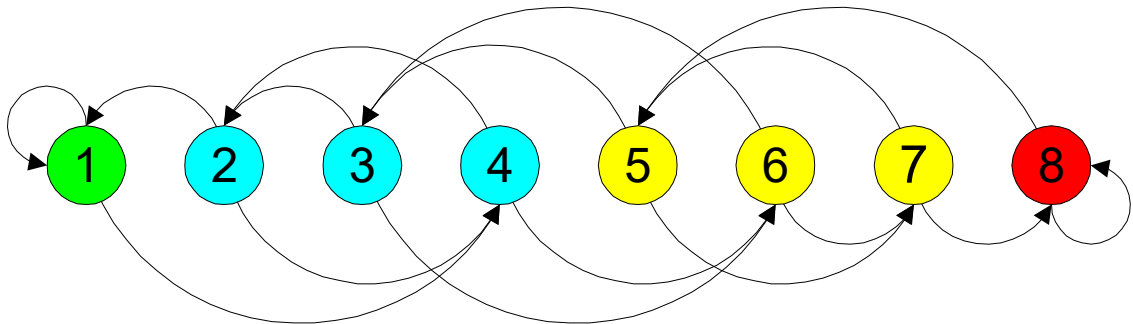Roman Szostek

R-Sport

Sports Playing System

Abstract

The aim of sports competitions is to select the best team, i.e. the champion, from a group of teams or players. Therefore, matches must be played between the individual teams. The results of all matches decide who becomes the champion. The rules of the season form the Sports Playing System. This document describes the new Sports Playing System. This system allows the fair and efficient selection of the winner of the entire season. It has advantages that other well-known and currently used Sports Playing Systems do not have. R-Sport can be used in classic sports as well as in e-sports. R-Sport is a Sports Playing System that allows conducting league matches in many ways.

Rzeszów 2021

R-Sport

i.e.

Sports Playing System

1. Introduction

The aim of sports competitions is to select the best team, i.e. the champion, from a group of teams or players. Therefore, matches must be played between the individual teams. The results of all matches decide who becomes the champion. The rules of the season form the Sports Playing System.

This document describes the new Sports Playing System. This system allows the fair and efficient selection of the winner of the entire season. It has advantages that other well-known and currently used Sports Playing Systems do not have. R-Sport can be used in classic sports as well as in e-sports.

The system presented here is a generalization of the Wheeled Sports Playing System developed by Jacek Drzystek, called the **"Mermeisse"** system (**M-Sport**).

R-Sport is a Sports Playing System that allows conducting league matches in many ways.

In this document, four system features have been presented in continuous frames, which distinguish it from the previously known and used Sports Playing Systems. Thanks to these features, the R-Sport has excellent features summarized in Chapter 6.

2. Copyright

This document has been elaborated for the documentation of copyrights resulting from the Copyright and Related Rights Act (in Poland Journal of Laws 1994 No. 24 item 83) and relevant international agreements on copyright protection, including the Paris Act of the Berne Convention for the Protection of Literary and Artistic Works drawn up in Paris on 24 July 1971 (in Poland Journal of Laws 1990 No 82 item 474).

Each element included in the Sports Playing System described in this document is protected by copyright.

3. Description of R-Sport

In R-Sport, teams play matches in a closed cycle. This way, teams do not have to play "each with each" matches and are not dropped off during the competition.

The features of R-Sport allow to choose the champion and create a reliable ranking of all teams after playing a relatively small number of rounds.

In the examples below, only systems consisting of such a number of teams will be shown, which is the power of two, i.e.: 4, 8, 16, 32, 64. If the number of teams is different, it can be filled with virtual teams, which by definition are worse than others. However, according to the rules presented in this study, it is possible to create R-Sport variants for any number of teams.

In R-Sport, each match (or two matches) must end with a decision on who won and who lost.

In R-Sport the teams that are currently at the same level play with each other. The teams that play matches at higher levels receive more points for their score than the teams that play at lower levels (chapter 4). Therefore in the final ranking the teams that stay longer at the higher levels for the duration of the whole sport are rewarded.

The first feature of R-Sport system is that the matches are played on different levels. This allows teams to receive a different number of points for their score in the match depending on the level at which it is played.

If enough rounds are played in R-Sport, then teams that have already played together may face each other again. This is a rematch.

Before the start of competition it is necessary to **seed** (that is, the positioning of the teams at the beginning, chapter 5) all teams in the league in orderly pairs that will play the matches of the first round. After all matches of the first round have been played the teams are seeded in new pairs. Then the second round matches are played. The teams are seeded in new pairs, etc. Matches end after a predetermined number of rounds have been played.

At the end of each round, the teams are ranked in the overall ranking according to the total number of points they have scored. The champion is the team that has scored the most points during the entire competition.

The way R-Sport functions has been shown in the examples below.

3.1. R-Sport/4, basic form

There are four teams in the R-Sport/4 league. The seeding at the start is shown in Figure 1. The circle is the match base, that is two teams. Each match base receives its own number.
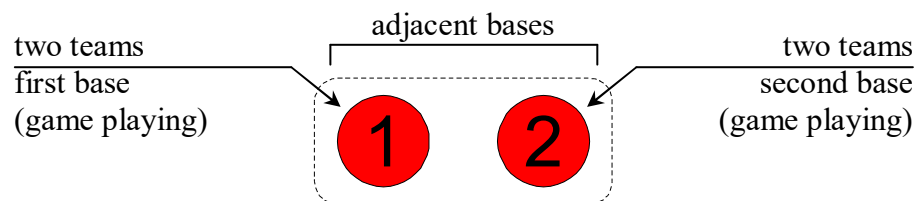

Figure 1. Seeding at the start in R-Sport/4

Therefore, there are two match bases in R-Sport/4. At the beginning all the match bases are on the same, the lowest level marked in red (level 1).

