COLLECTIVITY'S ELEMENTS RANKING

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Abstract
The concept of homogenous collectivity is presented. The template for describing the homogenous collectivity elements is defined. Criteria for differentiating the elements are identified. An algorithm for ranking the homogenous collectivity elements is built. A software product that ranks the collectivity elements and presents the differences between them in graphical form is described.

Key words: hierarchy, homogenous collectivity, comparison, distributed informatics application.

JEL classification: C8; C89

1. Homogenous collectivity

Let be the C collectivity, formed by the elements C_1, C_2, ..., C_n. The C_i element is fully described by the characteristics D_1, D_2, ..., D_m. For each characteristic D_j a procedure that measures its level and assures the consistent reproducibility of the dataset is defined. If through a measurement process PM_1 the data from table 1 is obtained

Table 1: The first measurement process regarding the C collectivity

	D_1	D_2	...	D_j	...	D_m
C_1	X_{11}	X_{12}	...	X_{1j}	...	X_{1m}
C_2	X_{21}	X_{22}	...	X_{2j}	...	X_{2m}
...	...	...	...	...	...	...
C_i	X_{i1}	X_{i2}	...	X_{ij}	...	X_{im}
...	...	...	...	...	...	...
C_n	X_{n1}	X_{n2}	...	X_{nj}	...	X_{nm}

and if through another measurement process, using the same procedures, the data from table 2 is obtained,

Table 2: The second measurement process regarding the C collectivity

	D_1	D_2	...	D_j	...	D_m
C_1	Y_{11}	Y_{12}	...	Y_{1j}	...	Y_{1m}
C_2	Y_{21}	Y_{22}	...	Y_{2j}	...	Y_{2m}
...	...	...	...	...	...	...
C_i	Y_{i1}	Y_{i2}	...	Y_{ij}	...	Y_{im}
...	...	...	...	...	...	...
C_n	Y_{n1}	Y_{n2}	...	Y_{nj}	...	Y_{nm}

the procedures are said to be well defined if:

$$WDPI = 1 - \frac{1}{mn}\sum_{j=1}^{m}\sum_{i=1}^{n}\frac{\left|Y_{ij} - X_{ij}\right|}{\max\limits_{i,j}\{X_{ij}, Y_{ij}\}} > 0.78$$

where:

WDPI - well defined procedure index
X_{ij} - the value obtained for the j characteristic of element i through the first measurement process
Y_{ij} - the value obtained for the j characteristic of element i through the second measurement process
n - collectivity's number of elements
M - collectivity's number of characteristics

If the well defined procedure index has a value greater than 0.78, it is considered that the defined procedures ensure the dataset reproducibility.
Only after ensuring the dataset reproducibility the collectivity's homogeneity is analyzed.
The common operations from classic statistics are characteristic to homogenous collectivities. The mean, median values and other indicators are representatives only if calculated for homogenous collectivities. Let A be a collectivity for which a characteristic is measured and the values V_1, V_2, ..., V_K, are obtained.

For collectivities it is possible to compute the homogeneity degree regarding a certain characteristic. The homogeneity coefficient describes the medium square deviation as percent from the mean value of the characteristic. The homogeneity coefficient is computed by the formula:

$$HC = \frac{\sigma_X}{\overline{X}} * 100$$

where:

HC - homogeneity coefficient
σ_X - medium square deviation of X characteristic
$\overline{X}$ - X's characteristic mean value

The closer to 0 the value of the homogeneity coefficient, the more homogenous the collectivity is. For the considered A collectivity and the characteristic values V_1, V_2, ..., V_K, the homogeneity coefficient is computed as:

$$HC = \frac{\sigma_V}{\overline{V}} * 100 = \frac{\sqrt{\dfrac{\sum_{i=1}^{n}(V_i - \overline{V})^2}{n-1}}}{\overline{V}} * 100$$

where:

HC - homogeneity coefficient

σ_V - medium square deviation for V characteristic
$\overline{V}$ - average value of the V characteristic
V_i - the value of the characteristic measured for the i element
n - collectivity's number of elements

A collectivity is homogenous if it is homogenous regarding all the characteristics that describes it. If homogenous regarding all the characteristics, an aggregate homogeneity coefficient is computed as the average value of the t partial coefficients:

$$AHC = \frac{1}{t}\sum_{j=1}^{t} HC_j$$

where:

AHC - aggregate homogeneity coefficient
t - collectivity's number of characteristics
HC_j - the homogeneity coefficient's value computed regarding the j characteristic

Let be C_i a collectivity of first year students characterized by height, weight and age.

