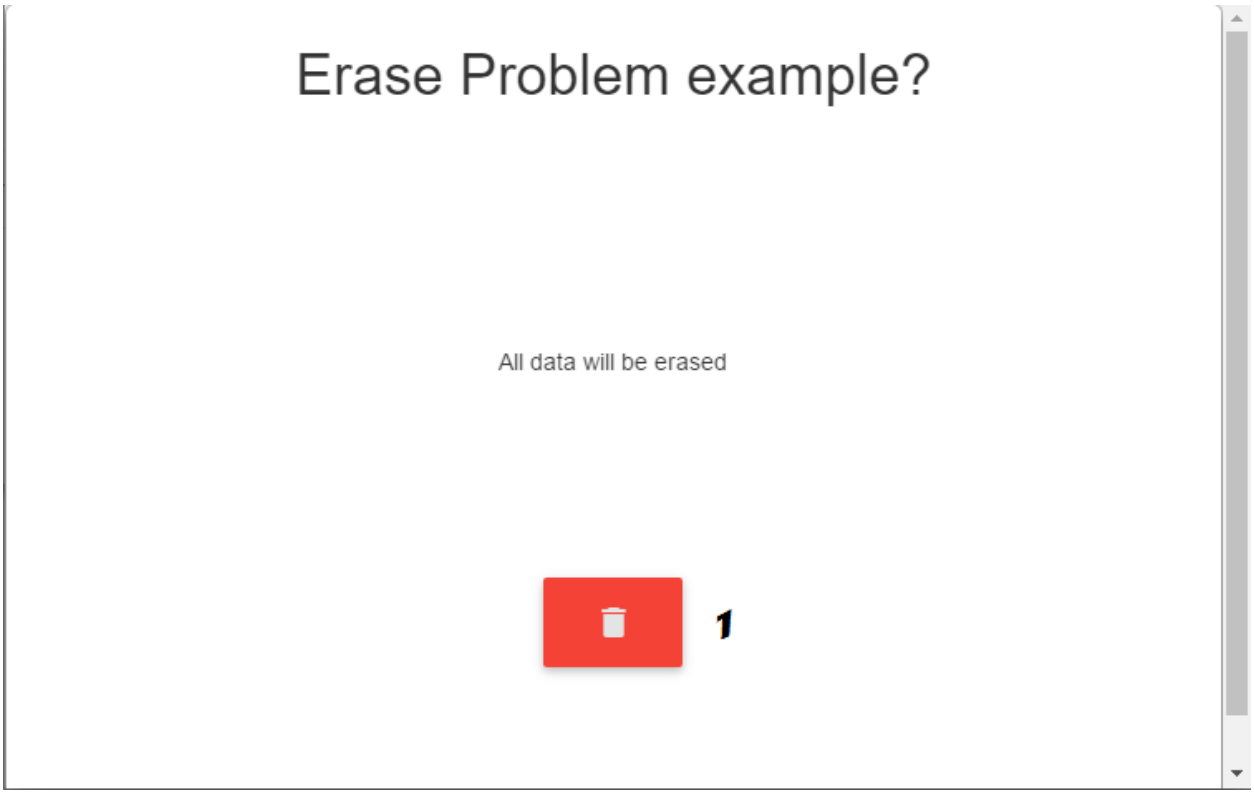
• 1. Field to change problem name: just like when creating the problem, this field should not contain spaces or be empty. At the bottom of the field you can see a message that specifies the condition of the name we provide, "right" in the case of being spelled correctly, or "wrong" in the case of being misspelled.

• 2. Add problema description.

• 3. Change button: when pressed, we make the change.

9.Erase a Problem.

Clicking the "remove problem" button (7.3), the following screen is displayed:

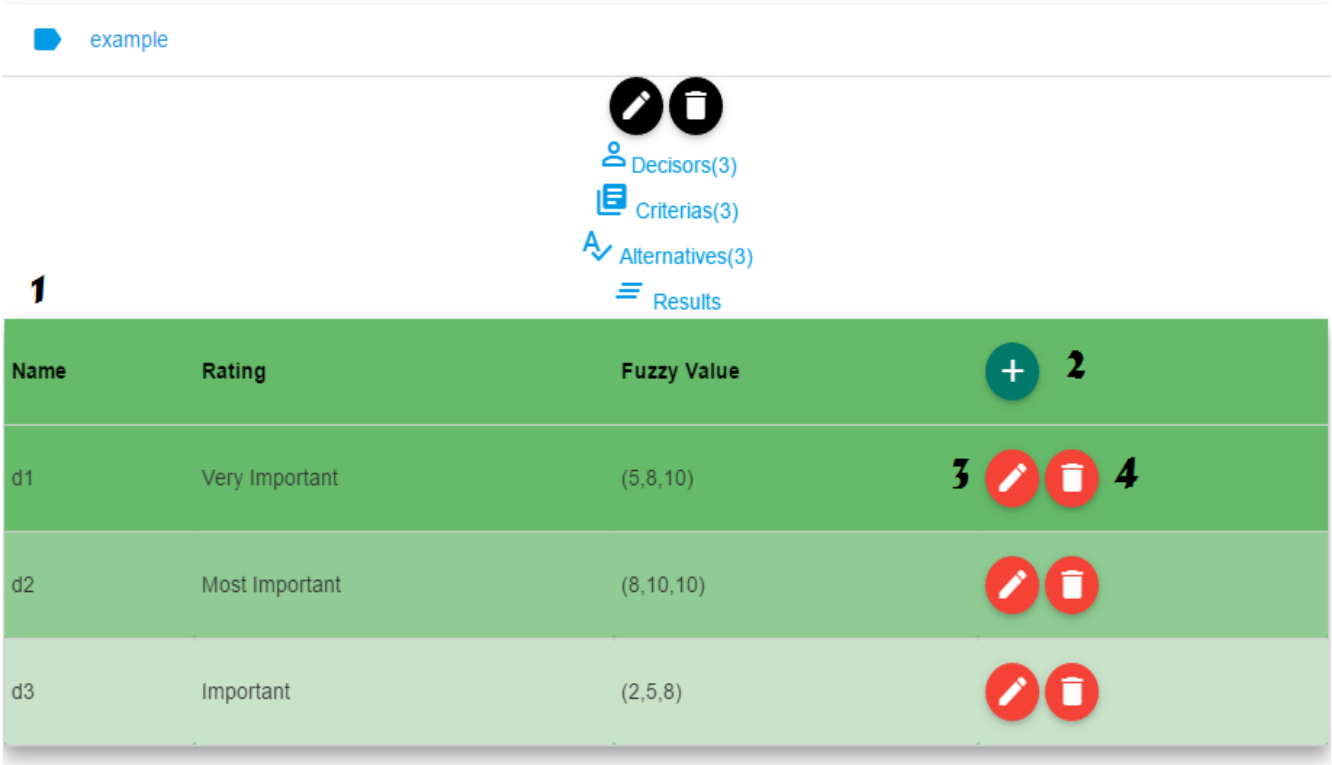


On this screen we found:

- 1.Button to eliminate the problem: pressing it removes the problem in its entirety from the database.

10. See decision makers' information.

To access the decision makers of the selected problem, we place the word "decisiors" together with the number of them in the displayed list of the problem (7), clicking on it (7.4) we can observe:

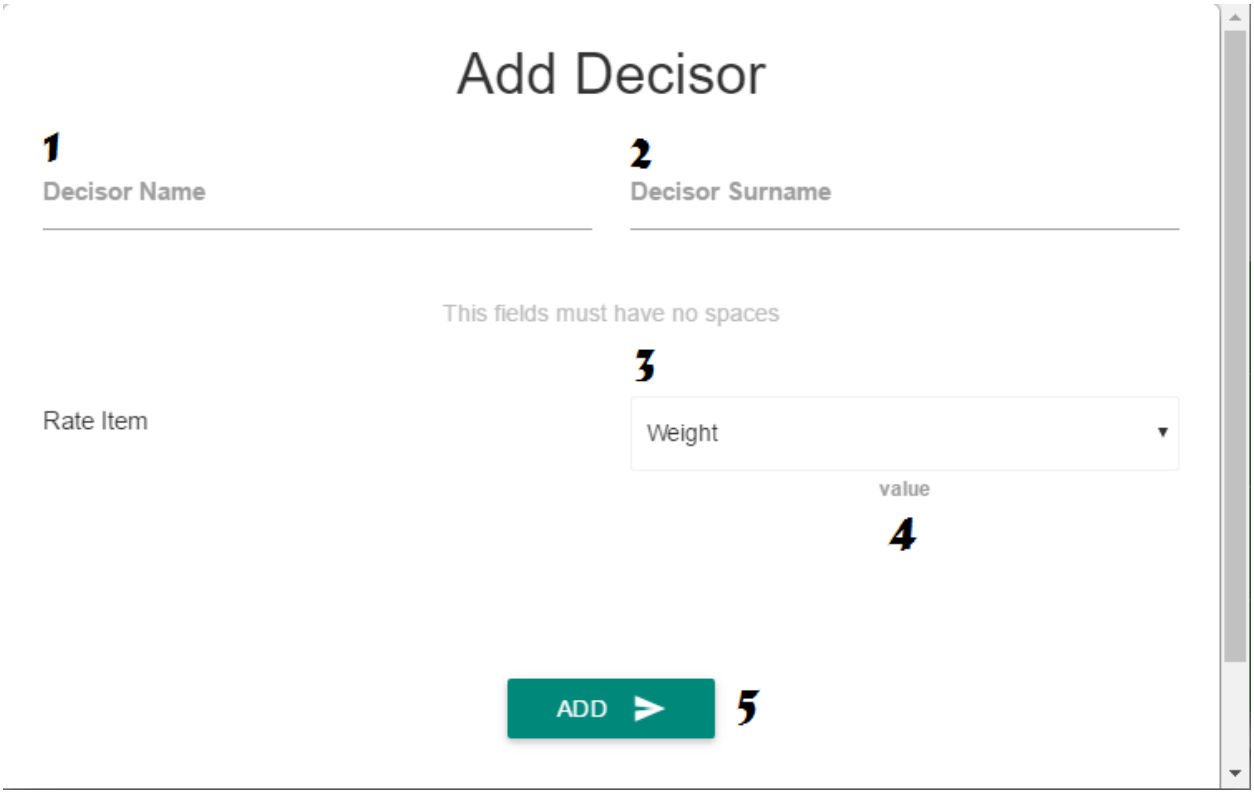


On this screen we found:

- 1. Table of Decisiors: it lists the decision makers of the problem with the following information:
  - O Name of the decisior.
  - O Weight of the decisior.
  - O Fuzzy value that corresponds to the weight of the decisior.
  - O "Add new decisor" button.
  - O "Edit decisior" button.
  - O "Erase decisor" button.
- 2. "Add new decisor" button: clicking on this button will appear the form to add a new decision maker to the problem.
- 3."Edit decisor" button: clicking on this button will appear the form to edit the decisior of the row corresponding to the button pressed. This row will change to a lighter color than the others to differentiate it.
- 4. "Erase decisor" button: clicking on this button will display the form to remove the decision maker from the row corresponding to the button pressed. This row will change to a lighter color than the others to differentiate it.

11. Add a Decisor.

In case you want to add a new decision maker to the list of decisors, clicking the "add new decisor" button (10.2) will display the following form:



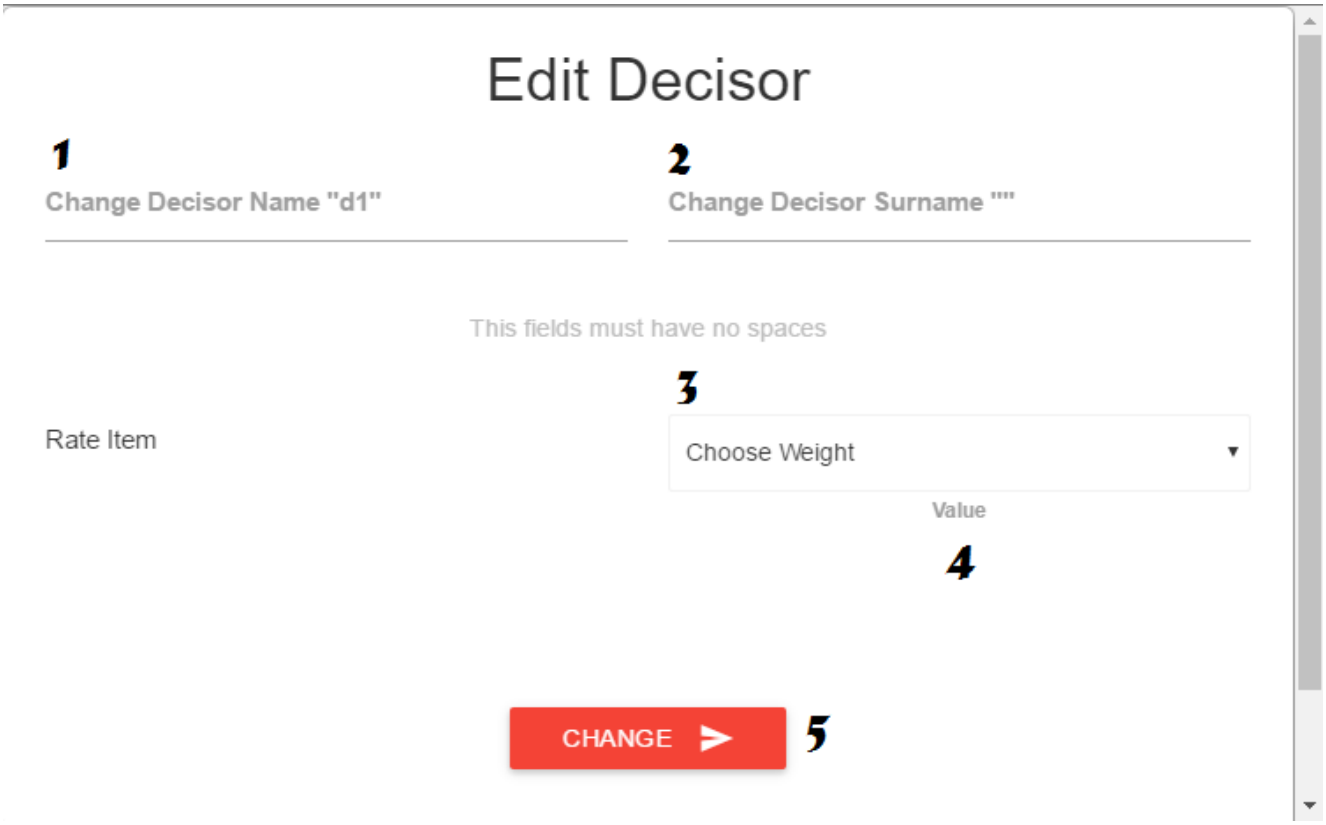
On this screen we found:

- 1. "Name of the decisor" field: the name of the decision maker is specified here, it can not contain blank spaces or be empty.
- 2. "Last name of the decisor" field: the name of the decision maker is specified here, it can not contain blank spaces or be empty.
- 3. "Weight of decisor" field: this specifies the weight of the new decision maker, it is a drop-down list with the possible weights.
- 4. Value of the field "weight of decisior": here the diffuse value corresponding to the weight selected for the new decisor will appear.
- 5. Add new decisor button: clicking on this button, we will add the new decision maker to the problem, if all the fields are correctly completed.

When you add a new decision maker to the problem, the entire method lists will be updated. In the case, for example, of having 3 decision makers as shown in structure 7.4, this will be updated to 4 decision makers and when deployed, the added information of the new decision maker will be shown in table 10.1. Likewise, the evaluations of the new decision-maker will be part of the final decision, so the information regarding criteria and alternatives must be completed, so that this information can be used with the other valuations within the problem.

12.Edit a Decisor.

