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NEGOTIATION AND ARBITRATION SUPPORT WITH ANALYTIC HIERARCHICAL PROCESS

Abstract

While preparing to negotiations, the negotiating parties usually concentrate on the behavioral aspects of them. They consider various negotiations strategies, tactics, actions, and responses believed to be the key factors that allow them to achieve their goals. They pay not enough attention to the adequate definition of their objectives and to the consideration of how to balance shortages in one objective with excesses of the others when it is impossible to achieve the aspiration or reservation values on the individual criteria.

In the paper we consider PrOACT approach presented by Hammond, Luce, and Raiffa to structure the negotiation goals and to score and analyze the negotiation template. We also try to incorporate the AHP procedures in the process of offer evaluation that allow us to avoid simple assigning of the scores to the issues and resolutions. We believe this is important especially for the decision makers who are not skilled in the formal analysis and perceive the assigning as unclear and complicated. After the evaluation of the offers we focus on the search of the fair compromise by means of a well known game theory approach. Finally, we return to AHP which allows us to find a fair compromise in the situation where the negotiation strengths of the parties are not equal.

Keywords

Negotiation, negotiation analysis, multiple attribute decision analysis, AHP, game theory.

INTRODUCTION

Negotiations are usually perceived as conflicting processes, the solving or wining of which requires some intrinsic interpersonal skills of behavioral nature and well-trained abilities of using negotiation strategies and tactics. The vast majority of the literature on negotiation is devoted to the problem of how to act and behave during the negotiation process to achieve a satisfying agreement; it also gives some descriptive advice to the negotiators [1, 10, 9].

But since the 1980s a parallel approach to the negotiation problems has been developed, called negotiation analysis[1]. It derives from decision analysis, game theory, multiple objective programming, and other mathematical procedures and aims at giving the negotiating subjects an advice of prescriptive or normative nature [17, 12]. Nowadays these two approaches combined together allow for successful negotiation support [8]. The negotiation support, being mostly based on formal analysis, can be easily conducted in a semi-automatic way by means of the negotiation support systems, that is, expert software with implemented formal procedures and algorithms which give to the negotiators support in evaluating and comparing offers and concessions, making proposals, and conducting pre- and postnegotiation analysis. There are some successful applications of the NSS into solving real-world negotiation problems such as negotiating the reduction of the pollution emission to the atmosphere in Europe with RAINS system [5] or the problem of the Law of the Sea [15]. Presently, while e-business expands, the NSS are implemented as e-Negotiation Systems that allow negotiating via Internet, beyond the bounds of time and space, by people from very different parts of the World at a time which is the most convenient for each of them. They give not only negotiation support to the parties, but they also facilitate the communication between them and conduct the arbitration and mediation analysis [6]. They became very sophisticated tools which use may cause resistance or concern, especially to the negotiators unfamiliar with newest computer technology and formal analysis. Therefore, it is very important to equip NSS and eNS with formal models that are, on the one hand, efficient and, on the other hand, can be intuitively operated by decision makers (negotiator, arbitrator, mediator, facilitator). The problem occurring for negotiation analysts or NSS designers is: What combination of formal methods applied satisfies these two criteria simultaneously.

In the paper we will try to apply the simplest possible mathematical tools to the computer-based negotiation and arbitration support. All the procedures that require more advanced calculations and analysis will be programmed in a spreadsheet, to show that they can be easily copied into more sophisticated software. Finally, we will show an example of the use of the proposed methodology and software in the solution of a hypothetical negotiation case.

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[1] The first works on formal modeling of negotiation by means of mathematical tools have been undertaken much earlier [14], but the discipline of negotiation analysis began to shape after 1982 [11].

1. NEGOTIATION STRUCTURE

We will consider two-party multi-issue integrative negotiations[2] conducted according to the negotiation template agreed upon by both parties in the prenegotiation phase. The negotiation template is a list of all issues that are to be negotiated with predefined full range of possible resolutions (options). The template is going to be analyzed and evaluated by the parties separately in order to build their own scoring systems that reflect their individual preferences. It will allow to compare the sequence of offers, analyze the concessions, and measure the quality of the agreement under discussion. There is no need to assume that the negotiation template remains stable during the entire negotiation process, but any changes made to it, such as adding issues or modifying options, will require additional calculations and rescoring of the template. The negotiation issues reflect the parties' objectives and can be both of qualitative and quantitative nature. Since we are going to introduce a separate scoring method for options and issues comparison, it does not matter whether the options are given as nominal, ordinal, interval, or ratio.

To construct a solid scoring system we will require the negotiators to follow the PrOACT [4, 12] approach for decision making. This approach consists of five elements that are the basis of successful decision making. They are: Problem, Objectives, Alternatives, Consequences, and Trade-offs. Each of these elements requires a thoughtful analysis and together they will result in proper definition and structuralization of the negotiation problem and in realization of the relations between the issues and options, and their importance.