Table 3: The collectivity of first year students

Name	Height (cm)	Weight (kg)	Age (years)
Adam Ion	179	80	19
Andone Ileana	164	48	20
Baba Florin	180	83	19
Balan Bianca	164	51	20
Bodelnicu Laurentiu	179	78	20
Bu□tulea Gabriela	165	49	19
Carstea Raluca	164	49	19
Cumbea Maria	167	47	20
Drica Ramona	164	50	19
Duca Marian	183	86	19
Dumitru Manole	177	75	20
Grigore Ioana	167	50	18
Haralambie Alexandru	180	80	20
Igor Vasile	182	75	19
Panici Anton	177	77	19
Pavel Alexandra	168	46	20
Pavelescu Ionut	179	77	19
Pu□ca□ Marian	181	84	19
Saba Iulia	166	51	19
Sima Simina	168	48	18
Simion Angela	163	49	19
Tamas Silvia	166	49	20
Toma Sandu	168	78	19
Tulea Simona	163	47	19
Vasilescu Gheorghe	173	77	20
Veres Alexandru	178	81	19
Vizitiu Oana	162	47	19
Vizitiu Ramona	163	48	20

For the student collectivity, homogeneity coefficients are computed regarding the height, weight and age.

The obtained values are:

- height homogeneity coefficient HHC (Ci, H) = 4.3%
- weight homogeneity coefficient WHC(Ci, W) = 25.13%
- age homogeneity coefficient AHC(Ci, A) = 3.11%

The collectivity is homogenous regarding the height of the students, only small deviations being present. The age deviations from the average value are small, so the collectivity is homogenous regarding this characteristic.
The homogeneity degree of the collectivity is small regarding the weight. The weight characteristic varies strongly from the average value. In order to obtain homogeneity regarding this characteristic, the collectivity is split in two distinct smaller collectivities. As the gender is a strong factor of the weight of a person, the smaller collectivities are formed using the gender criterion. The female collectivity contains 15 elements while the male collectivity contains 13 elements.

For the female collectivity the following values are obtained for the homogeneity coefficients:

- height homogeneity coefficient HHC(Cf, H) = 1.18%
- weight homogeneity coefficient WHC(Cf, W) = 3.09%
- age homogeneity coefficient AHC(Cf, A) = 3.65%

For the female collectivity are obtained improved values of the homogeneity coefficients regarding the three considered characteristics compared with the initial values. The height's deviation of only 1.18% of the average value characterizes a homogenous collectivity. Homogeneity regarding the weight is attained as the value if the coefficient is of only 3.09%. The deviation of the age from the average value is stronger if compared with the initial value, but still small enough to ensure homogeneity regarding this characteristic. The female collectivity is homogenous regarding all of the considered characteristics.
For the male collectivity the following values are obtained:

- height homogeneity coefficient HHC(Cm, H) = 2.22%
- weight homogeneity coefficient WHC(Cm, W) = 4.31%
- age homogeneity coefficient AHC(Cm, A) = 2.49%

For the male collectivity the values of the homogeneity coefficients are improved if compared with the initial values. The homogeneity regarding the height is ensured by the value of the coefficient of 2.22%. The weight homogeneity coefficient is strongly improved from the value of 25.13% to a value of 4.31%. This ensures the collectivity's homogeneity regarding height. The age homogeneity coefficient has a value of only 2.49%, thus the collectivity is homogenous. As the collectivity is homogenous regarding each of the characteristics, it is considered homogenous.

By splitting the initial collectivity in two smaller collectivities using the gender criterion is attained homogeneity regarding the weight characteristic. The homogeneity coefficient values for the new formed collectivities are improved if compared with the initial values. The two collectivities are thus homogenous regarding all the considered characteristics.

To compute the homogeneity coefficients the application available online at www.vintilabogdan.ro/omogenitate was used. The application's input is a plain data file. Only one characteristic a time is computed. The file contains the values of the characteristic one on each line. After the file validation the results are presented to the user.

An empirical approach of the quality problem regarding homogeneity assumes:

- let C be a collectivity;
- the $D_j, j = 1, t$ characteristics are measured;
- the mean values of the characteristics values are computed $Dmean_j, j = 1, t$;
- the homogeneity intervals are set to $[0.975*Dmean_j; 1.025*Dmean_j]$;
- if more than 78% of the elements are within the interval for a characteristic, the C collectivity is homogenous regarding the considered characteristic;
- if for all characteristics homogeneity is achieved, the collectivity is homogenous.