In case of wanting to edit: name, surname, and weight of the decision maker, we select the "edit decisor" button (10.3). We can see the following screen:



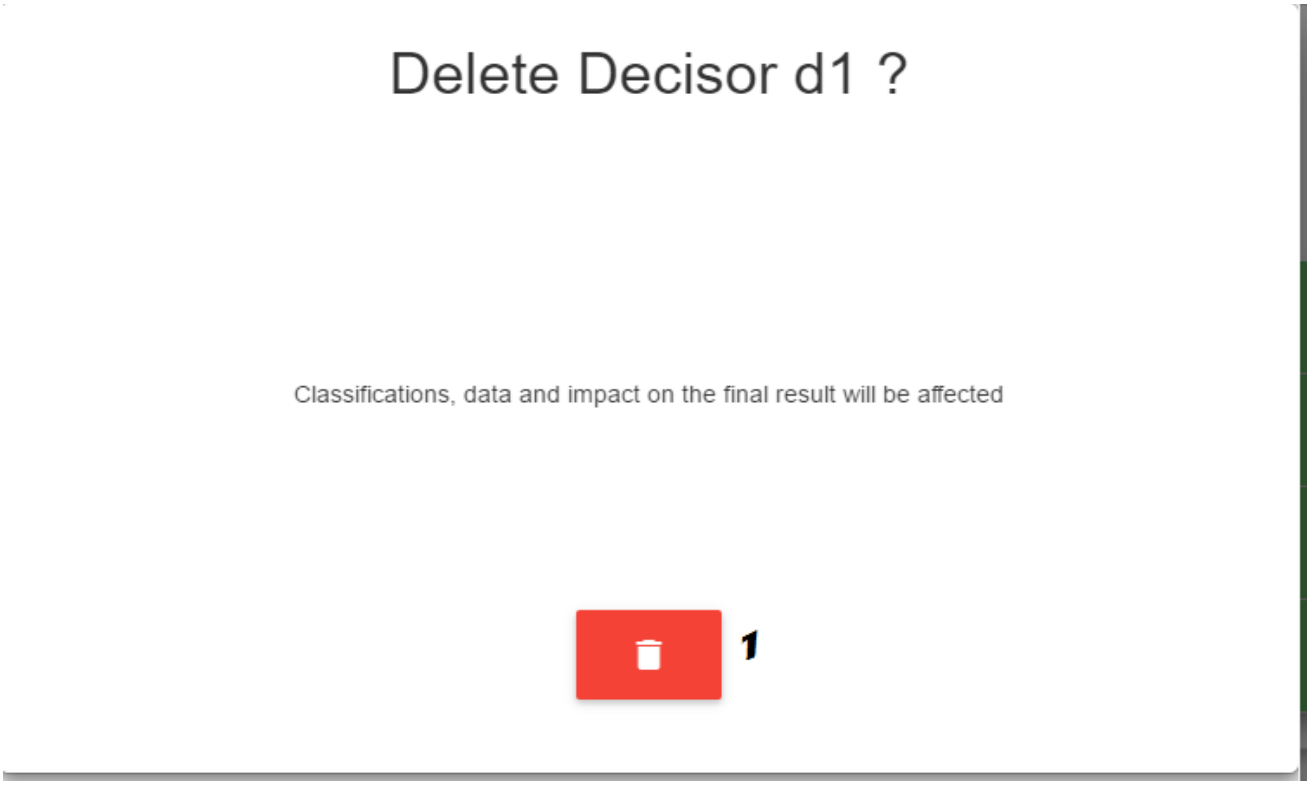
On this screen we found:

- 1. "Change name of decisor" field: the new name of the decision maker is specified here, it can not contain blank spaces or be empty.
- "Change name of decisor maker" field: this specifies the new surname of the decision maker, it can not contain blank spaces or be empty.
- 3. "Change weight of decisor" field: this specifies the weight of the decision maker, it is a drop-down list with the possible weights.
- 4. Value of the field "change weight of decisor": here the fuzzy value corresponding to the weight selected for the decision maker will appear.
- 5. Change decisor button: by clicking on this button, we will change the decision maker's information, if all fields are completed correctly.

When editing a decision maker, we can specify any of the 3 fields we need to change, in case of changing only the weight of the same, only this value will be modified in the database. If no field is changed and the change button (12.5) is pressed, no change is made.

13.Erase a Decisor.

If you want to delete a decision maker, select the "Erase Decisor" button (10.4), which will show the following screen::



On this screen we found:

- 1. Erase Decisor button: clicking here, we eliminate the decision maker of the problem.

By eliminating a decision maker, we eliminate all information regarding this including assessments that relate to the criteria and alternatives of the problem.

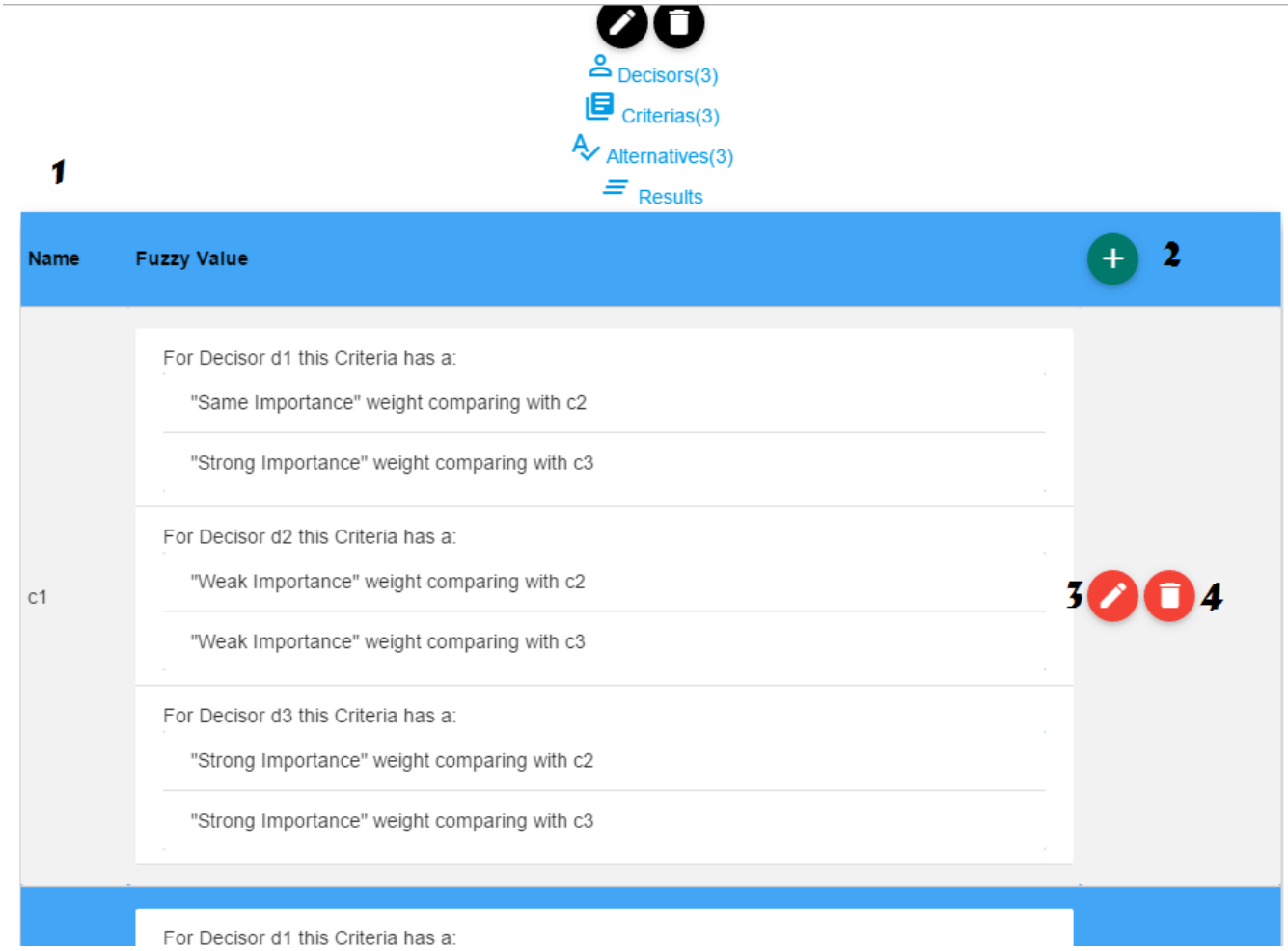
14.Weights of decisors.

As we saw in order to use the method correctly, it is necessary to assign "weights". In the case of decision makers, the weights would be as follows:

Weight	Fuzzy Value (triangle)
Normal	(0,0,4)
Important	(2,5,8)
Very Important	(5,8,10)
Most Important	(8,10,10)

15.See Criteria Information.

