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# Consensus for Team play

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The beginning of Consultation Algorithm started with proving the old saying "two heads are better than one", and the theory of group problem solving has been already researched in the field of artificial intelligence. If solutions provided by a group are better than that brought up by an individual, the old saying "two heads are better than one" can be more right. The method of choosing the best program by numerous people is called Consultation Algorithm. "Algorithm called 3-hirn was proposed by Ingo in the field of chess" This system consists of two computer chess programs and one person. First, each programs output a candidate move, and the player adopt one of the move from candidates. According to the experiment result, the player can give some rating,  $200 \pm 50$  chess capability can be improved. From this system, good candidate can be chosen from a group of low leveled candidates. In general, the program is able to select good candidate, and it can become the best move in the game of chess. In the field of Artificial Intelligence, there are many studies about computer Consultation Algorithm. Based on consultation, the most reasonable judgment is possible to be chosen. As a result, I began my study by conducting a survey for a new Consultation Algorithm. In the process of consensus formation, the most popular way is voting Yes or No, the higher number of people wins. According to this method, the intermediate answers can be rolled out, and you do not have to make tough decisions. As the fastest way of choosing the best answer, it is being used constantly. Although, it may be the best method especially when considering the law and country's policy, it is may not be the best appropriate one. This method always neglects the advices brought by minority. However, is there a way which can take take advice from everyone in consideration. Here, I want to present a method which can identify all stakeholder's opinion. This method not only can make participants to come up with the best conclusion which comes from their hearts, and it has the reasonability of majority rule. It also has equality and principle

of optimality. While making an agreement, the participants can discuss with each other to cancel some contradictory items, therefore, this method is more reasonable. In this way, there will be less trouble, more productivity. The system of voting is the process of analyzing. There are also Sharpley-Shubik power index and Banzhaf power index which can lead to affection to the voting system. In recent years, in the case of doing business in companies or organization, the combination of Linear Programming Model and Analytic Hierarchy Process are constantly being used as effective ways to make decisions or plans. As for the personal decisions, the AHP (Analytic Hierarchy Process) is very useful. This is one of the structured methods based on the analysis on decision making, which is meant to conduct decision making under complex situations and while considering personal judgment and system approach. AHP can play a good role in complex group decision making, and also in politics, business, industry, medical, and education. Other than being the "right way", AHP is the best method to lead to the best decision based on the users' understanding and the factor of inevitability. "There is method called ANP, which is able to use more complicated evaluation architecture." "I have roughly described about consultation algorithm. Next, I will introduce relation between each chess engine programs value and benefit of group. "The mathematic model involved with the idea of Consultation Algorithm is created. The bigger one group is, the smaller the share every engine holds, which means the gross profit of each engines become smaller. Therefore, if the scale of one group gets bigger, the small its value will become. Because of this, the question is how to choose the right size of one group in order to achieve the most value. In recent years, research group of Ito suggested to test the effectiveness of consultation algorithm by applying it to Shogi. Consultation Algorithm collects numerous advises and decides the next move. By using this, the move made by loosely coupled multiprocessor can be concentrated. research group of Ito used Consultation Algorithm (majority vote, optimistic consultation algorithm and random Consultation Algorithm) and collaborated Strong Shogi programs (Bonanza, YSS, GPS), successfully developed a great program. After that, they implemented the algorithm called "optimistic consultation" to the chess engine Crafty. From this we can see that consultation algorithm has better performance. So far, Ito has only put forward the Consultation Algorithm of optimistic, random and majority vote, there are still other kinds of consultation algorithm. Because majority vote only concentrates on advises brought by more people, the minority may be neglected. By using this method, is it non-prejudice or omnipotent? Is there a more reasonable and fair way to do this? From that point, we have proposed a new method of consensus making. This is a method of choosing a program with the close rating (if too separate apart, there is a down trend), and then choosing the best move generated from voting, and then fight in the game. From example, the voter can give points of 2, 1, and 0, to conduct voting,

the one with the most points will be made candidates. This method is not majority voted, it has considered all the opinions to obtain the best answer, therefore it is considered as the method will concentrate on the accordance of public opinion. Ballot vote can urge the agreement. Based on this experiment, we used simple majority voting algorithm, The voting is the future trend and will be conducted in research. In the future, by compared with majority vote, dominance of majority vote and consensus building will be compared. In our experiment, we verified the difference of rating in chess caused by simple majority voting. And we also analysed the adopted rate of each chess engines candidate.