If compensation is allowed between the measured characteristics, the homogeneity interval is set to:

$$AHI = \left[\sum_{i=1}^{t} \frac{1}{t} Dmean_i * 0.975; \sum_{i=1}^{t} \frac{1}{t} Dmean_i * 1.025 \right]$$

where:

AHI - aggregate homogeneity interval
$Dmean_i$ - mean value of the i characteristic's values
t - collectivity's number of characteristics

For a collectivity to be considered homogenous, 78% or more of its elements must be within the set interval. For each element in the collectivity the aggregate value is computed as:

$$AV_j = \frac{1}{t} \sum_{i=1}^{t} Di$$

where:

AV_j - aggregate value for j element
D_i - the value of characteristic i of element j
t - collectivity's number of characteristics

Assuming no compensation between the characteristics is allowed, 78% or more elements must be within the set interval for each of the considered characteristics.

2. Criteria for differentiating the collectivity elements

Differentiating between the homogenous collectivity's elements is done by a criterion or by criteria in order to obtain a complex indicator. To increase the homogeneity degree, the inhomogeneous elements are analyzed and:

- are sorted ascending;
- differences to left/right are made;
- the element with the highest deviation from the mean value is eliminated;
- the indicators are computed again;

The single criterion differentiating process assumes:

- extracting a characteristic considered by the specialists as being representative;
- setting its type (minimum or maximum);
- sorting the elements according to the considered characteristic;

The single criterion differentiating process using measurements based on procedures assumes:

- evaluating the measurement procedures to see if they ensure the reproducibility of data;
- checking the data obtained through the measurement process and eliminating the invalid values;
- extracting from the set of characteristics the one considered by specialists to be the most representative;
- setting its type (minimum or maximum);
- sorting the collectivity's elements by the considered characteristic;

The multi criteria differentiating process assumes:

- identifying many representative characteristics for defining the collectivity's elements;
- setting their type (minimum or maximum);
- normalizing;
- weighted aggregation or weightless aggregation of the characteristics;
- ascending or descending sorting;
- if there are elements with the same value for the computed aggregated indicator, additional characteristics must be taken into account when computing the indicator;

The multi criteria differentiating process using procedures for measuring the aggregate characteristics value assumes achievement of additional steps compared to the multi criteria differentiating process:
- checking the procedures to ensure the correctness of the obtained data and the reproducibility character of the measurement process;
- checking the obtained dataset and removing the invalid values;

The single criterion differentiating process based on quality estimations assumes granting points for the characteristics describing the collectivity's elements by a series of specialists using a rule set that ensures the widest estimation of the collectivity's elements and sets ground for differentiating process or different scores are set as to create gaps between the characteristics.
Let C be a collectivity formed of objects made of different metals. To realize a hierarchy of the elements, the prices of component metals are considered. Table 4 contains the component metals.

Table 4: Component metals of the collectivity's elements

Metal	Price / g	Coefficient	Grade
Platinum	200	10000	Very good
Gold	70	3500	Good
Silver	30	1500	Satisfying
Iron	0.02	1	Sufficient

To obtain the coefficients for the considered metals, all prices are divided by the lowest of them all. After computing the coefficients, grades are given. The metal with the highest coefficient receives the highest grade. The grades are then diminished proportional with the considered metal's coefficient. Using such a hierarchy the user can easily chose from the set of options.

The problem of the homogenous collectivity is raised again in this case. The mark register of a pupils' class is regarded similar:
- marks are being given; the marks are given to show the measure in which the pupils have the knowledge specified in the school programs;
- mean values are computed; for each subject at least two marks are given, depending on the allocated number of hours; the mean is computed as sum of the marks divided by their number; for the main subjects the thesis has a special weight and the mean value is computed using weights;
- aggregate mean values are calculated; these are computed as sum of mean values of the subjects divided with their number; if not all mean values of the subjects are greater or equal with the passing grade, the aggregate mean value can't be computed;
- pupils are sorted by the aggregated mean value; this is the indicator the collectivity is sorted by;
- prizes and mentions are awarded; the prize awarding process is made for each class; the prize awarding process is the same for all classes; the pupils are ranked by the aggregated mean value so the greatest aggregate value gets the highest rank (usually 1); if two or more pupils have the same aggregate mean value, they are ranked the same; prizes are awarded to pupils with rank from one to three; mentions are awarded to pupils with rank below three;

The homogeneity for this case is assured by:
- the mark system from one to ten; there are no marks that don't belong the set interval; this leads to having mean values from the same interval;
- the same teachers; for each subject that pupils learn teachers exist; all pupils study a subject with the same teacher;
- the pupils have the same age; the age differences between pupils are very small, maximum one, two years;
- the same manuals; even though there are many alternative manuals, all of them respect the school curricula;
- same study time; for all classes of a certain level, the weekly number of school hours is the same, ensuring though the same study time for all pupils;
- same evaluating methods; the knowledge evaluation is done aiming the school programs requirements;

If a school hierarchy is desired, all the pupil lists are concatenated and after that the obtained list is sorted by the aggregated mean value. The obtained collectivity is not homogenous regarding the age of the pupils.

