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Optimizing the Making of Karate Match Bracket with Tournament Bracket Seeding: Case Study of Inkanas West Java

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Abstract:
Based on World Karate Federation regulations, organizers of both Karate and Kata Karate competitions must follow the World Karate Federation standards, including the use of new rules on panel point assessments for Kata Class and refer-change or double knockdown for Kumite Class. In Indonesia, the big competition has used the knockout system or refer-change. The biggest challenge for the organizers of the competition is to make the matchmaking tournament bracket balance with shorter time and less effort required. In one competition there are more than 100 class matches where from each class of matches must be provided a match bracket quickly and effectively. In general, the match bracket will be made after the athlete's data verification completed and technical meeting are held. Problems arise when athletes from the same contingent face off at the start of the match and this problem makes the bracket not balance. Several methods are used to create the match bracket, but the results are still less than optimal because the number of athletes from the same contingent that facing off each other at the beginning of the match is still high. With some experiment in applying the algorithm to the existing method, the Tournament Bracket Seeding is expected to overcome these problems effectively and efficiently. The output of the method is to decrease the percentage of athletes from the same contingent that not supposed to match at the beginning of the match.

Keywords: Karate, tournament bracket, World Karate Federation standards.

INTRODUCTION

Regulations at the World Karate Federation obliged for every match to use a system for the assessment, which is expected to be an easy way for the organizing committee to holding a match. Usually in one match there are 100 or more class matches so they need a system that supports to make the match bracket.

At present, the panel point scoring system is used for Kata matches, and the reference or knockout system is used for Kumite matches in most matches held in Indonesia. Starting in 2020, the Kata competition in Indonesia must use a panel point assessment system. This encourages all match organizers to use the overall system from registration, verification of the athlete who will compete, the match system and the match results in order to become an integrated system.

Some organizers have problems when creating the match bracket. In general, the match bracket will be made after the athlete's data verification completed and technical meeting are held. Problems arise when athletes from the same contingent face off at the start of the match. Athletes from the same contingent should be distributed in the match bracket so they don't meet in the first round (Hikmah, *et al.*, 2014).

The purpose of this study is to develop an optimal system that can be used by match organizers to produce optimal competition charts using the Tournament Bracket Seeding method. The research uses data from the *Piala Kapolres Kabupaten Purwarkata* which was held on December 20-22, 2019 at the *Purwakarta* Sport Center.

RESEARCH METHOD

Roger (2012). this research uses the prototype method by applying the Tournament Bracket Seeding method (Hennessy, *et al.*, 2016). The more detailed explanation of the method in this study can be seen in the point below.

A. Prototype Method

In this study, researchers used a prototype method to develop the tournament bracket seeding method. The prototype process in the research begins with gathering user needs. After gathering information, conducting analysis and making mock-ups for the system to be built, then sending mock-ups to users for testing. The result of user testing will be evaluated, if the result not meet the user needs, it should be re-analysed and revise the mock-ups (Kendall, *et al.*, 2014). The use of prototype method in this study can be seen in figure 1.

Figure 1. Prototype Method

In this research, the first step taken by researchers is to conduct observations and interviews with users at INKANAS West Java. The author made observations to the Karate competition and saw how the process was carried out by them, then the authors conducted an analysis and developed a mock-up to test the tournament seeding method. After prototyping, the results are given to users to get feedback. The steps are repeated until researchers get results that meet their needs.

B. Bracket Tournament Seeding

Bracket Tournament Seeding is a method used to place a player in a certain position following the general format (usually the format is like a binary tree). The most popular format is the placement of players starting from the first node to the N-node on the leaf nodes of binary tree. Players at the branching node will compete in the match and the winner will move to the next node. The winner of the tournament is the player who reaches the root node (Vu, *et al.,* 2011).

Most research that deals with seeding method focuses more on finding methods to maximize the probability of finding the strongest player placed in the root node position (Mishan, *et al.,* 2018*)*.. The popular seeding bracket can be seen in figure 2. The research shows probability player 1 in the node is the strongest player (Dagaey, *et al.,* 2018).