To access the Criteria of the selected problem, we place the word "criteria" along with the number of them in the displayed list of the problem (7), clicking on it (7.5) we can observe:



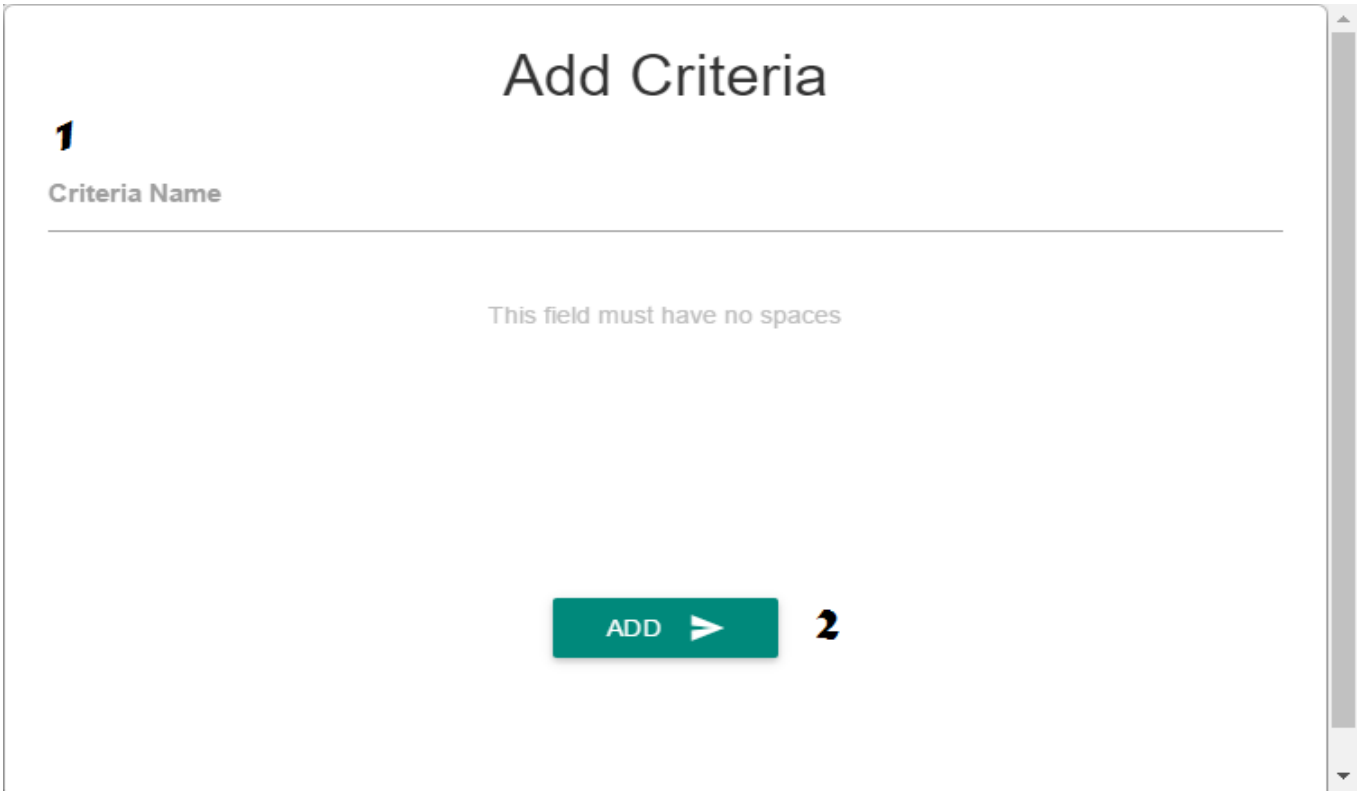
On this screen we found :

- 1. Table of Criteria: it lists the criteria of the problem with the following information:
  - O Criteria Name.
  - O Comparisons of decision makers with respect to other criteria.
  - Or "Add a new criteria" button.
  - Or "Edit a criteria" button.
  - Or "Erase a criteria" button.
- 2. "Add a new criteria" button: clicking on this button will appear the form to add a new criteria to the problem.
- 3. "Edit a criteria" button: clicking on this button will appear the form to edit the criteria of the row corresponding to the button pressed. This row will change to a lighter color than the others to differentiate it.

• 4. "Erase a Criteria" button: clicking on this button will appear the form to eliminate the criteria of the row corresponding to the button pressed. This row will change to a lighter color than the others to differentiate it.

16. Add a Criteria.

In the case of wanting to add a new criteria to the list of criterias, clicking the "add a new criteria" button (15.2) will appear the following form:



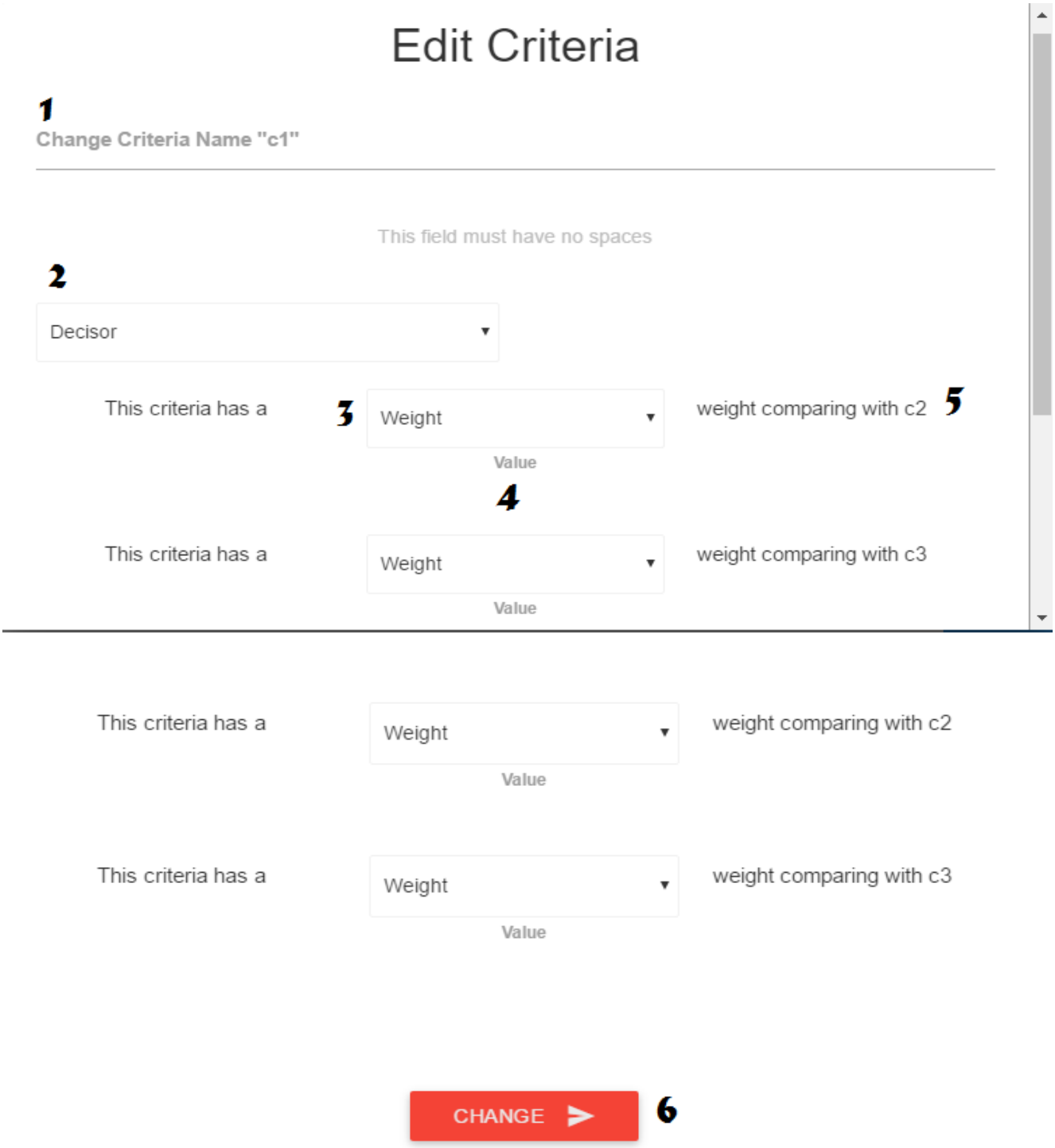
On this screen we found:

• 1. "Criteria name" field: the criteria name is specified here, it can not contain any blank spaces or be empty.
• 2. Add new criteria button: by clicking on this button, we will add the new criteria to the problem, if the previous field is correctly completed.

When adding a new criteria to the problem, all the lists of the method will be updated, reason why the respective evaluations of the decision makers must be done with this added criteria.

17.Editing a Criteria.