After seeding at the start, a match (or two matches) is played at each base, i.e. the matches of the **first round** are played. The match (or two matches) is played by the teams from the same match base.

Figure 2 shows the situation after the first round has been played. The arrows pointing upwards indicate the direction of winning teams. The arrows pointing downwards indicate the direction of losing teams. The winning teams move to a higher level 2 marked in green, while the losing teams remain at level 1.
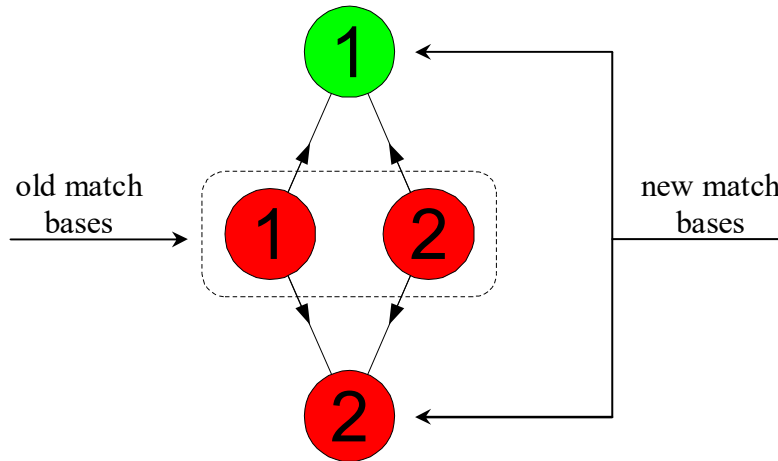
Figure 2. First round in R-Sport/4

> **The second feature of R-Sport system is the generation of new levels in such a way that the winning teams move to the bases located at levels higher than their current bases (preferably one level higher), while the losing teams move to the bases located at the same levels as their current bases.**

Two new bases have been created and are numbered. The number 1 is given to the base with the higher level and the number 2 to the base with the lower level. The new bases are again placed on the horizontal line in the order of their numbering(Figure 3).
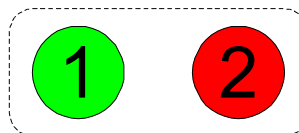
Figure 3. Seeding in R-Sport/4 after the first round

Now the matches of the second round are played. This time one match is played at level 2 (higher) and the other at level 1 (lower).

Figure 4 shows the situation after the second round.
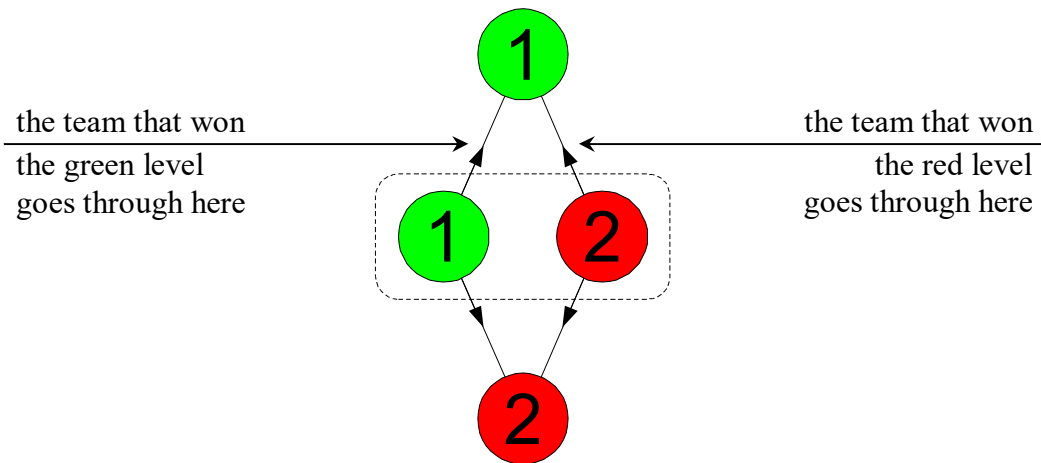
Figure 4. Second, third, fourth, ... round in R-Sport/4

The situation is different from the previous one, because the teams from different levels (adjacent bases have different levels) are moving to the new base. Therefore from now on the number of levels does not increase anymore. The winning teams move to the green base, while the losing teams move to the red base.

All subsequent rounds are played according to the scheme shown in Figure 4. From now on, the teams can move up to a higher level if they win the match or down to a lower level if they lose the match. After a fixed number of rounds have been played, the team that scored the most points becomes the champion.