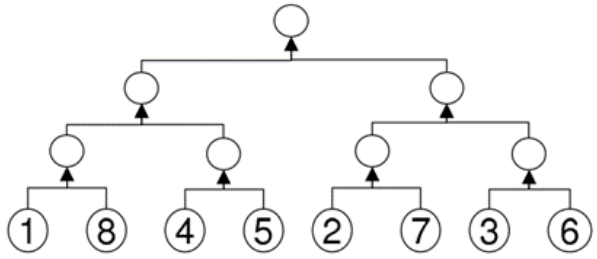

Figure 2. Popular Seeding with 8 players (Vu, *et al.,* 2011).

Commonly, seeding algorithm perform by random filling the nodes in the tournament bracket with a player. To make this method can be implemented in karate tournament, there are several conditions that must be considered. Additional parameter included in the algorithm to make balanced tournament bracket. Balanced tournament bracket is condition when the athletes from same contingent not meet in the first elimination round. The maximum number of total athletes from same contingent is half from the total of athletes competing. If the number of total athletes from same contingent is larger than half of total athletes competing, the athlete from same contingent will compete at first round (Schwenk, *et al.*, 2000).

C. Karate Match Bracket

The *Kumite* match with a knockout system uses a single elimination match bracket, where each athlete who will compete is faced with one opponent. The winner will go to the next round until they reach the final round. Each match chart will consist of *Aka* (athlete using the red belt) and *Ao* (athlete using the blue belt). The *Kata* match using panel point system. This match bracket is like the soccer standing. The maximum number of athletes in a group is 12 player and minimum number of groups is two groups. The athletes will evenly be divided to each group.

From each group, the top four athletes will go to next round based on panel score points. That four athletes will be competed again until the final round. For the first place of the competition, first place of group one will compete with first place of group two. For the third place of the competition, the second place of group one will be competed with the third place of group one, and third place of group one will compete with second place of group two. The winner of that match won 3rd place so there will be 2 athletes who occupy the 3rd place. If the number of athletes in first group is odd, the second place of this group will not be contested. An explanation of the panel points match chart can be seen in Figure 3.

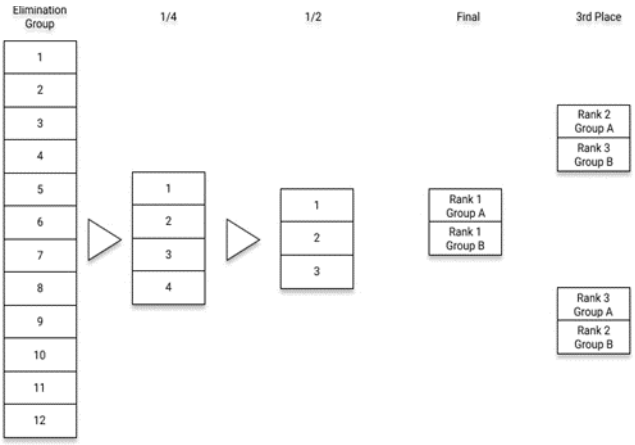

Figure 3. Karate Match Bracket Scheme for *Kata* (Point Panel)

For the *Kumite* match, the match bracket scheme can be seen in Figure 4.