1. **Problem.** The first element of the PrOACT approach requires the analysis of the actual negotiation problem. The work need to be undertaken by both parties together in the pre-negotiation phase. They need to recognize the background of the conflict and all its aspects to be solved to see what must be decided, which will lead to the definition of the negotiation subject.
2. **Objectives**[3] are the criteria used to evaluate the offer which reflect the negotiator's needs, hopes, and wishes. To assess the objective true necessity the negotiator should consider why it is important to her/him and what she/he means by it. This will lead to clarification of the negotiation issues. In the negotiations, objectives are defined separately by the parties and are included in the mutual negotiation template.

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[2] The subject of the negotiation does not matter in fact.
[3] In the negotiation theory "Objectives" are sometimes called "Interests".

3. **Alternatives** are the actions that can be taken to satisfy negotiators' needs. Thinking of the alternatives will result in identifying those options that constitute the range of all possible resolutions for each negotiation issue. The process of the generation of alternatives, similar to the generation of objectives, should be conducted jointly by the parties in the pre--negotiation discussion.
4. **Consequences** of all the alternatives approved in pre-negotiation phase should be recognized at that time. The evaluation of the subjective quality and value of each alternative for the negotiators is required. Many different types of analysis can be provided here such as conditional analysis, utility analysis, ordinal ranking, etc.
5. **Trade-offs.** Since at least some of the objectives are conflicting, it is usually not possible to end with the compromise that is overall the best for both parties. In such a situation it is necessary for the parties to sacrifice some of the objectives in favor of others. Each negotiator should realize the balance of options between the issues. This requires evaluating the importance of the objectives and then the importance of the options within the objectives.

Following the PrOACT approach will result in preparing a solid common negotiation template and the negotiators' individual scoring systems that are sufficient for negotiation support.

Finally, we assume the existence of a third party – an arbitrator or mediator (or an NSS/eNS playing this role) – who will facilitate the negotiation process by helping with scoring end evaluating the offers and suggesting a "fair" agreement. The third party has access to all the data describing the negotiators' structure of preferences required to find a compromise satisfying both of them.

Having described the negotiation situation, in the next section we present a set of analytic tools whose software implementation will allow for negotiation and arbitration support.

2. ANALYTIC TOOLS FOR NEGOTIATION AND ARBITRATION SUPPORT

2.1. Negotiation template evaluation

2.1.1. Additive scoring system

One crucial issue in the negotiation structure described above requires special consideration, namely, the problem of the evaluation of objectives and alternatives with respect to the negotiator's structure of preference. This evaluation is required for analyzing alternatives consequences and trade--offs. We suggest the application of the additive scoring system which is the simplest possible tool that have already been successfully applied in such eNSs as Inspire [6] or Negoisst [15]. It requires a simple qualitative between-issues and within-issues analysis consisting of two steps:

1. Distributing a certain amount of scoring points among all the issues established in the negotiation template.
2. Assigning scoring points allocated to the issue to all its resolution levels.

The scoring points allocated to each negotiation issue describe its importance. If the score of 40 is assigned to an issue, this issue is more important than two others which scores sum up to 30. Since the values which we assign to each issue come from a particular amount of scoring points, we can also explain the scores on a ratio scale calling the issue with the score of 20 twice as important as the issue with the score of 10.

The allocation of scoring points to resolution levels within issues follows a different rule. The level that best satisfies the issue receives the maximum possible score, while the level that least satisfies it, the score of 0. The other levels receive scores from the range $\langle 0; \max \rangle$, but the distributions do not have to be linear. A simple example of template evaluation is shown in Table 1. The table shows the analysis conducted by the employee that negotiates a new contract with the management.

Table 1

Scoring the negotiation template

Issue	Issue score	Resolution	Resolution score
Salary	50	3000 PLN	0
		4000 PLN	15
		5000 PLN	40
		6000 PLN	50
Holiday	30	20 days	0
		25 days	10
		30 days	30
Life-insurance	20	covered by employee	0
		covered by employer	20

Note: The issue scores sum up to 100.

One restriction has to be fulfilled to make the additive scoring system legitimate. Values associated with a given resolution of one issue cannot depend on the resolutions of other issues [11]. If the trade-offs of two issues depend on the levels of the third one then the new composite issue should be created that comprises these three issues and which values do not depend on the resolutions of the other issues.

2.1.2. AHP for template evaluation support

Even though the template evaluation with additive scoring systems seems to be rather easy, the process of assigning scores to issues and resolution levels can be a little vague and artificial, especially for the negotiators who had never followed such quantitative analysis before. Therefore we suggest applying the AHP procedure as a support tool for construction of a scoring system[4]. To use AHP methodology for negotiation support with the structure described in Section 1, we obviously need to satisfy the axioms that are the basis of this approach [13]. The reciprocal axiom is satisfied when we assume that our negotiators act rationally. The software support we suggest allows us to satisfy this axiom by using the ratio scale interpretation. If a negotiator rates one resolution level to be 3 times better than another one, the support system will

[4] The problem of usefulness of AHP for negotiation support has been discussed before in some papers, e.g. [7].

automatically interpret the latter to be 1/3 as good as the former one. The homogeneity axiom should be sufficient because the pre-negotiation phase analysis is conducted that results in the construction of negotiation template. The resolution levels established for each issue in negotiation template comprise the subset of all possible levels for this issue. Since the pre-negotiation phase allows to discuss the negotiation problem and find the preliminary negotiation set, the resolution levels proposed should not differ by more than one order of magnitude. The third axiom of judgment independence is similar to the one we had to satisfy when applying the additive scoring system described in Subsection 2.1.1. Having satisfied the three main AHP axioms we can assume that AHP procedure will result in appropriate judgments and can be incorporated in our notion of negotiation support.