3. Collectivity's elements ranking

Let C be a collectivity whose elements are identified by $U_1, U_2, ..., U_n$ for which the characteristics' levels were measured and a hierarchy was realized based on an aggregated indicator $V_1, V_2, ..., V_n$. To rank the elements means creating a correspondence between them and the natural numbers set. If a pair set exists
(U_1, V_1)
(U_2, V_2)
(U_3, V_3)
(U_4, V_4)
...
(U_n, V_n)
for the sorted collectivity $V_1>V_2>V_3>\ldots>V_n$, by ranking, three element sets are obtained
$(U_1, V_1, 1)$
$(U_2, V_2, 2)$
$(U_3, V_3, 3)$
$(U_4, V_4, 4)$
...
(U_n, V_n, n)
which means that the collectivity's elements are positioned as to have the first element, the last element and all the other between these two. Once the weights or aggregating model are changed, the elements are ranked different. There are few situations in which the changes don't affect the results.
If very large differences between the $V_1, V_2, ..., V_n$ exist, the ranks are corrected.
To correct the ranks, the following steps are achieved:

- the differences $D_i = V_i - V_{i-1}$ are computed;
- the smallest difference is chosen $D_{\min} = \min\limits_i D_i$;
- all differences are divided with the smallest one and rank differences result $RD_i = \dfrac{D_i}{\min\limits_i D_i}$;
- ranks are computed as $R_i = \begin{cases} 1, i = 1 \\ R_{i-1} + RD_i, i > 1 \end{cases}$

Let C be a collectivity whose elements are characterized by the values {100; 70; 40; 20; 10}.

Table 5: Qualitative ranking

Values	D_i	RD_i	R_i
100	-	-	1
70	30	3	1+3
40	30	3	1+3+3
20	20	2	1+3+3+2
10	10	1	1+3+3+2+1

This manner of ranking creates a better image of the differences between elements as it includes qualitative components.

4. Software structure for homogenous aggregates hierarchism

In order to assign ranks and gradate collectivities based on ranks, data needs to be normalized.
Let C be a collectivity with proprieties $Car_1, Car_2, ..., Car_m$ and elements $E_1, E_2, ..., E_n$. Let x_{ij} be the measured value of property j for element i. Data normalization it's done giving the nature of the property:

$$a_{ij} = \begin{cases} \dfrac{x_{ij}}{\max\limits_i \{x_{ij}\}}, \max \\ 1 - \dfrac{x_{ij} - \max\limits_i \{x_{ij}\}}{\max\limits_i \{x_{ij}\} - \max\limits_i \{x_{ij}\}}, \min \end{cases}$$

where:

a_{ij} - normalized value of property j of element i
x_{ij} - value of property j of element i
$\min\limits_i \{x_{ij}\}$ - minimum value of property j
$\max\limits_i \{x_{ij}\}$ - maximum value of property j

In case of property maximization, the normalized value is obtained by reporting measured values to the maximum value. For property minimization, is aimed the same adjustment of unfilled requirements as in the previous case.
In case of an existing reference element, data normalization is done by using the property values of that element. Let ER be a reference element in C collectivity mentioned above. The property values of ER are copied in vector V.

$V_i = ER_i$, $i=1,m$

Normalization follows the relation:

$$an_{ij} = \left| \frac{x_{ij} - V_j}{V_j} \right|$$

where:
an_{ij} - normalized value of property j of element i
x_{ij} - value of property j of element i
V_j - reference value of property j

Specialized data normalization requires data files that include metadata as well. Metadata defines descriptive elements of data contained in files. Metadata follows certain standards set out by developers of the application that uses the file.
The application for ranks computation – ORC **O**nline **R**ank **C**alculator which can be found at http://www.vintilabogdan.ro/orc - has the following characteristics:

- it is freeware; there are no fees or rates for using the application; any user wields the application, the costs summing up the computer and the network (internet) connection;
- it has a database that describes the collectivity, using a template; the database contains data that define the elements of a collectivity; the data structure is predetermined, the collectivity is described by attributes, elements and values of attributes for each element;
- the user inserts his own data by filling a data file following the template; in order to permit large data insertion, the application accepts data files; the data file is plain text, each value being separated by ";"; the data file is validated by application and the user is warned by error messages that indicates the error nature and its localization within the file; if the file is valid the user is redirected to the page where he can visualize results and select options;
- it computes the normalized values; for nomogram drawing, the data needs to be normalized; the behavior of collectivity attributes needs to be known; for each property/attribute, the data file specifies whether the maximization or minimization is desired; the normalization is done following the option previously selected;
- it aggregates; assigning ranks to the elements of collectivity is based on computation of the aggregate index; the computation takes the values of the elements proprieties; each property has

the same weight in aggregate index computation; the aggregate index defines the degree of fulfilling the requirements by the considered element;

- it draws the nomogram; the users selects the element for which the nomogram should be drawn; the application extracts the selected data from the file and cover all the steps for presenting the nomogram as a spider's web or in circular form;
- it computes the area index; in order to have the best image of the percentage in which the nomogram area of one element covers the ideal element area, the area index is computed; the area index is different for the two types of nomogram, the spider web emphasizing more the unfulfilling properties;
- it sets the user position within the collectivity; the position is computed using the area index which compares the selected element nomogram with the ideal element nomogram; the ideal element has all its properties maximized;
- it sets the user position against a selected reference element; the areas ratio of the user's element nomogram and the selected reference element nomogram; by selecting this option, the application overlaps the two nomograms, the base one in grey and the user's element in random colors with transparency degrees that allow visualization of the overlapping areas;

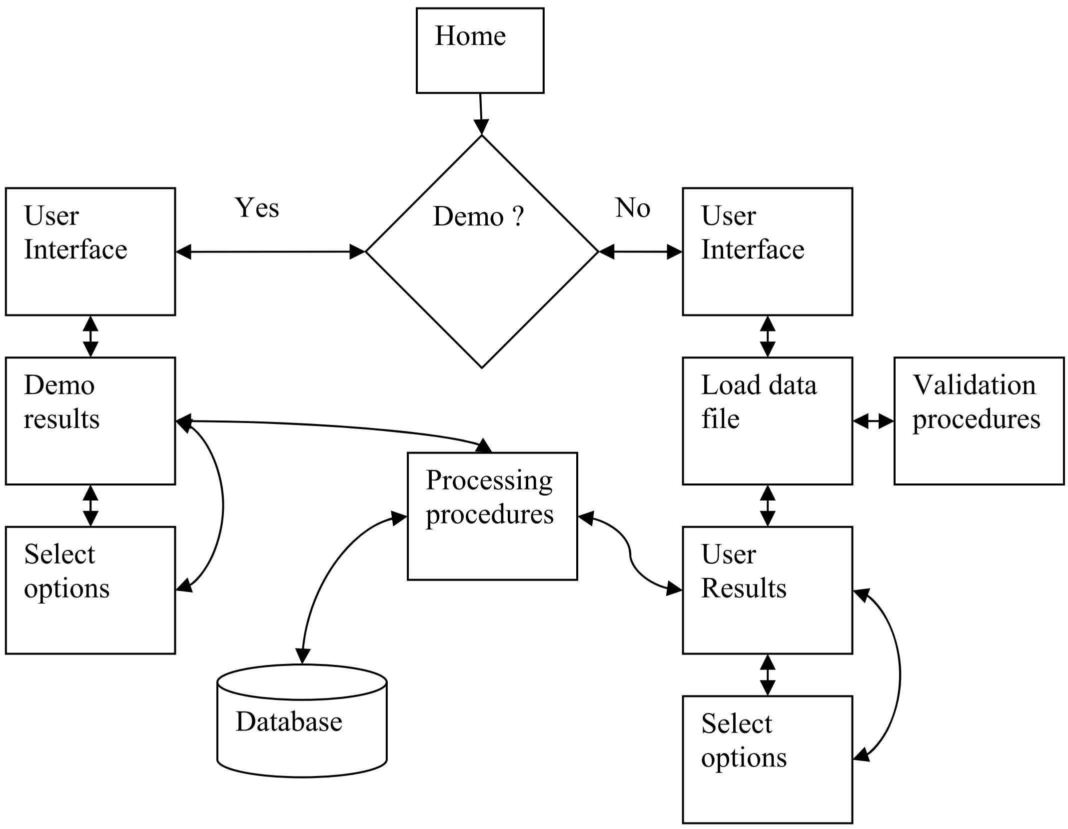

Figure 1 - ORC's application structure

The application was developed under the .NET framework, using ASP.NET and the C# programming language for data processing. The software is online and is available any time on a web server regardless of the geographical location.