3.2. R-Sport/4, graph form

R-Sport/4 can be presented in graph form shown in Figures 5 and 6.
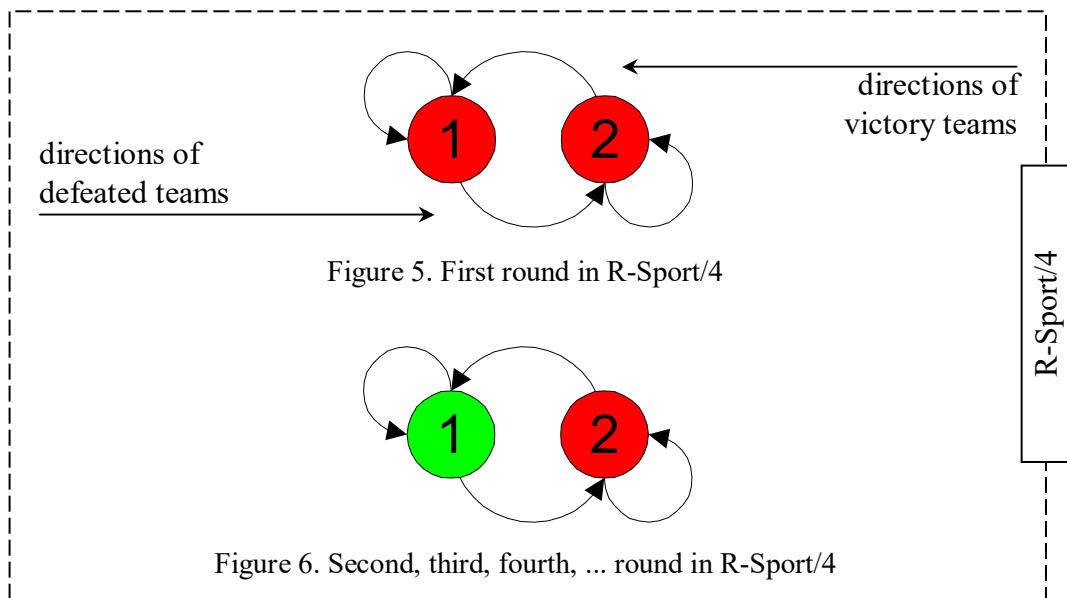
Figure 5. First round in R-Sport/4

Figure 6. Second, third, fourth, ... round in R-Sport/4

The circles shown in these figures represent the matches of the respective round (the bases). The arches above the bases indicate the direction of teams that won the matches. The arches below the bases indicate the direction of teams that lost the matches. The direction of crossing indicates the number of base to which the team moves. For example, the team that played in the first round (Figure5) at the second base and won the game moves to a new base

with the number 1. The lost team moves to the base with the number 2. The levels at which the new bases are located are shown in Figure 6.

3.3. R-Sport/8, basic form

Figure 7 shows the seeding at the start of eight teams (R-Sport/8). Therefore, the round consists of four bases, which are at level 1.
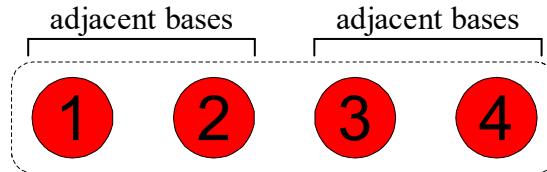
Figure 7 Seeding at the start in R-Sport/8

Figure 8 shows the situation after the first round has been played.
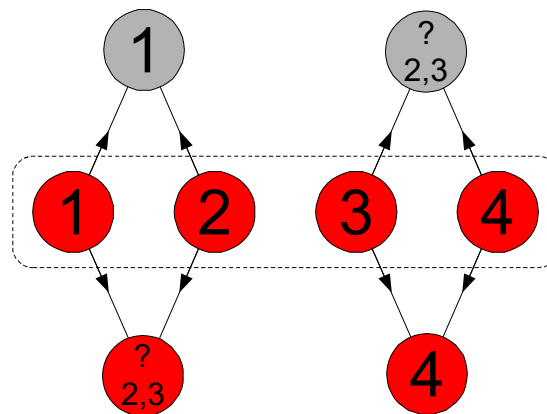
Figure 8. First round in R-Sport/8

After the first round, the four winning teams move up (they are promoted to level 2) and the four losing teams move down (they remain at level 1). This creates four new bases, two at level 2 (silver) and two at level 1 (red).

In Figure 8 and other figures, some bases are not numbered. Depending on the numbering adopted, different R-Sport variants are obtained.

The third feature of R-Sport system is the way of moving teams to new bases, which is such that each team that wins a match moves to a base not lower than its current base (moves left). At the same time, each team that lost the match moves to a base no higher than its current base (moves to the right).

In the examples presented in this document, all base numbers are selected in such a way that the R-Sport is symmetrical.

The new bases obtained in Figure 8 must be numbered. In this example, two different numbers are possible. We assume that numbers 1 and 2 receive bases with a higher level,

while numbers 3 and 4 receive bases with a lower level. The new bases are again placed in the horizontal line in the order of their numbers (Figure 9).
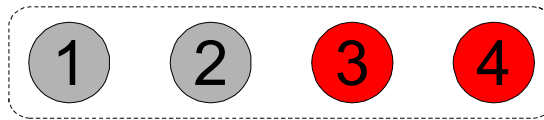
Figure 9. Seeding in R-Sport/8 after the first round

Now the matches of the second round are played. This time two matches are played at level 2 (higher) and two at level 1 (lower).

The teams that have won the match move to a higher level than they have been so far. Therefore from level 2 (silver) they move to level 3 (green) and from level 1 (red) they move to level 2 (silver).

The teams that have lost remain at their current level.