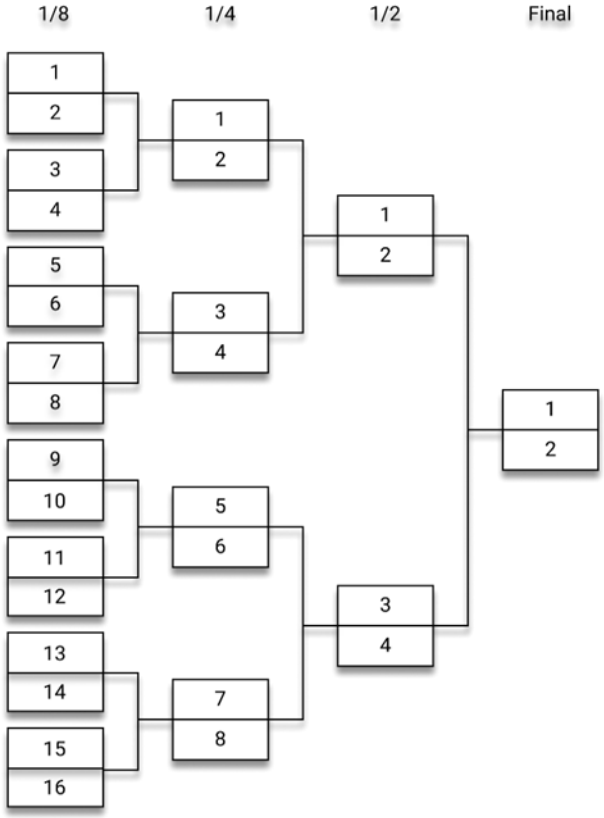

Figure 4. Karate Match Bracket Scheme for *Kumite*

RESEARCH RESULTS AND DISCUSSION

Research conducted by Hennessy, *et al.*, (2016) on business intelligence for matchmaking tournaments using the particle swarm optimization algorithm explains that for small populations (<100) the algorithm is trapped in local optima so this method is not suitable for karate tournament because the *Karate* competition generally does not exceed 100 players in one group.

Research conducted by Arabzad, *et al.*, (2014) describes the standard seeding method most commonly used in fixed match bracket for knockdown systems. They mentioned that the

most optimal match bracket for a knockdown match can be seen in figure 5. The match bracket has the highest probability to determine that the best player wins the tournament.

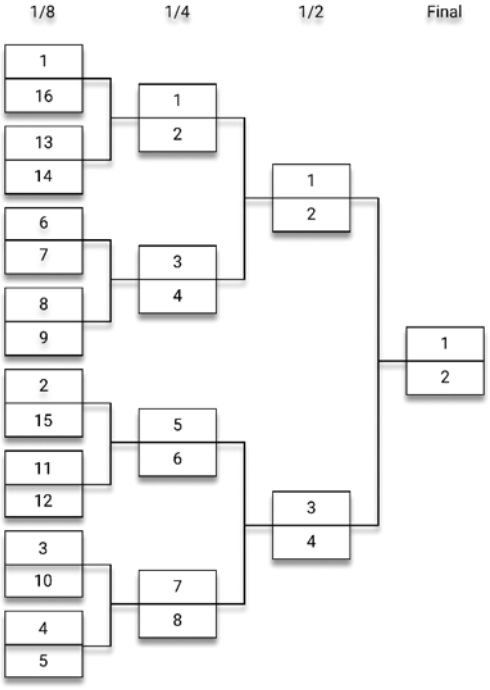

Figure 5. Optimal Bracket for Two Best Players meeting in final (Hennessy, *et al.,* 2016).

In this study, we use data on the *Piala Kapolres Kabupaten Purwarkata* with a total of 134 competition class that can be seen in table 1. The total number of athletes competing in this tournament was 715 athletes.

Table 1.Total of Competition Class in Piala Kapolres Kabupaten Purwakarta

Class Type	Total
Kumite	90
Kata Single	34
Kata Group	10

A. Bracket Tournament Seeding

In this study, seeding the tournament bracket is using tournament seeding algorithm. The first step is counting the number of participants. If there are more than 16 athletes, the tournament uses the 2 pools bracket. If there are more than 32 athletes involved, the bracket used is a 4 pools bracket, and if there are more than 64 athletes competing, the 8 pools bracket is used. The maximum number of athletes competing with this system is 128 athletes. In general, competition for each class of competition never exceed the maximum number of athletes competing. The division of the number of pools in this match chart can be seen in table 2.