We will use a nine-point verbal scale for comparison of the importance of issues and resolution levels, and the AHP rating approach for large numbers of alternatives [3]. In our negotiation case the procedure will consists of three steps:

1) application of the AHP procedure to pairwise comparisons of the issues,
2) application of the AHP procedure to pairwise comparisons of the resolution levels within each issue,
3) synthesis of results.

The characteristic AHP hierarchy for our negotiation problem described in Table 1 in terms of overall goal, criteria (issues), and resolution levels is shown in Figure 1.

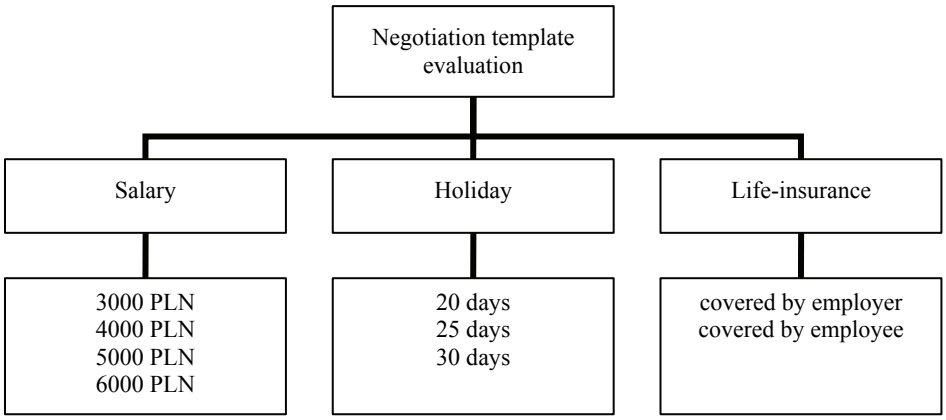


Fig. 1. AHP hierarchy for negotiation template evaluation

After completing Step 2 we will need to rescale the scores determined for the resolution levels of every issue. It is required to obtain an additive scoring system corresponding to the one proposed in section 2.1.1. We can apply the AHP rescaling formula proposed in Expert Choice [2]:

$$\tilde{s}_i^{rl} = s_i^{rl} \frac{s_i}{s_i^{\max}} \tag{1}$$

where:

$\tilde{s}_i^{rl}$ – is the rescaled score of the resolution level *rl* of issue *i*,

s_i^{rl} – is the original score of the resolution level *rl* of issue *i* obtained in Step 2,

s_i – is the original score of issue *i* obtained in Step 1,

$s_i^{\max}$ – is the maximum original score of any resolution level of issue *i*.

But this rescaling method leads us to the scoring system with the scores of different interpretation from the ones in Table 1. Since we had applied the AHP for within-issue analysis (Step 2), we obtained the reservation level scores of ratio scale interpretation. Hence, the score assigned to the worst resolution level is not 0, but a positive value, which describes how many times it is worse than the best one for this issue. To avoid this side effect we can apply a different rescaling method, but we suggest retaining this ratio scale interpretation, since it can be useful in comparing complete alternatives and in considering how much one alternative is better than another one.

2.2. Negotiation template analysis

Having completed the between- and within-issues quantitative analysis with the tools proposed in subsection above, the negotiators obtain the scoring system of the negotiation template that can be used in the negotiation phase for analyzing consequences and trade-offs (which we call template analysis). The negotiator knowing the scores of each resolution level within each issue may now compare two offers and judge which one is better based on the total sum of scores that they receive from the negotiation template. This is the negotiation support aspect we wanted to achieve. For instance, based on the template described in Table 1 the negotiator knows that the difference between agreeing

for 25 days of holidays or 30 days of holidays is of the same importance as the difference between agreeing for life-insurance coverage by the employer or by the employee himself, herself. And further, she/he will agree for a salary reduction from 6000 PLN to 5000 PLN, but will request 25 days holidays instead of 20 days to balance the difference in scores. Finally, she/he can judge the offer of 4000 PLN, 25 days of holidays, and life-insurance coverage by the employee to be worse than the offer of 3000 PLN, 25 days holidays, and life-insurance coverage by the employer, since the former produces the total payoff of 25 and the latter, the payoff of 30. The negotiation support system can easily support this simple calculation.

But there is another aspect of the template analysis that can be successfully supported with the tools proposed previously. It is an arbitration process that focuses on the search of a mutually accepted and satisfying agreement.