In case of wanting to edit: name, and weight of the criteria, we select the button "edit criteria" (15.3). We can see the following screen:



On this screen we found:

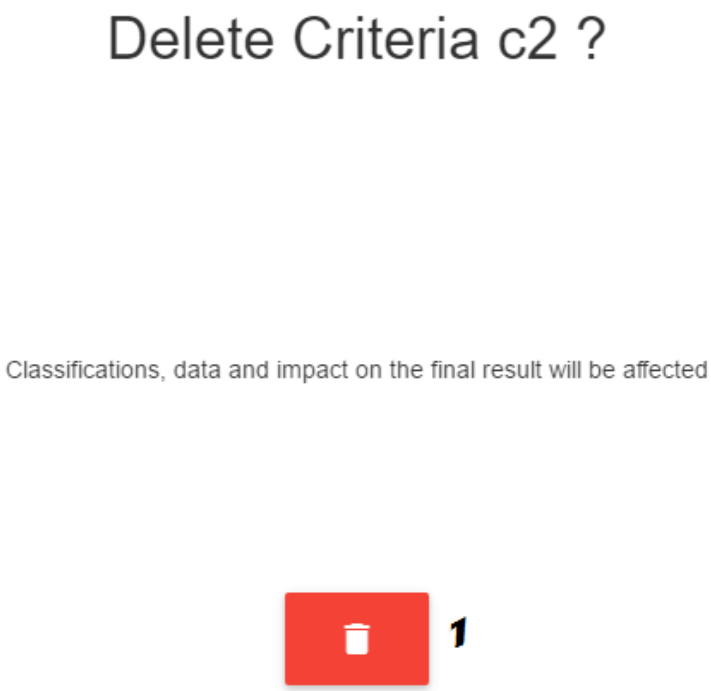
- 1. "Change criteria name" field: this specifies the new criteria name, it can not contain blank spaces or be empty.
- 2. "specify decisor" field: this specifies the decision maker making the assessments, it is a drop-down list with the decision makers of the problem. This is a required field.
- 3. "Change criteria weight" field: this specifies the weight of the criteria in comparison with another. It is a drop-down list with all possible weights.
- 4. Field "Value of the criteria weight field": here the fuzzy value corresponding to the weight assigned in the upper field will appear.
- 5.Criteria to which it is compared: it appears here the criteria to which the decision maker is comparing the selected criteria. One will appear for each criteria to compare.
- 6. "Change criteria" button: clicking on this button saves all the comparisons made to the corresponding criteria and decisor in the database.

When we edit a criteria, we are performing one of the fundamental actions to make the method work correctly, since we keep the valuations corresponding to the comparisons between criteria that a decision maker made. It is so:

- If no decisor is specified, no change will be saved.
- If decisor is specified, but no comparison is made between criteria, no change is saved.
- If the decisor is specified, and at least one comparison is made, this comparison will be saved as a change or as a new comparison.
- If decisor is specified, and at least one comparison is made, the other unrealized comparisons are not saved as changes.
- If a new name is not entered for the criteria, then the previous name will be retained.
- If a criteria name is entered incorrectly, the message "wrong" will appear.
- If the new name of a criteria is entered and no comparison is made, the name is saved in the same way.

18.Erase a Criteria.

If you want to delete a criteria, select the "Erase criteria" button (15.4), which shows the following screen:



On this screen we found:

- 1. Erase criteria button: clicking here, we eliminate the criteria of the problem.

By eliminating a criterion, we eliminate all information regarding this including the ratings that relate to the other criteria and alternatives of the problem.

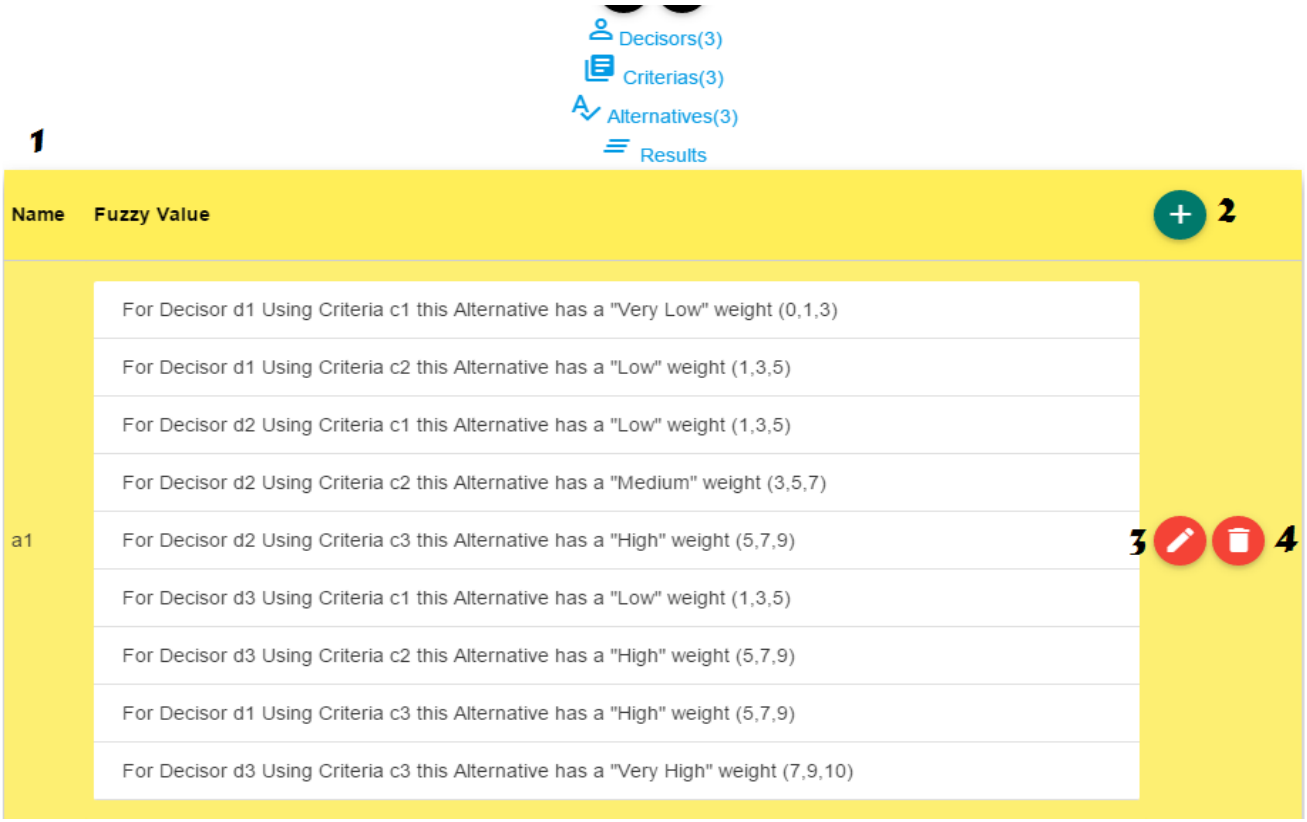
19.Weights of criteria.

As we saw in order to use the method correctly, it is necessary to assign "weights". In the case of the criteria the weights would be the following:

Weight	Fuzzy Value (triangle)
Same Importance	(0,1,2)
Weak Imporntace	(1,2,3)
Light Importance	(2,3,4)
Importance between Light and Accentuated	(3,4,5)
Importance Accentuated	(3,5,7)
Strong Importance	(5,6,7)
Very Strong Importace	(6,7,8)
Extremely Strong Importance	(7,8,9)
Absolute Importance	(8,9,10)

20.See Alternatives Information.