The software testing was done with datasets that contain data about weight lifters. For the test datasets, the ranks of the elements, the nomograms and the intermediate computation values are known. The dataset is introduced in the database. The application extracts the data from the database, computes the necessary indexes and represents the results in graphic form. The intermediate results are verified by additional displays in development framework. By testing with the datasets, all identified errors were corrected.

For familiarizing with the application, the users apply the test dataset. The application automatically extracts the information needed from the database and user is redirected to the page where he can visualize the results.

For working with own data, the user needs to upload a file according with the template. The file is analyzed and, in case of inadequate format, the user is warned by messages.

The template file format contains:
- on the first line, the number of properties (NC) of the collectivity and number of records (NI), separated by ";";
- on the next NC lines, follows the name, the minimum value and the maximum value of the property and a variable which catch the manner of normalization (0 for property minimization and 1 for property maximization);
- on the next NI lines the records are described by record identifier and values for each properties in the order previously mentioned;

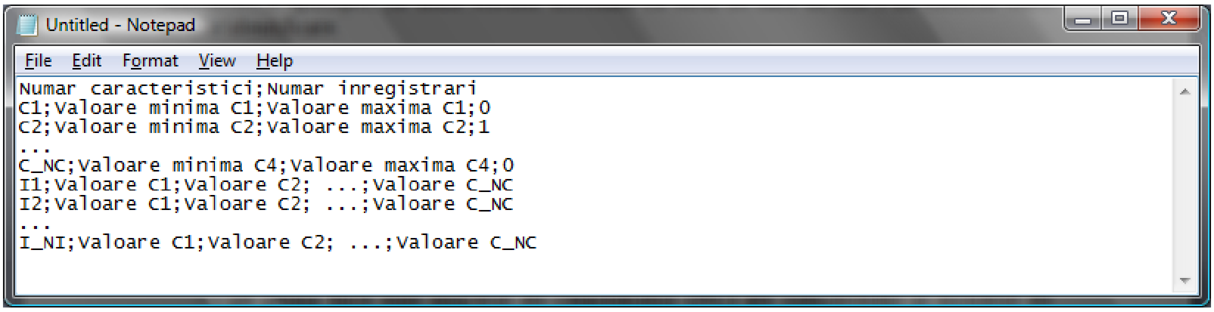

Figure 2 - Input data file structure

The error warnings displayed:
- are explicit, deciding the cause of the data file invalidity;
- are exact, specifying the property or the record which does not correspond the requirements;
- are concise, displaying the wrong value;
- are friendly, using popular terms;

After validating the data file, the users is redirected where he visualize the analysis results of the uploaded file. On this page, the user:
- selects the elements for nomogram building;
- visualizes the elements of the collectivity and the assigned ranks;
- triggers graphical comparisons of collectivity elements;
- saves nomograms;
- saves the collectivity with its assigned ranks;

The results are saved in Portable Network Graphics format for images and in Comma Separated Values format for the assigned ranks table.

Let C be a student collectivity with properties: Mathematics, Economics and English. The collectivity has 30 elements. It is required the ordering of the students by the average mark of the three objects. For problem solving, the ORC application is used. The Input file for the specified collectivity has the following content:

3;30
Mathematics;1;10;1
Economics;1;10;1
English;1;10;1
Popescu Petronel;9;10;8
...
Ionescu Vasile;10;9;10

Using the data file, the application realizes the nomograms for each member of the collectivity, the overlapped nomograms for emphasizing differences, and the hierarchism of the collectivity elements based on the computed area index.

5. Experimental results

The following table is considered containing the measurements of the people practicing bodybuilding.

Table 6: Collectivity of persons practicing bodybuilding

Name	Calves (cm)	Thighs (cm)	Waist (cm)	Chest (cm)	Arms (cm)	Weight (kg)	Height (cm)	Age (ani)
Arnold SCHWARZENEGER	50.80	72.30	86.30	144.70	55.80	106.50	188.00	21.00
Dexter JACKSON	45.70	72.60	70.00	114.00	55.00	106.00	168.00	39.00
Claudiu ROMAN	44.00	72.00	82.00	148.00	52.00	100.00	174.00	29.00
Jay CUTLER	53.00	78.50	86.50	147.50	57.00	125.00	175.50	35.00
Victor RICHARD	61.00	94.00	92.00	170.00	66.00	143.00	178.00	28.00
Gheorghe HUMA	42.00	65.00	78.00	132.00	50.00	95.00	183.00	30.00
Cristian MIHAILESCU	40.00	60.00	70.00	120.00	42.00	74.00	165.00	21.00
Fuad ABIAD	48.00	81.00	76.00	140.00	56.00	109.00	179.00	30.00
Steve HOLT	41.00	63.00	81.00	114.00	43.00	74.00	173.00	53.00