2.2.1. Game theory approach for arbitration support

The simplest way to support the arbitration procedurees is to incorporate the game theory approach [12, 16]. When randomization is assumed (which is acceptable for integrative negotiations), the approach focuses on finding the set of extreme-efficient contracts in order to derive from it the single alternative as the equitable or fair one. We recommend that three conceptions of the symmetric analysis be considered, which are most frequently applied for solving such two-person conflict:

1. **Maximizing the sum**.
   We seek an alternative a^e that produces the maximum sum of the payoffs of both negotiators:

$$s(a^e) = \max\{s_A(a^e) + s_B(a^e) : a^e \in A^e\} \tag{2}$$

   where:

   $s(a^e)$ is a total payoff for the alternative a^e,

   $s_A(a^e)$ is a payoff the negotiator *A* receives for the alternative a^e,

   ($s_B(a^e)$ is defined similarly for the negotiator *B*),

   A^e is the set of extreme-efficient contracts.

2. **Maximizing the minimum**.
   This approach was originally proposed by von Neumann and Morgenstern for solving two-person non-cooperative games. It identifies a fair alternative a^e that maximizes the minimum payoff of either negotiator *A* or negotiator *B* and which global score is given as:

$$s(a^e) = \max\{\min\{s_A(a^e), s_{\mathbf{B}}(a^e)\} : a^e \in A^e\} \tag{3}$$

   We will apply this approach in a modified form. Since we accept the reservation levels which the parties can derive from their BATNA, we will maximize the minimum of the proportion of potential [12] (for details see Section 3).

3. **Maximizing the product**.
   Basing on the concept of the Nash solution of the game we seek an alternative a^e that maximizes the payoffs product of both negotiators:

$$s(a^e) = \max\{s_A(a^e) \cdot s_{\mathbf{B}}(a^e) : a^e \in A^e\} \tag{4}$$

Since these three notions can be easily explained to and interpreted by the negotiators, we will use them simultaneously in our arbitration analysis.

2.2.2. AHP for arbitration support

The game theory approach is commonly applied for seeking a fair or equitable compromise, but it does not take into consideration the negotiation strength of the parties. When we face a problem with disproportional negotiation strength, we need to analyze how the weaker negotiator is impacted by the acceptance of a compromise which gives a much better payoff to his/her partner than to himself/hereself. This is a very complicated psychological problem widely discussed in many papers on the psychology of conflict and is not the subject of this paper. But we will propose a procedure to determine the best compromise in the situation in which we are able to describe the negotiation strength quantitatively. We will incorporate the AHP approach for many players [3]. This approach will follow the analysis we conducted before in Subsection 2.1.2 for negotiation template evaluation and will require assigning to the negotiation parties weights which reflect their negotiation strength. The weights have to sum up to 1. If there are more than two negotiating parties we can recommend the AHP procedure with verbal judgments to find appropriate weights. If there are only two parties, not more than a simple calculation is required to solve the equation:

$$ax + x = 1 \tag{5}$$

where:

a – describes how many times the negotiation strength of one negotiator is greater than that of the other, and must be subjectively assumed by NSS/sNS or the arbitrator,

ax, x – is the weight reflecting the negotiation strength of the parties.

This step will lead us to the weights of the ratio scale interpretation required for AHP analysis. Before the analysis we need to add another level of hierarchy to the current AHP hierarchy structure. This level will reflect the parties' negotiation strength. The AHP synthesis procedure will then use the weights of resolution levels, the weights of issues, and the weights of the parties. The offer that receives higher priority should be recommended as the fair compromise.

The hierarchy structure of the problem of the application of AHP for determination of negotiation compromise is shown in Figure 2.