(7.6) we can observe: (7.6) To see the alternatives of the selected problem, place the word "alternatives" together with the number of them in the deployed list of problem (7):

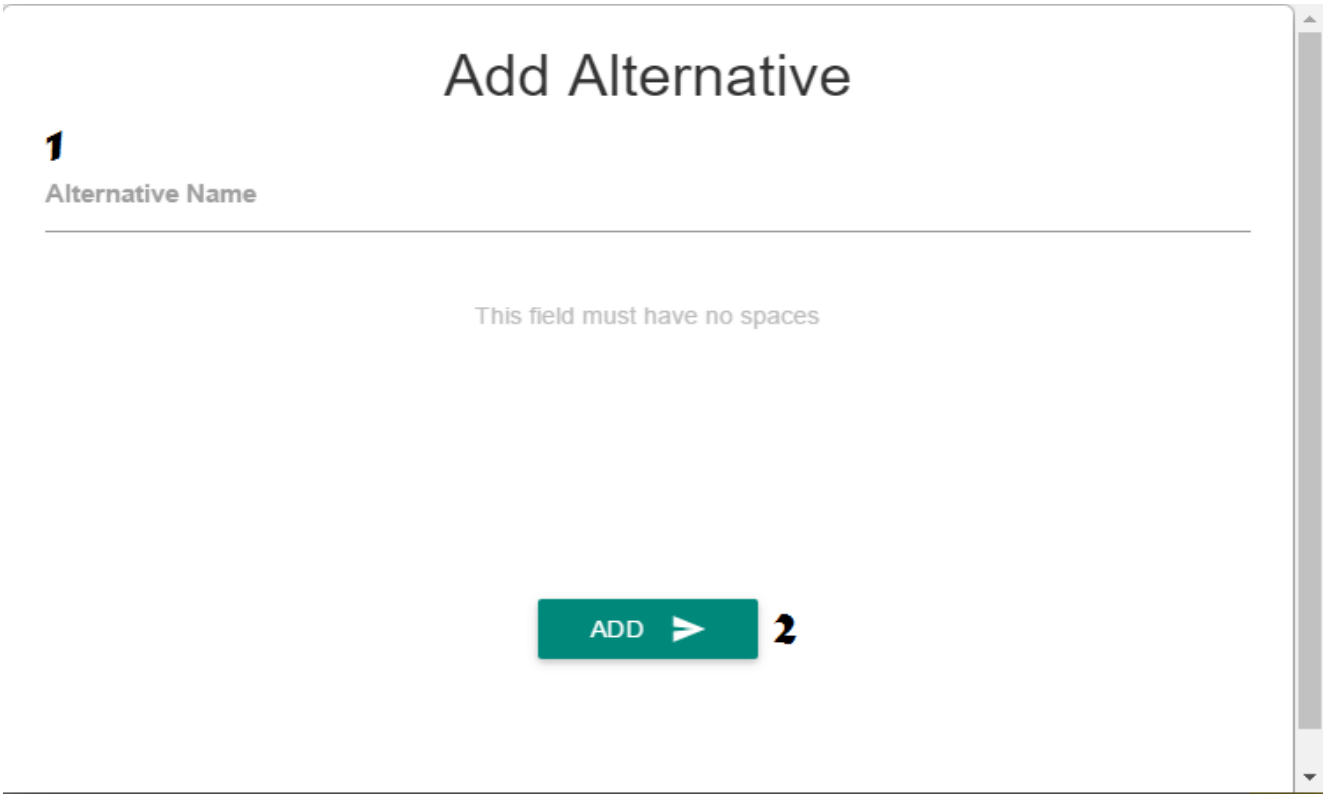


On this screen we found:

- 1. Alternatives table: it lists the criteria of the problem with the following information:
  - O Name of the alternative.
  - O Weights established by the decisiors for the alternative using the different criteria.
  - O "Add new alternative" button.
  - O "Edit alternative" button.
  - O "Erase alternative" button.
- 2. "Add new alternative" button: clicking on this button will appear the form to add a new alternative to the problem.
- 3. "Edit alternative" button: clicking on this button will appear the form to edit the alternative of the row corresponding to the button pressed. This row will change to a lighter color than the others to differentiate it.
- 4. "Erase Alternative" button: clicking on this button will appear the form to delete the alternative of the row corresponding to the button pressed. This row will change to a lighter color than the others to differentiate it.

21.Add an Alternative.

In case you want to add a new alternative to the list of alternatives, clicking the "add new alternative" button (20.2) will display the following form:



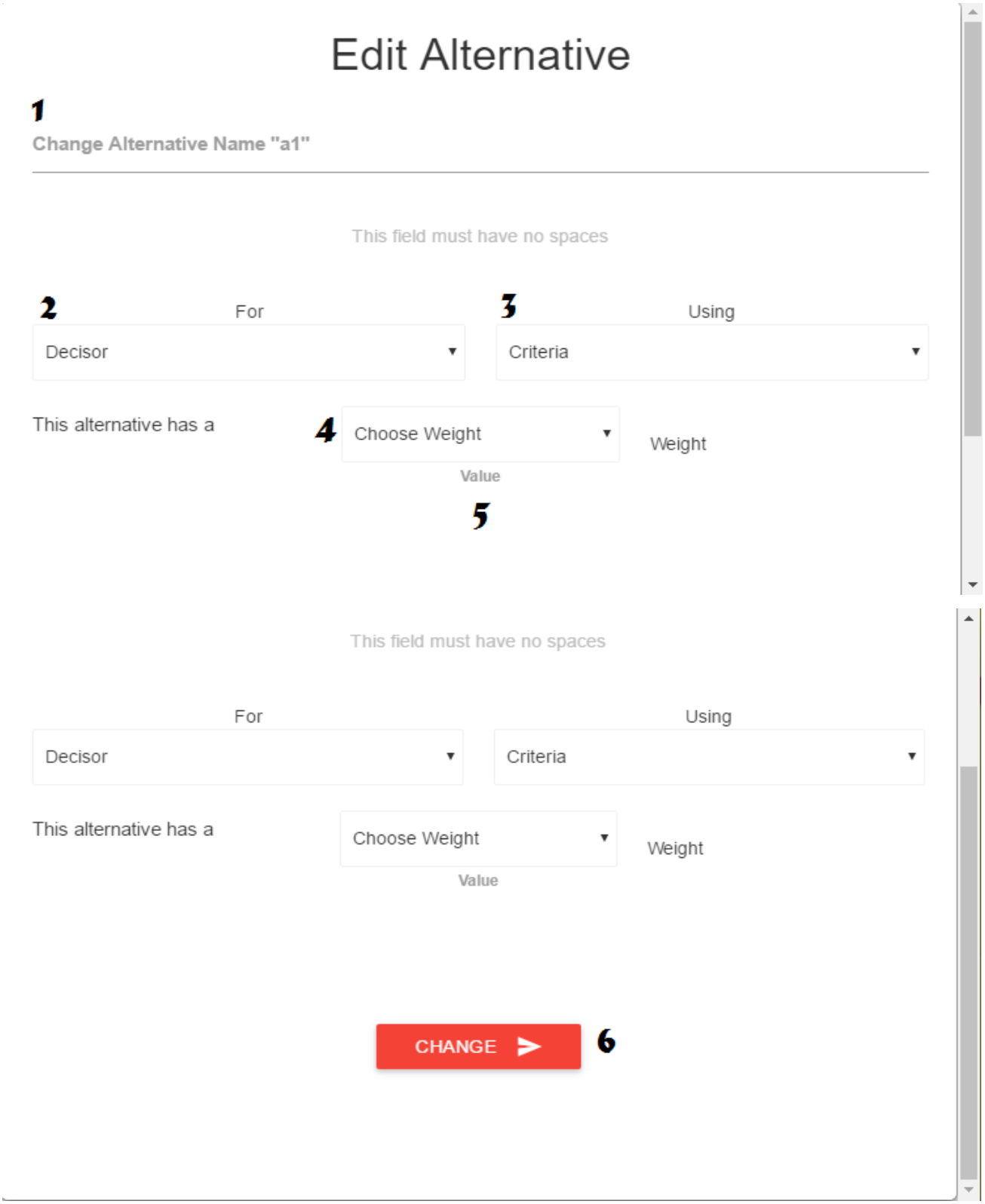
On this screen we found:

- 1. "Alternative name" field: the name of the alternative is specified here, it can not contain blank spaces or be empty.
- 2. Add new alternative button: by clicking on this button, we will add the new alternative to the problem, if the previous field is correctly completed.

When adding a new alternative to the problem, all the lists of the method will be updated, so the respective evaluations of the decision makers must be done with this added alternative, to provide the results that are sought.

22.Edit an Alternative.

In the case of wanting to edit: name, and weight of the alternative, select the "edit alternative" button (20.3). We can see the following screen:


Edit Alternative
1
Change Alternative Name "a1"
This field must have no spaces
2
For
3
Using
Decisor
Criteria
This alternative has a
4
Choose Weight
Weight
Value
5
This field must have no spaces
For
Using
Decisor
Criteria
This alternative has a
Choose Weight
Weight
Value
CHANGE
6

On this screen we found:

• 1. "Rename Alternative" field: The new alternative name is specified here, it can not contain any blank spaces or be empty.
• 2. "Specify decisor" field: this specifies the decision maker making the assessment, it is a drop-down list with the decision makers of the problem. This is a required field.
• 3. "Specify criteria" field: this specifies the criteria on which the decision maker makes the valuation of the alternative. It is a drop-down list with all criteria of the problem.
• 4. Field "Weight of the alternative": here the decision maker specifies the weight of the alternative according to the selected criteria. It is a drop-down list with possible weights.
• 5. Field "Value of the alternative weight field": here the fuzzy value corresponding to the weight assigned in the upper field will appear.
• 6. "Change Alternative" button: clicking on this button saves the valuation made for the alternative indicating the decision maker and the criteria that was taken into account for the same in the database.