Figure 10 shows the situation after the second round.
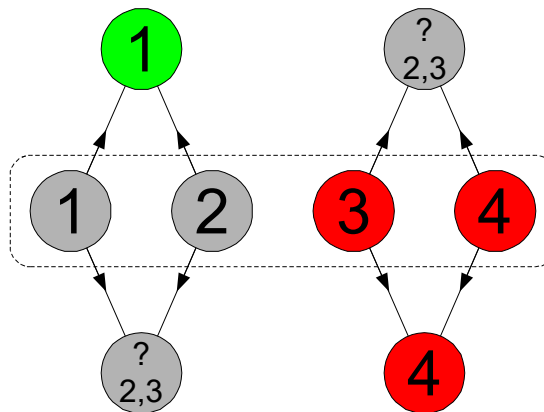
Figure 10. Second round in R-Sport/8

Now the bases are on three levels. These bases are again placed in a horizontal line in the order of their numbers (Figure 11).
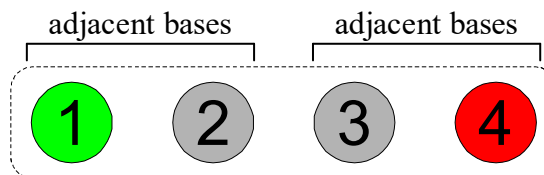
Figure 11 Seeding in R-Sport/8 after the second round

Third round matches are played. Because the adjacent bases have different levels, the number of levels in R-Sport is no longer increased from now on. <u>In all rounds the teams will only move between the bases</u>. There will be one green level, two silver levels and one red level. The situation shown in Figure 12 is obtained.
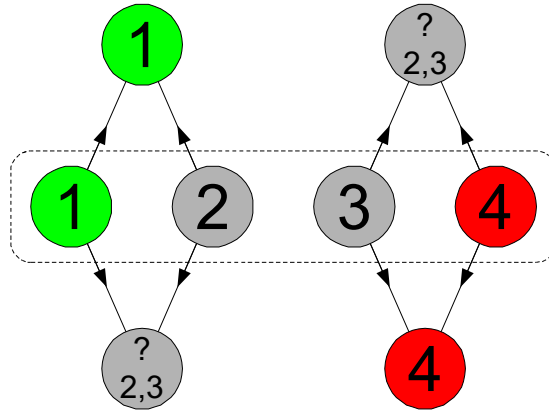
Figure 12. Third, fourth, fifth, ... round in R-Sport/8

All subsequent rounds are played according to the scheme shown in Figure 12. From now on, the teams can move up if they win the match or move down to a lower level if they lose the match. After a fixed number of rounds have been played, the team that scored the most points becomes the champion.

> **The fourth feature of R-Sport system is the way of assigning levels to the bases at a later stage of the game. The levels assigned to the bases have not changed for some time. In the examples provided, moving teams to new bases, at a later stage of the game, takes place in such a way that one of the two playing teams moves to the base with the same level, while the other moves to the base with an adjacent level.**

3.4 R-Sport/8, graph form

In this section four variants of R-Sport/8 have been presented. Different variants are created by establishing a specific numbering of bases.

If the bases from Figures 8, 10 and 12 are numbered as shown in Figure 13, then R-Sport/8 is obtained as shown in Figure 14-16.
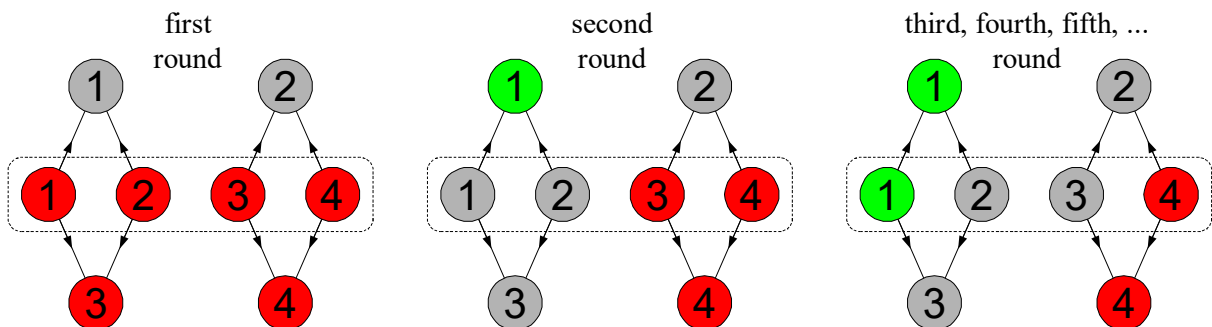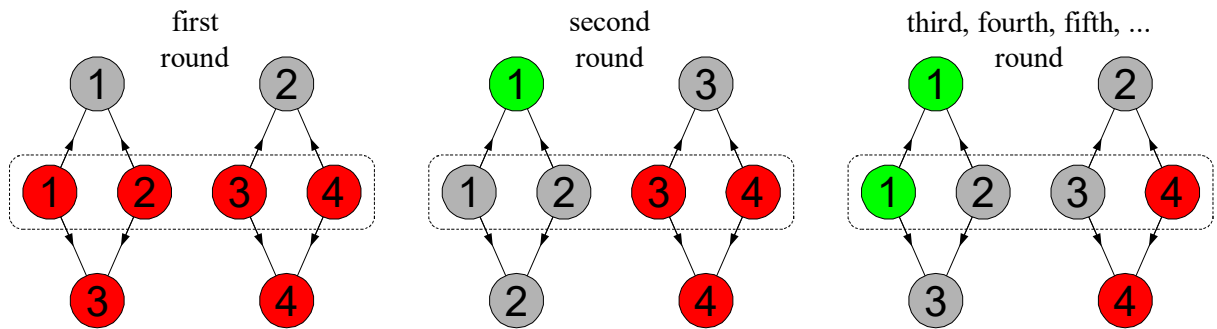