The data is recorded in application database.
The application:

- builds the nomogram for the selected element;
- compares the nomogram of the selected element with another selected nomogram;
- builds the overlapped nomogram for two selected elements; one element is used as a comparison base, and the other one is overlapped for emphasizing property differences;
- computes and assigns ranks for every element;
- saves the nomogram in image file format;
- saves the table with the collectivity elements and the assigned ranks;

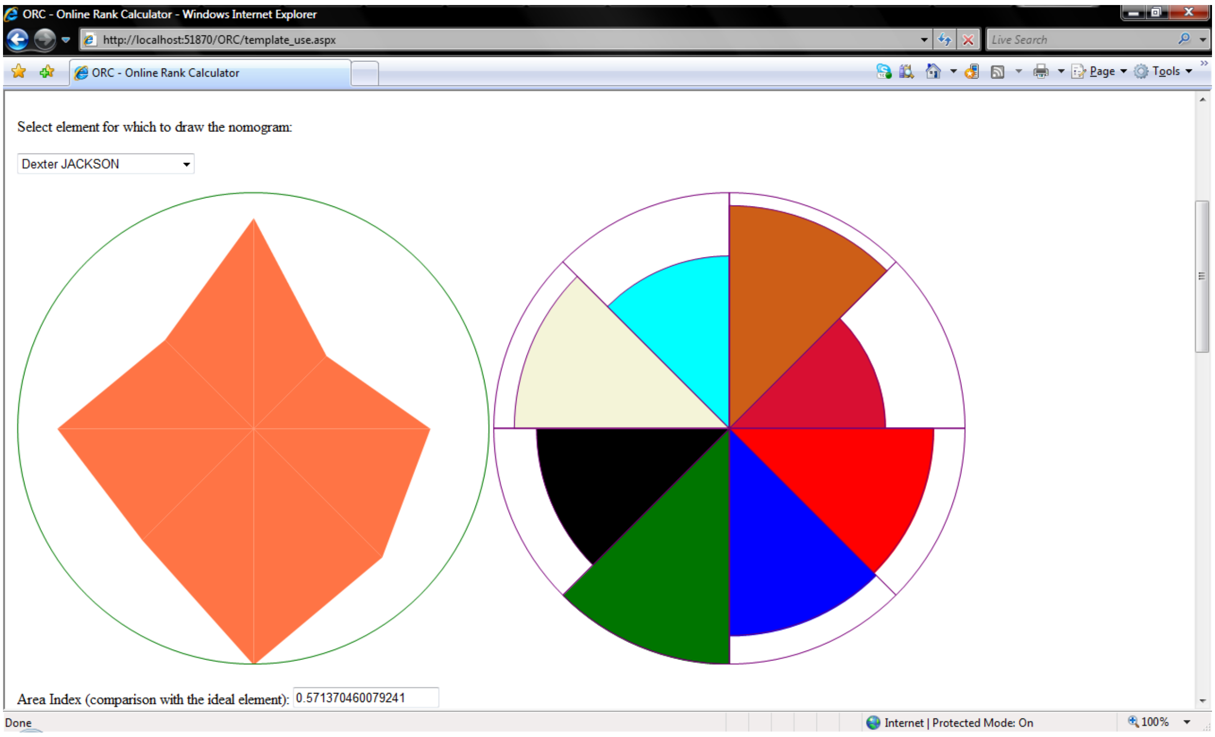

Figure 3 - Nomograms in ORC application

The left nomogram from figure 3, presents the polygon area as the aggregate index of the element. This way of representation has its weaknesses: a property with the minimum value within the collectivity is visible ratified by the graphics and by the index itself. The right nomogram of figure 3 is computed with the same weight for each property. A minimum value of one property does not ratify the index more than necessary.