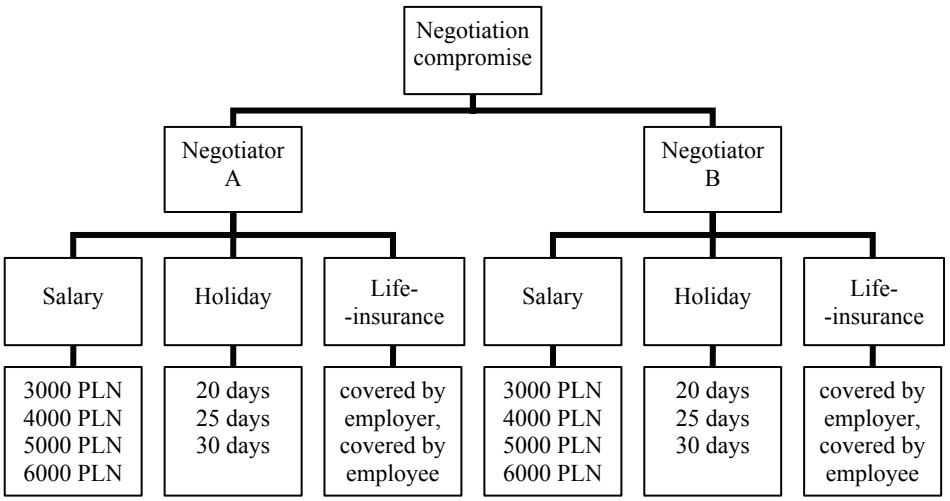


Fig. 2. AHP hierarchy for determination of negotiation compromise

3. EXAMPLE

We will now apply the above idea to the negotiation and arbitration support for a hypothetical example of bilateral negotiation. Let us explore the negotiation problem as presented in Figure 1. Next, we will consider three issues: the first of four resolution levels, the second of three, and the last of two. In order to construct an additive scoring system we use the AHP pairwise comparison to evaluate, first, the ranking of the issues and then the ranking of the resolution levels for each party, separately. After completing this comparison we will check the consistency of the evaluation based on a consistency ratio [3]. The process of ranking construction can be simply programmed in a spreadsheet (we will use MS Excel) based only on standard formulas without necessity of incorporating macros or VB scripts. An adequately programmed spreadsheet for ranking construction is shown in Figure 3.

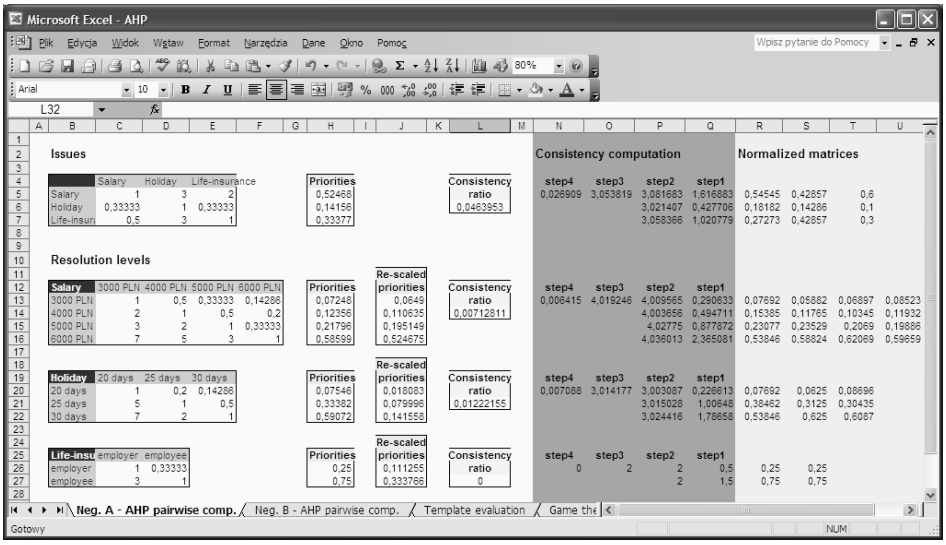
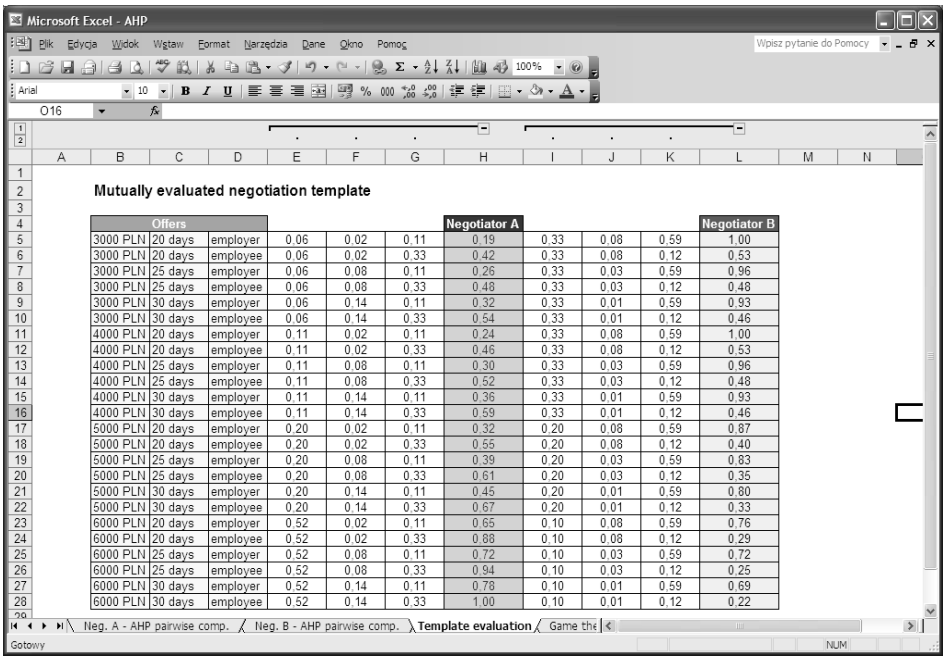


Fig. 3. Spreadsheet for issues and resolution levels ranking evaluation

Another sheet is similarly programmed for the negotiator B. The rankings of acceptable consistency determined for both parties allow for construction of mutually evaluated negotiation template (see Figure 4).