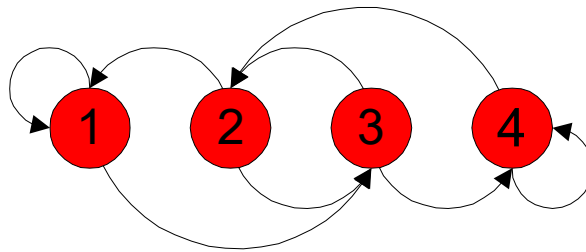Figure 13. Designations of bases in R-Sport/8 (variant 1)
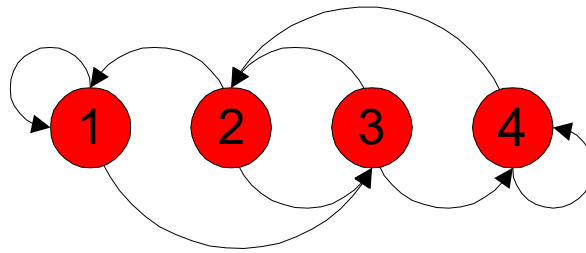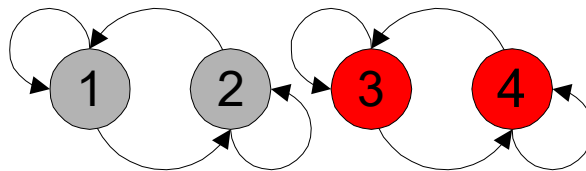
Figure 14. First round in R-Sport/8 (variant 1)
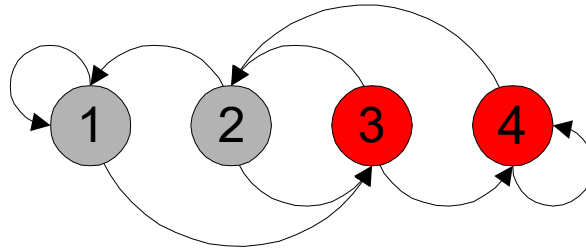
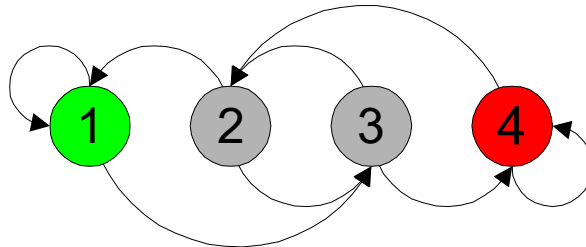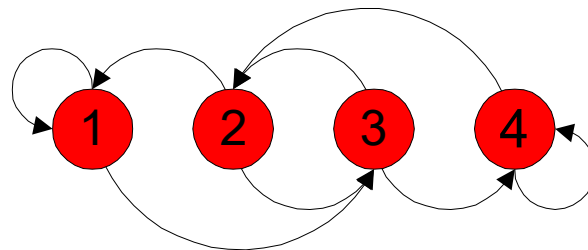
Figure 15. Second round in R-Sport/8 (variant 1)
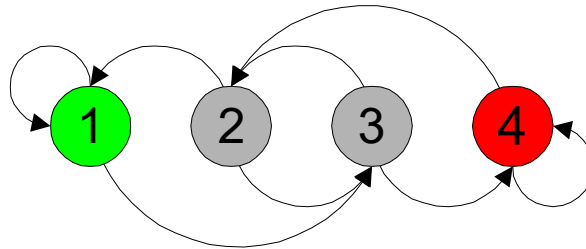
Figure 16. Third, fourth, fifth, ... round in R-Sport/8 (variant 1)

R-Sport/8
Variant 1

In sports competitions, it is possible to stop at a smaller number of levels. For example, if the competition is based on Figures 14, 15, with omission of Figure 12, then only two levels will occur in R-Sport/8. This variant of the system is shown in Figures 17-18 (bases are numbered as in variant 1).
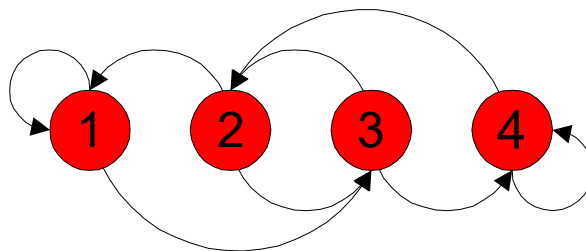
Figure 17. First round in R-Sport/8 (variant 2)
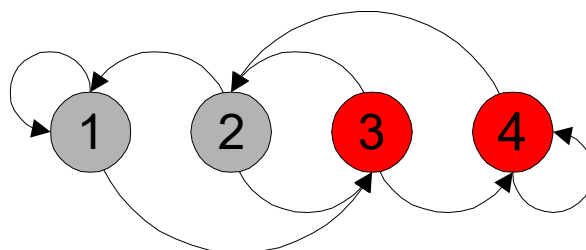
Figure 18. Second, third, fourth, ... round in R-Sport/8 (variant 2)

R-Sport/8
Variant 2

If the bases from Figures 8, 10 and 12 are numbered as shown in Figure 19, then R-Sport/8 is obtained as shown in Figures 20-22.