Table 2. Division of Pool Match Bracket

Number of Athletes	Pool Count
2 - 16	1
17 - 32	2
33 - 64	4
> 65	8

After determining the number of pools, the next step is counting the number of athletes from the same contingent to be seeded evenly for each pool. This is done to avoid athletes from the same contingent meet in the elimination round (first round). After determining the composition of the number of athletes from a certain contingent for each pool, then do seeding randomly. After that seeding is done randomly for athletes who are not included in that category. This is repeated for each pools of the matches.

Figure 6 shows the seeding results for the men's cadet kumite match -52kg with 9 participants. From the results of the implementation of this method, 9 athletes were randomly divided and balanced so that no athletes met during the elimination round (round 1).

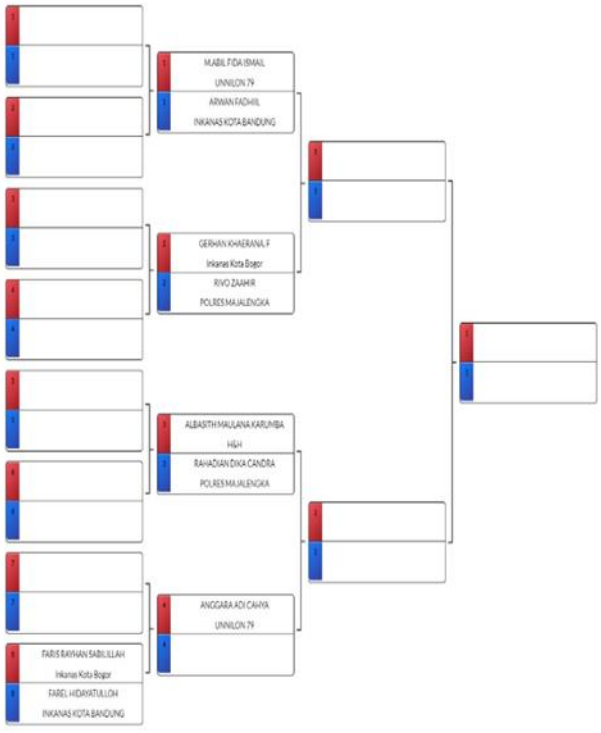

Figure 6. Men's Cadet Kumite Match Bracket -52kg with 9 participants

Figure 7 shows the results of seeding for the pre-beginner kumite match for women -30 showing that athletes from the *Inkanas Karaba* contingent met in the round (round 1).

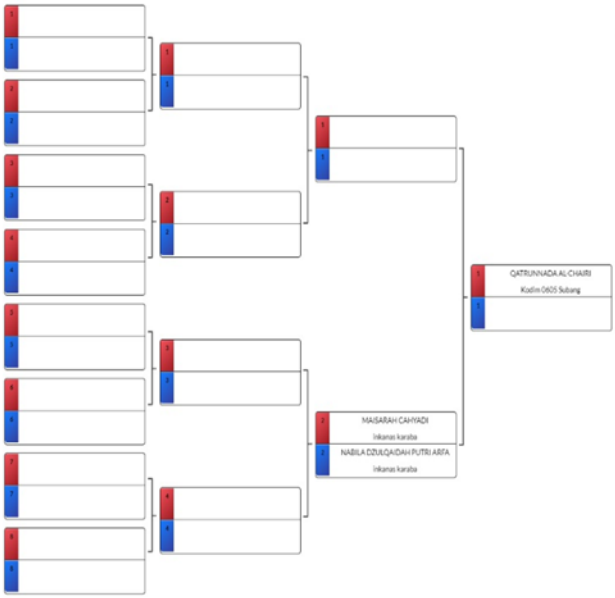

Figure 7. Women's Pre-Beginner Kumite Match Bracket -30 with 3 participants

CONCLUSION

After testing the tournament bracket seeding method in karate matches conducted at the *Piala Kapolres Kabupaten Purwakarta*, the results from 90 kumite matches, there are only 3 match charts with fail conditions (athletes from the same contingent meet in the elimination round) so that using the tournament bracket method This seeding has an optimum value of 96.7% to produce a karate match bracket without contingent meeting in the elimination round (first round).

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