Offers						Negotiator A				Negotiator B
3000 PLN	20 days	employer	0.06	0.02	0.11	0.19	0.33	0.08	0.59	1.00
3000 PLN	20 days	employee	0.06	0.02	0.33	0.42	0.33	0.08	0.12	0.53
3000 PLN	25 days	employer	0.06	0.08	0.11	0.26	0.33	0.03	0.59	0.96
3000 PLN	25 days	employee	0.06	0.08	0.33	0.48	0.33	0.03	0.12	0.48
3000 PLN	30 days	employer	0.06	0.14	0.11	0.32	0.33	0.01	0.59	0.93
3000 PLN	30 days	employee	0.06	0.14	0.33	0.54	0.33	0.01	0.12	0.46
4000 PLN	20 days	employer	0.11	0.02	0.11	0.24	0.33	0.08	0.59	1.00
4000 PLN	20 days	employee	0.11	0.02	0.33	0.46	0.33	0.08	0.12	0.53
4000 PLN	25 days	employer	0.11	0.08	0.11	0.30	0.33	0.03	0.59	0.96
4000 PLN	25 days	employee	0.11	0.08	0.33	0.52	0.33	0.03	0.12	0.48
4000 PLN	30 days	employer	0.11	0.14	0.11	0.36	0.33	0.01	0.59	0.93
4000 PLN	30 days	employee	0.11	0.14	0.33	0.59	0.33	0.01	0.12	0.46
5000 PLN	20 days	employer	0.20	0.02	0.11	0.32	0.20	0.08	0.59	0.87
5000 PLN	20 days	employee	0.20	0.02	0.33	0.55	0.20	0.08	0.12	0.40
5000 PLN	25 days	employer	0.20	0.08	0.11	0.39	0.20	0.03	0.59	0.83
5000 PLN	25 days	employee	0.20	0.08	0.33	0.61	0.20	0.03	0.12	0.35
5000 PLN	30 days	employer	0.20	0.14	0.11	0.45	0.20	0.01	0.59	0.80
5000 PLN	30 days	employee	0.20	0.14	0.33	0.67	0.20	0.01	0.12	0.33
6000 PLN	20 days	employer	0.52	0.02	0.11	0.65	0.10	0.08	0.59	0.76
6000 PLN	20 days	employee	0.52	0.02	0.33	0.88	0.10	0.08	0.12	0.29
6000 PLN	25 days	employer	0.52	0.08	0.11	0.72	0.10	0.03	0.59	0.72
6000 PLN	25 days	employee	0.52	0.08	0.33	0.94	0.10	0.03	0.12	0.25
6000 PLN	30 days	employer	0.52	0.14	0.11	0.78	0.10	0.01	0.59	0.69
6000 PLN	30 days	employee	0.52	0.14	0.33	1.00	0.10	0.01	0.12	0.22

Fig. 4. Negotiation template evaluated by both parties

This negotiation template can be used directly by parties for negotiation support. The parties can analyze negotiation offers and consider the concessions made by the partner using a trade-off analysis. For instance, the offer of the negotiator B of {4000 PLN; 20 days, employer} gives to the negotiator A the score (0,24 scoring points) which is better than the one of {3000 PLN; 20 days, employer} by 0,19 points. Therefore it will be perceived by the negotiator A as a concession, although it did not require a true concession from the negotiator A (both offers have the same score of 1 for her/him). And, further, if the negotiator B suggests the salary reduction from 5000 PLN to 4000 PLN while leaving 30 days of holidays and life-insurance coverage by the employee, which for the negotiator A is a move from the offer of 0,45 to one of only 0,36 then the negotiator A will ask to leave the salary at the level of 5000 PLN, but to lower the request of 30 days of holidays to 25 days instead (an offer which ensures the score of 0,39). Many other trade-off analyses can be conducted similarly.

A further template analysis of arbitration support requires somewhat more advanced tools. First, we apply the game theory approach. To find a fair compromise the spreadsheet has to be prepared by listing all the resolution levels for all the issues considered. Then, binary cells corresponding to every resolution level must be identified that will indicate the level chosen for a compromise. The values of these cells must sum up to 1 within each issue. Adequately prepared spreadsheet cells are presented in Figure 5 in the range B4:E17.