Figure 19. Designations of bases in R-Sport/8 (variant 3)

Figure 20. First round in R-Sport/8 (variant 3)

Figure 21. Second round in R-Sport/8 (variant 3)

R-Sport/8
Variant 3

Figure 22. Third, fourth, fifth, ... round in R-Sport/8 (variant 3)

Figure 23 shows the numbering of bases adopted in the fourth variant. The adopted numbering is not fixed and changes cyclically.
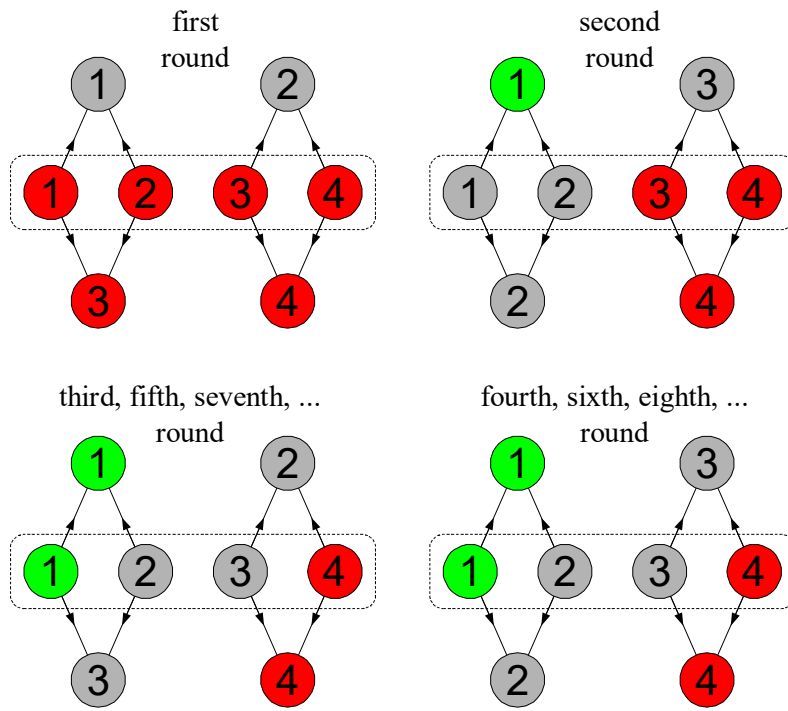
Figure 23. Designations of bases in R-Sport/8 (variant 4)

There is represented R-Sport/8 in Figures 24-27.

Figure 24. First round in R-Sport/8 (variant 4)
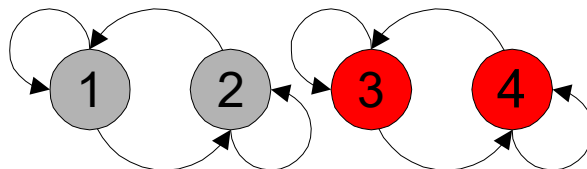
Figure 25. Second round in R-Sport/8 (variant 4)
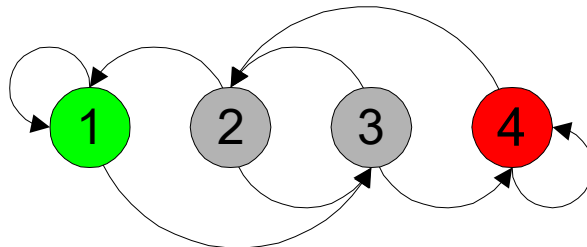
Figure 26. Third, fifth, seventh, ... round in R-Sport/8 (variant 4)
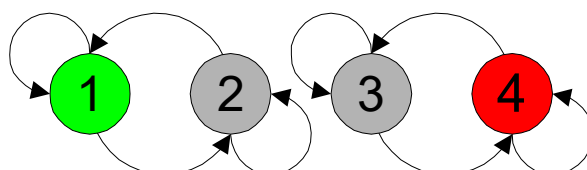
Figure 27. Fourth, sixth, eighth, ... round in R-Sport/8 (variant 4)

R-Sport/8
Variant 4

Each of R-Sport/8 variants presented above has its own individual features, the discussion of which goes beyond the scope of this document. Particularly interesting is R-Sport/8 from variant 3.