When we edit an alternative, we are performing one of the fundamental actions to make the method work correctly, since we save the valuation made by a determined decision maker according to a certain criteria. It is so:

• If a new name is entered for the alternative, but the corresponding weight is not selected, only the new name will be saved.

• If no new name is entered, and no alternative weight selection is made, no changes will be saved.

• If a weight selection is made for the alternative but a new name is not entered, the name of the alternative will not be changed and the corresponding selection will be saved.

• If both actions are performed, selection and name change, both will be saved.

• Choice of alternative weight:

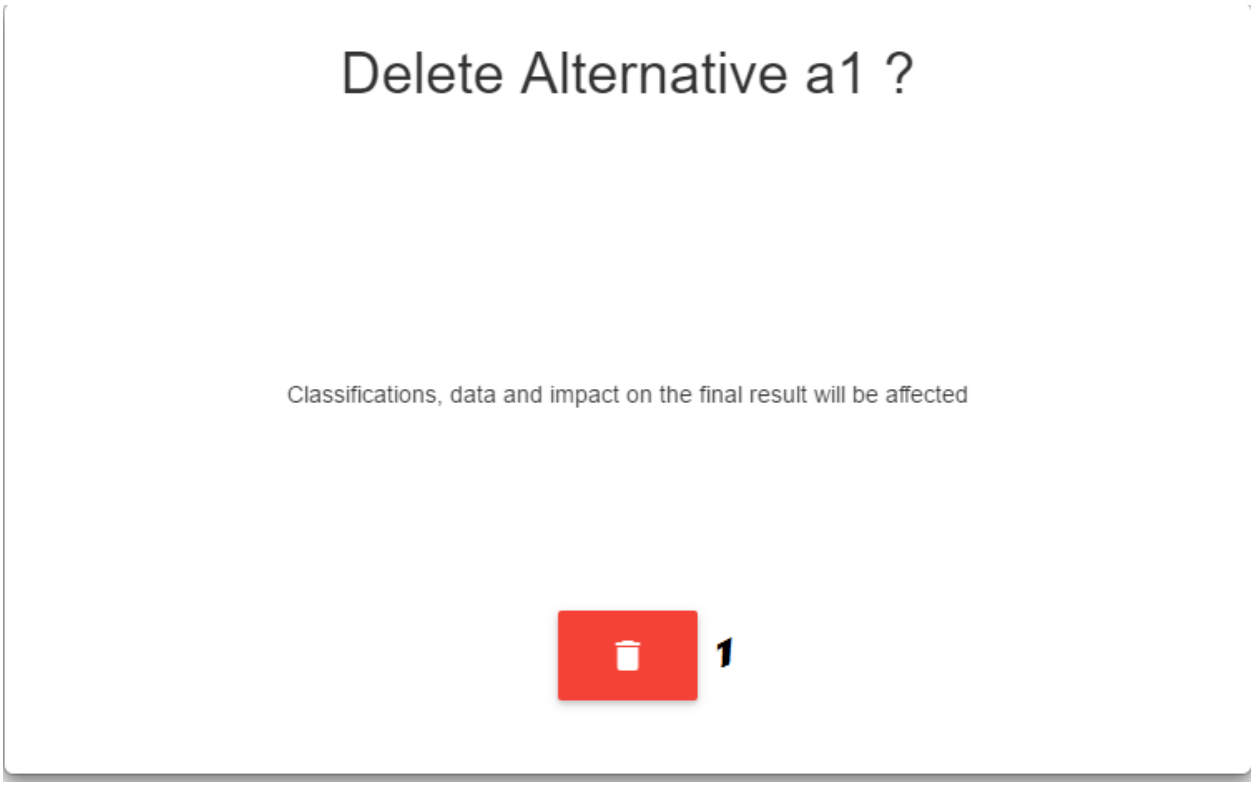
O Includes:

- Selection of the decisior.
- Selection of the criteria.
- Selection of the weight of the alternative.

O If any of the previous 3 fields is not selected, no write to the database will be performed.

23.Erase an alternative.

If you want to delete an alternative, select the "Erase alternative" button (20.4), which will show the following screen:



On this screen we found:

- 1. Erase alternative button: clicking here, we remove the alternative from the problem.

By eliminating an alternative, we eliminate all information regarding this including the assessments that relate it to the decision makers and criteria of the problem. So it is no longer part of the final solution.

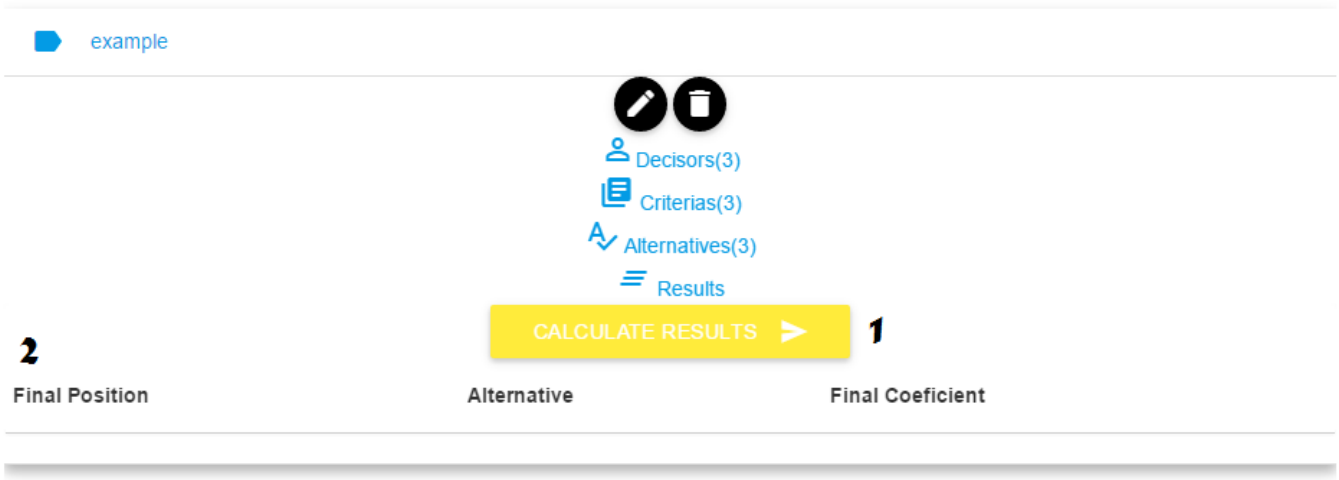
24. Weights of Alternatives.

As we saw in order to use the method correctly, it is necessary to assign "weights". In the case of the criteria the weights would be the following:

Weight	Fuzzy Value(triangle)
Extremely Low	(0,0,1)
Very Low	(0,1,3)
Low	(1,3,5)
Medium	(3,5,7)
High	(5,7,9)
Very High	(7,9,10)
Extremely High	(9,10,10)

25.To the Solution.

Clicking on "Results" (7.7), we will get the following screen display:



On this screen we found:

- 1. Calculate results button: Clicking this button starts the method. It will take all the information provided to calculate the results. Here the fuzzy numbers are actually used to represent the actual valuations of the members of the decision group.
- 2. Final table of alternatives: in this we found:
  - O Final position: indicate the final positional number of the alternative.
  - O Alternative: the possible solution to the problem.
  - O Final coefficient: coefficient obtained from the method on which the alternatives are listed.

26.Obtain Results.