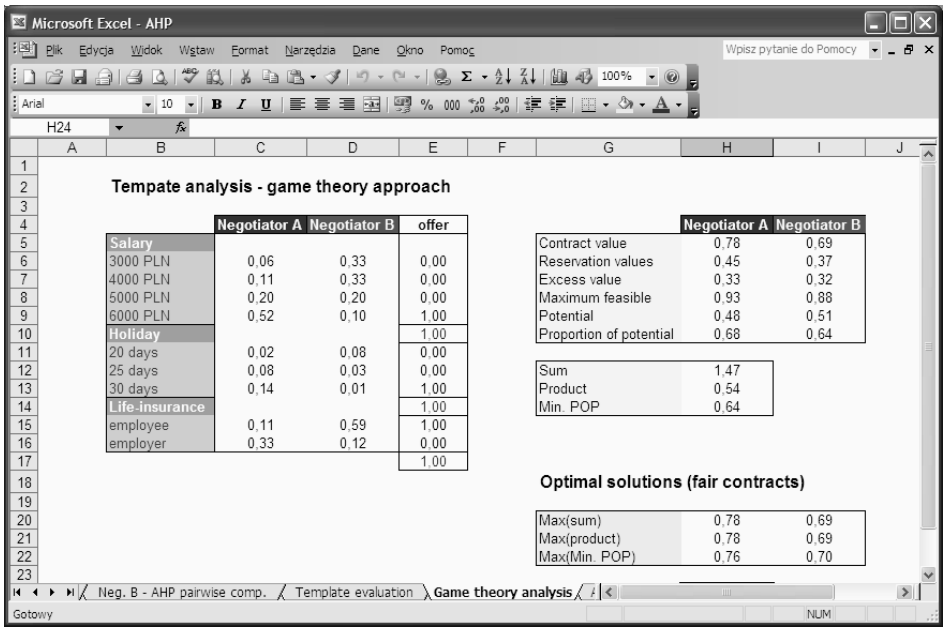


Fig. 5. Arbitration support based on game theory

In the next step we identify (and store in cells H5:I5) the scores which each party receives for a contract described with binary cells that are the sum of products of column C and E (for the negotiator A) and D and E (for the negotiator A). These values will be used to calculate the total sum (H12) and the total product (H13) of offers that we are going to maximize according to the approach presented in Subsection 2.2.1. We also allow for introducing reservation values that come from parties' BATNA, but they can be set to 0 if not known. We are now looking for the maximum of minimum of the proportion of potential, which is (individually) the excess (the difference between

the contract and the reservation values) divided by the potential (the difference between the maximum feasible value that can be achieved for the partner's reservation value and his/her own reservation value).

To find a fair compromise we need to run the Solver thrice. First, we maximize the cell H12 (the sum) allowing Solver to manipulate the variables from column E with the following constraints:

– the sum of the values from column E must be 1 within the groups of issues: SUM(E6:E9) = 1, SUM(E11:E13) = 1, SUM(E15:E16) = 1
– the values from column E must be non-negative (we can also wish them to be integers, but it is not necessary, since we assumed that randomization is possible),
– the excesses (H7:I7) must be non-negative.

Next, we receive the optimal solution, which is the offer {6000 PLN, 30 days, employee} that gives the score of 0,78 points to the negotiator A and of 0,69 points to the negotiator B. The Solver gives the same recommendation if we maximize the product (cell H13). When we maximize the minimum proportion of potential (cell H14) the negotiators receive the scores 0,76 and 0,70, respectively, but for the randomized offer. The randomized offer is shown in Figure 6.

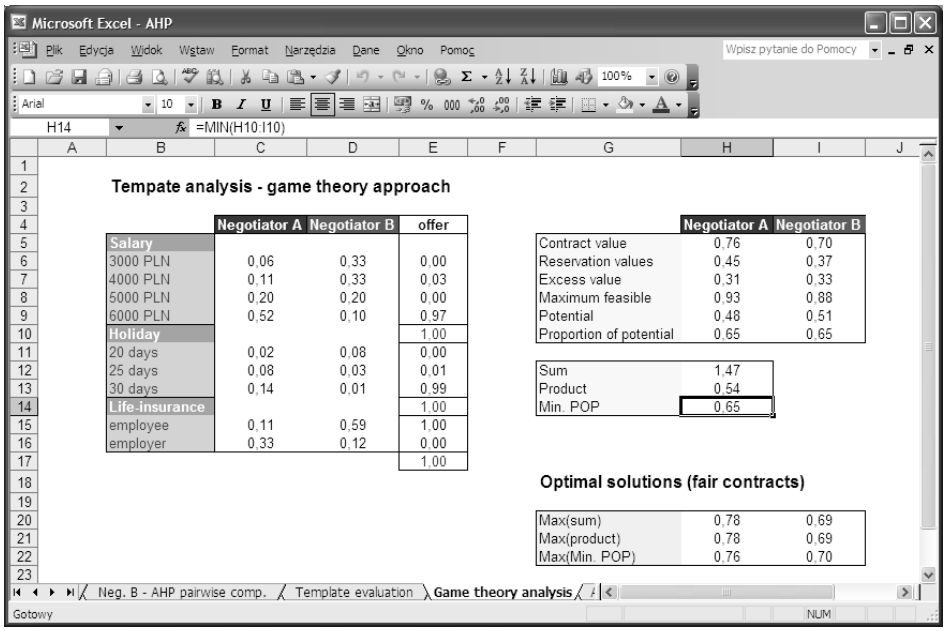
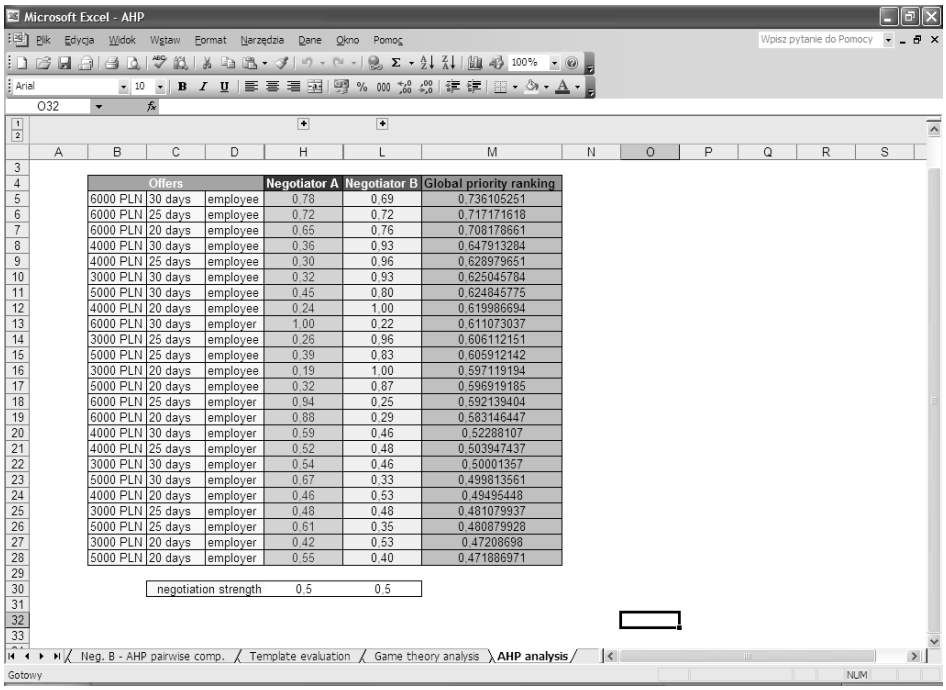