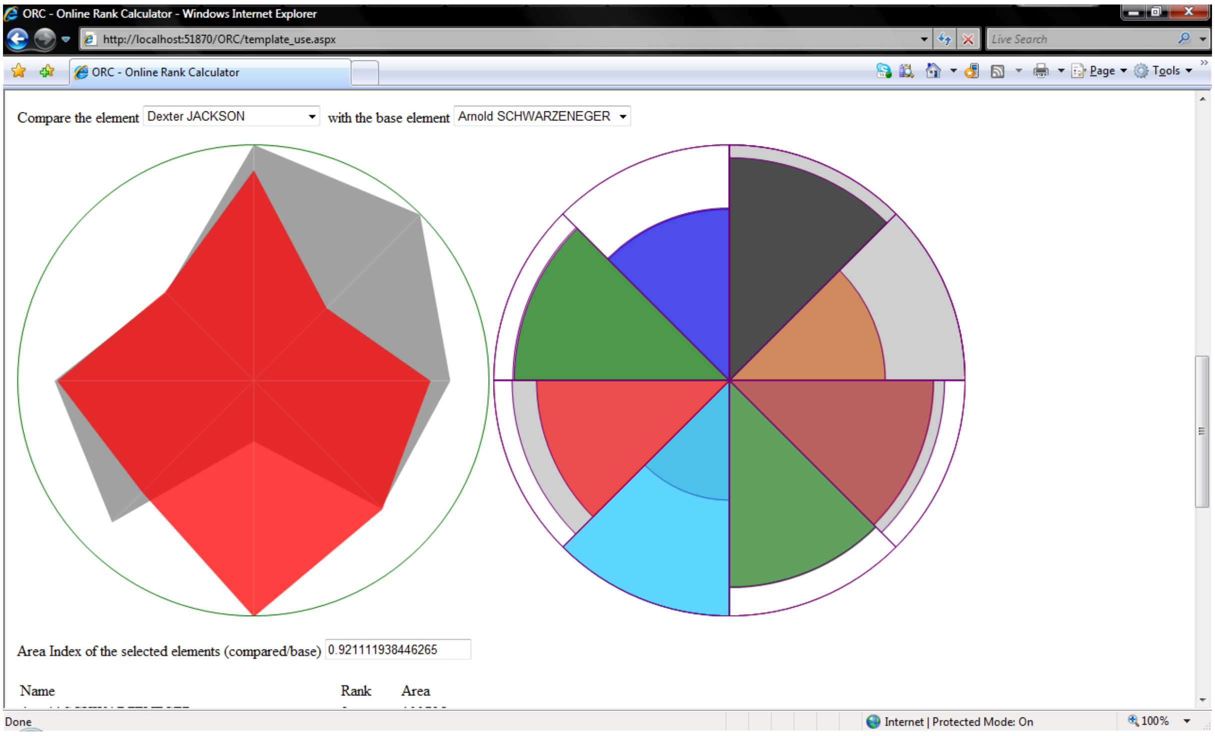

Figure 4 - Overlapped nomograms in ORC application

In figure 4 are represented overlapped nomograms for emphasizing the differences between two elements of the collectivity. The base element is in grey, and the compared element is in random color with some transparency for viewing the base element. The monochromatic representation of the nomogram means identical values for each property of the compared elements. For the right nomogram of figure 4, three situations are identified:

- single color representation meaning the perfect overlapping of the considered property;
- two colors representing (of which one is grey) meaning that value of the base property is higher than the compared element's property;
- two hues of the same color meaning that the value of the compared element property is higher than the base one;

Table 7: Collectivity ordered by assigned ranks

Name	Rank	Area Index
Cristian MIHAILESCU	1	0.8142426
Fuad ABIAD	2	0.7764382
Arnold SCHWARZENEGER	3	0.7608304
Gheorghe HUMA	4	0.7422788
Claudiu ROMAN	6	0.7373752
Dexter JACKSON	7	0.7365989
Victor RICHARD	8	0.7160073
Jay CUTLER	9	0.6802653
Steve HOLT	10	0.6355825

In table 7 is represented the collectivity ordered by the ranks assigned by the ORC application. The ranks are computed taking into account the area index. The area index represents the measure of closeness between the selected element and the ideal one.

The application features a controlled way of adding the information to the database by assigning username and password. One user is allowed to upload just one file containing data, which will be stored to the database.
Users upload the data file, the file is validated and explicit, concise and exact error messages are displayed in case of invalidity. After validating, the user is redirected to the page where are selected options, visualizations and savings. Data filled by users are not stored.

6. Conclusions

The rank determination for elements contained in a homogenous collectivity having simple or aggregate criteria is very important. Making of an element's hierarchism is vital for choosing the element which satisfies the best certain quality requirements. Assigning ranks to a homogenous collectivity helps in optimizing decision support applications, in building strategy for different collectivities by building an individual hierarchism based on the specified criteria. The rank assigning methods which include qualitative criteria result in a better hierarchy because it quantifies the differences between considered elements.

The applications for rank assigning and building element hierarchy in homogenous collectivity use graphical instruments in emphasizing differences between elements. In the future, in order to use the ORC software, the user will be prompted for a username and password given by the application administrator. These accounts grant right for working with the database, this way the data introduced will be available for future usage. A self-account creation mechanism is aimed as ulterior improvement along with payment services. For these accounts, the data persistency is assured as well as other data computed results.

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