When pressing the button "calculate results" (25.1), will see the data loaded and in the table:

Final Position	Alternative	Final Coeficient
1	a2	0.6466716092815469
2	a1	0.5057337753038413
3	a3	0.4279554715352456

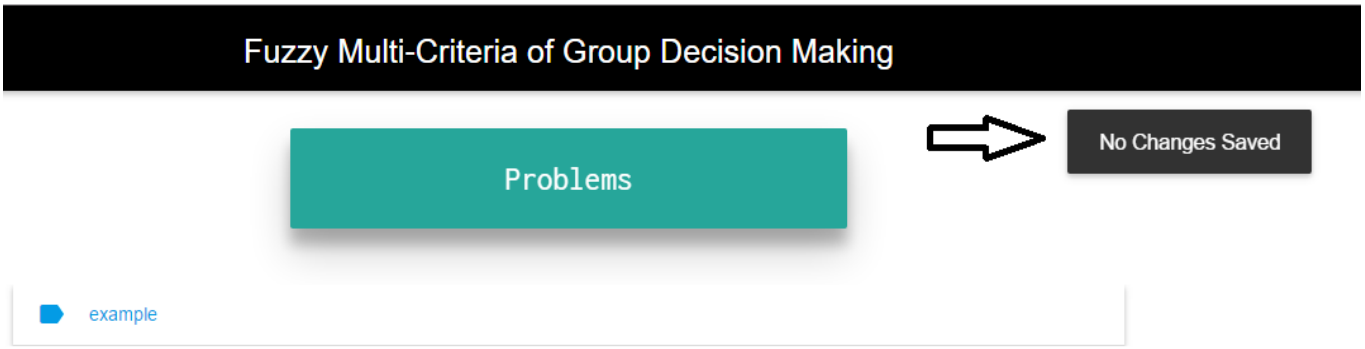
The best alternative rated by the method was alternative 2.

27.Close or hide Windows.

Upon completion of their respective functions, the screens are closed automatically. In case you do not finish an action and want to leave the screen, just click outside the screen and press the ESC key. In Help Modals also have a Close button.

28.Toasts.

"Toasts" are transient messages presented by the software each time an action is performed. For example, when no change was made, the problem list is retracted and the following toast is displayed:



Messages will appear for a period no longer than 3 seconds.

29.Automatic Generation of Components.

When creating a new problem, we indicate to the method 4 elements:

- Name of the problem.
- Number of Decisors.
- Number of Criteria.
- Number of Alternatives.

Once these values are specified, the method will generate the names of the same as follows:

Number of Decisors: 4.

- Name of decisor 1: d1.
- Name of decisor 2: d2.
- Name of decisor 3: d3.
- Name of decisor 4: d4.

Initial weight for each of the decision makers:

- "Important". (2,5,8).

Number of Criteria: 3.

- Name of criteria 1: c1.
- Name of criteria 2: c2.
- Name of criteria 3: c3.

Number of Alternatives: 4.

- Alternative 1 name: a1.
- Alternative 2 name: a2.
- Alternative 3 name: a3.
- Alternative 4 name: a4.

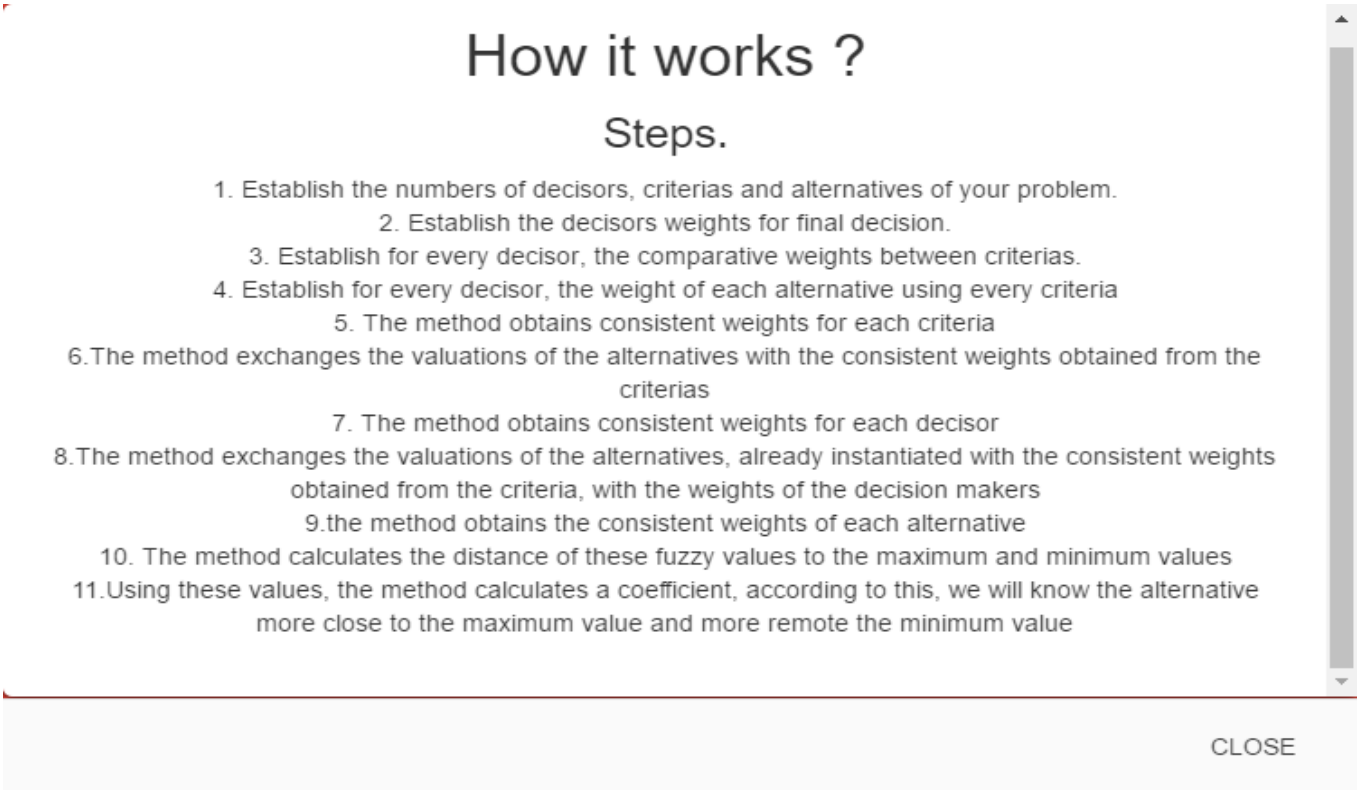
30.Others.

For:

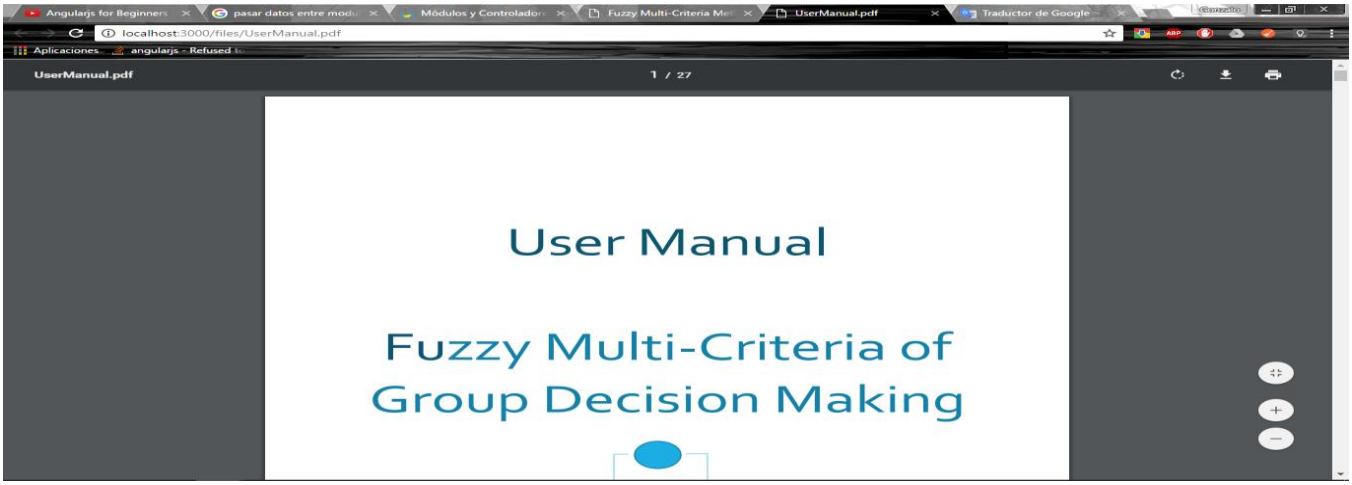
- 1.Log out.
- 2.Erase account.
- 3.View documentation.
- 4.Method steps.

Slide the mouse up when it is over the drop button to see these options.

Option 4.



Option 3.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