Fig. 6. Randomized compromise generated for maximizing the minimum proportion of potential

The arbitration support with the AHP approach is far easier. We need to assume (or calculate) the negotiation strength of the parties first and then to compute the global score for every feasible offer, which is a weighted sum of the individual scores multiplied by the strength weights. Thus, we obtain the global ranking where the offer with the highest score should be recommended as the fair one (see Figure 7). In our example, using weights reflecting equal negotiation strength of each party, we obtain the same recommendation for the fair compromise as in the case of maximizing the sum and maximizing the product in game theory based approach.



Offers			Negotiator A	Negotiator B	Global priority ranking
6000 PLN	30 days	employee	0,78	0,69	0,736105251
6000 PLN	25 days	employee	0,72	0,72	0,717171618
6000 PLN	20 days	employee	0,65	0,76	0,708178661
4000 PLN	30 days	employee	0,36	0,93	0,647913284
4000 PLN	25 days	employee	0,30	0,96	0,628979651
3000 PLN	30 days	employee	0,32	0,93	0,625045784
5000 PLN	30 days	employee	0,45	0,80	0,624845775
4000 PLN	20 days	employee	0,24	1,00	0,619986694
6000 PLN	30 days	employer	1,00	0,22	0,611073037
3000 PLN	25 days	employee	0,26	0,96	0,606112151
5000 PLN	25 days	employee	0,39	0,83	0,605912142
3000 PLN	20 days	employee	0,19	1,00	0,597119194
5000 PLN	20 days	employee	0,32	0,87	0,596919185
6000 PLN	25 days	employer	0,94	0,25	0,592139404
6000 PLN	20 days	employer	0,88	0,29	0,583146447
4000 PLN	30 days	employer	0,59	0,46	0,52288107
4000 PLN	25 days	employer	0,52	0,48	0,503947437
3000 PLN	30 days	employer	0,54	0,46	0,50001357
5000 PLN	30 days	employer	0,67	0,33	0,499813561
4000 PLN	20 days	employer	0,46	0,53	0,49495448
3000 PLN	25 days	employer	0,48	0,48	0,481079937
5000 PLN	25 days	employer	0,61	0,35	0,480879928
3000 PLN	20 days	employer	0,42	0,53	0,47208698
5000 PLN	20 days	employer	0,55	0,40	0,471886971

negotiation strength	0.5	0.5

Fig. 7. AHP based arbitration support

SUMMARY

In the paper we have suggested simple negotiation and arbitration support. This support is based on an additive scoring system that have already been applied in real-word negotiation support systems, but we combine it with AHP methodology to find the process of the negotiation template evaluation

easier and more intuitive. We believe that this approach is an alternative to the simple assigning of scores, which can be perceived by as too abstract. Furthermore, we apply the commonly known game theory approach for seeking a fair compromise within such evaluated negotiation template and show that AHP can still be used for a similar analysis. Finally, we show that all the computations can be done in a simple spreadsheet, and consequently, they can be performed by a negotiation and arbitration support system which simplifies the negotiators' task even more. The spreadsheet, as presented in the paper, requires some preparation work, but can be easily automated with a VB programme which uses dialog boxes. Writing such programme is the next step of our research; it will show how easy it is to construct support tools that allow us to make the negotiation process clearer, faster, and fairer.

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