3.5 R-Sport/16, basic form

R-Sport for more leagues functions in a similar way. Therefore in this subsection examples of R-Sport/16 variants will be presented without detailed commentary.
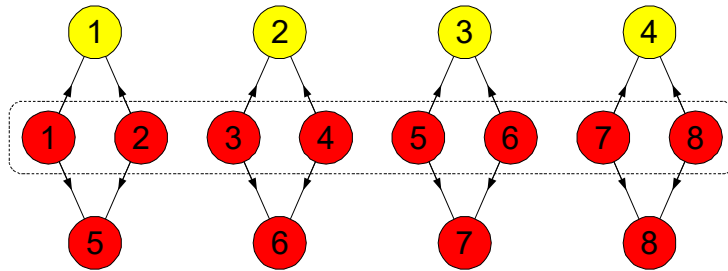
Figure 28. First round in R-Sport/16
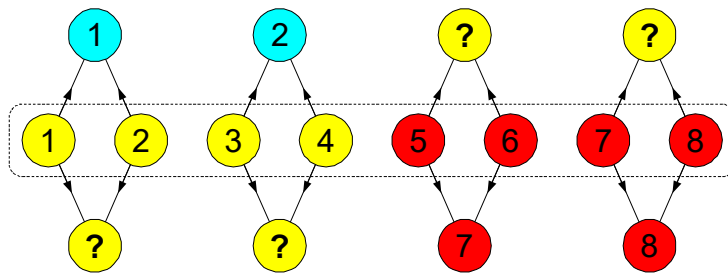
Figure 29. Second round in R-Sport/16
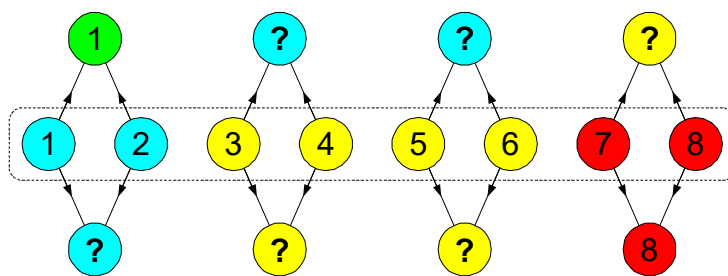
Figure 30. Third round in R-Sport/16
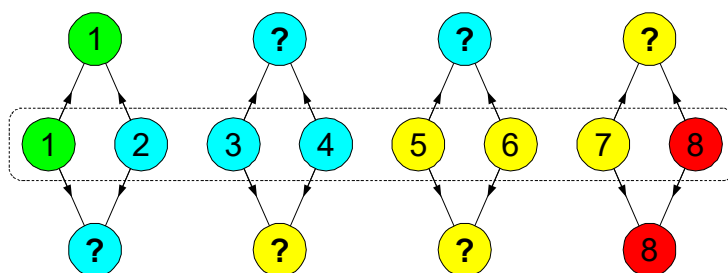
Figure 31. Fourth, fifth, sixth, ... round in R-Sport/16

In the first three rounds, the teams that won the match move on to a higher level, while those that lost remain at their current level. In Figure 28 one of the several possible base numbers is adopted, while in Figure 29 partial base numbering is adopted.

In Figures 28-31 level 4 (highest) is marked green, level 3 is marked blue, level 2 is marked yellow and level 1 (lowest) is marked red.

As after the third round was played, the adjacent bases were created in the system which have different levels, and therefore the number of levels will no longer be increased. From now on, the bases of the new rounds will have levels such as those of the last round (Figure 31).

From now on (Figure 31), teams can move up when they win a match or move down when they lose a match. After a fixed number of rounds has been played, the team that has scored the most points becomes the champion.

Depending on the adopted numbering of bases, different R-Sport variants are obtained. Some variants have been presented in the next section.

3.6. R-Sport/16, graph form

In this subsection three variants of R-Sport/16are presented. Different variants are created by establishing a specific numbering of bases.

The most interesting R-Sport/16 appears to be the system presented in variant 1.

R-Sport/16 presented in variant 2 has the simplest graphical structure as it is based on only two different graphs.

In variant 3 of R-Sport/16 the bases are numbered in such a way (Figures 51-53) that when they are placed in the horizontal line, the different levels alternate. This example has been included in the document to show that this is acceptable with the adopted system features (in Figure 31, for simplicity, this possibility has not been taken into account). In addition, this variant has several graphs in a cyclic way.

If the bases from Figures 28-31 are numbered as shown in Figures 32-35 then R-Sport/16 is obtained as shown in Figures 36-39.
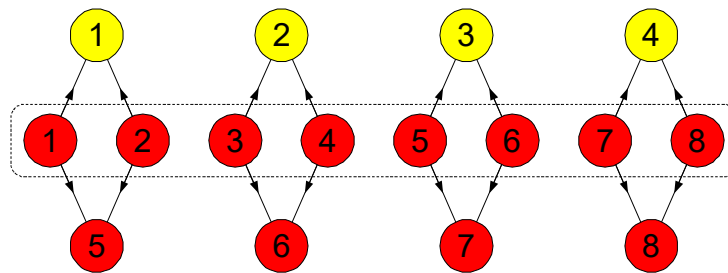

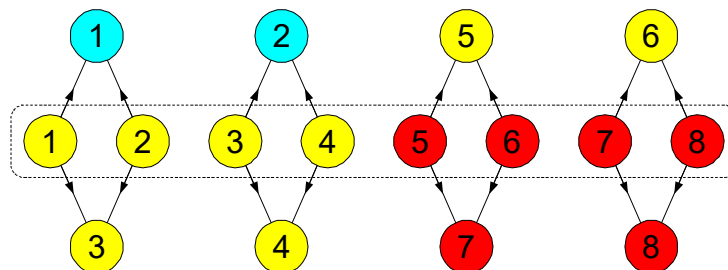Figure 32. First round in R-Sport/16 (variant 1)

Figure 33. Second round in R-Sport/16 (variant 1)
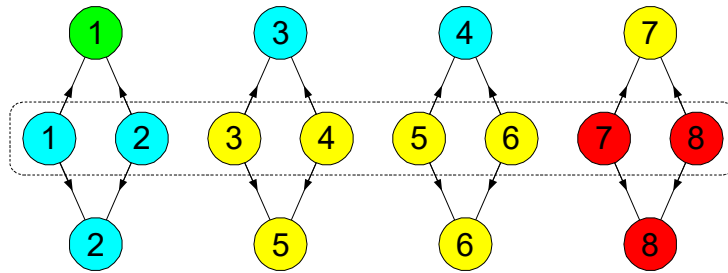
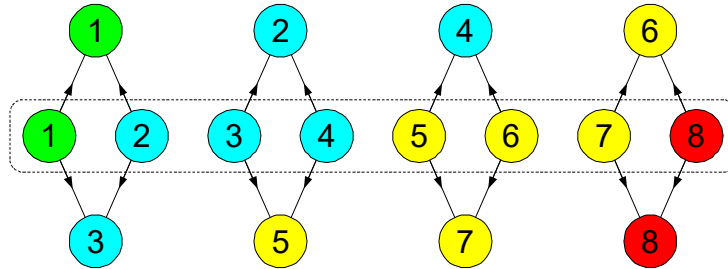Figure 34. Third round in R-Sport/16 (variant 1)

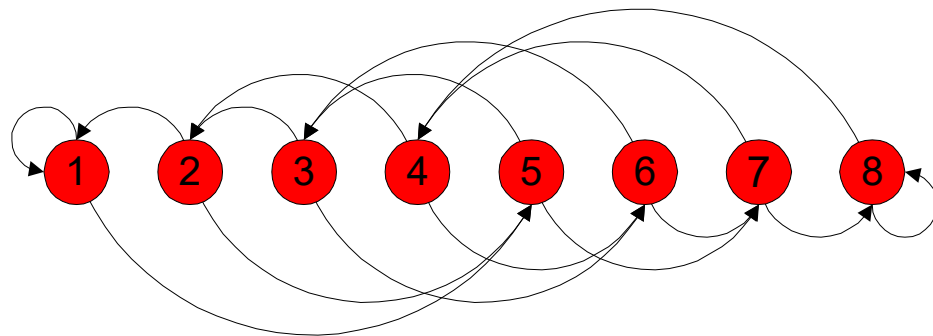Figure 35. Fourth, fifth, sixth, ... round in R-Sport/16 (variant 1)

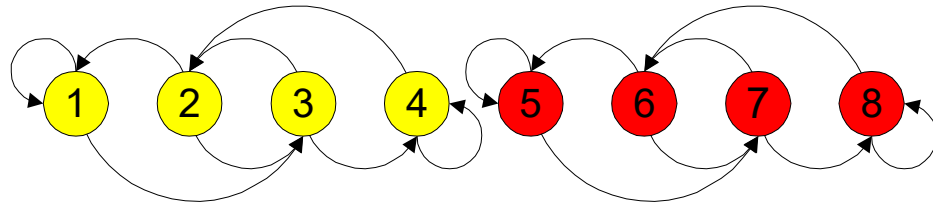Figure 36. First round in R-Sport/16 (variant 1)

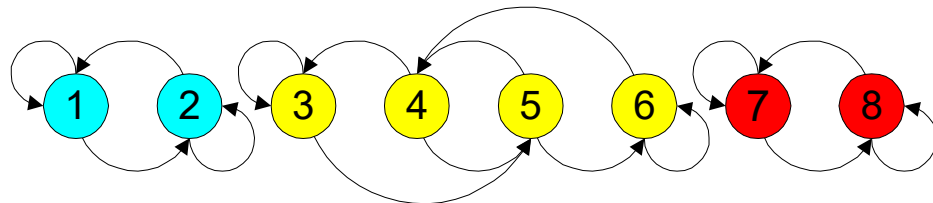Figure 37. Second round in R-Sport/16 (variant 1)

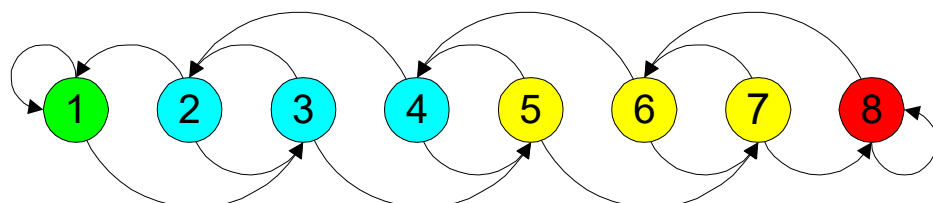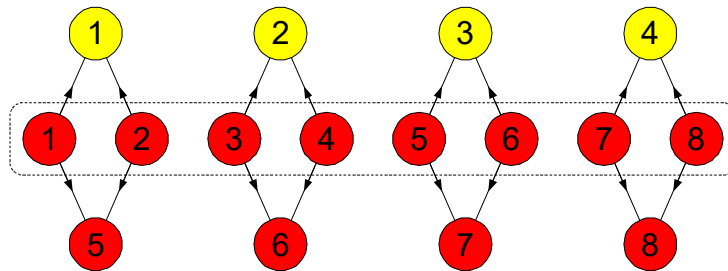Figure 38. Third round in R-Sport/16 (variant 1)

Figure 39. Fourth, fifth, sixth, ... round in R-Sport/16 (variant 1)

R-Sport/16
Variant 1

If the bases from Figures 28-31 are numbered as shown in Figures 40-43, then R-Sport/16 is obtained as shown in Figures 44-47.

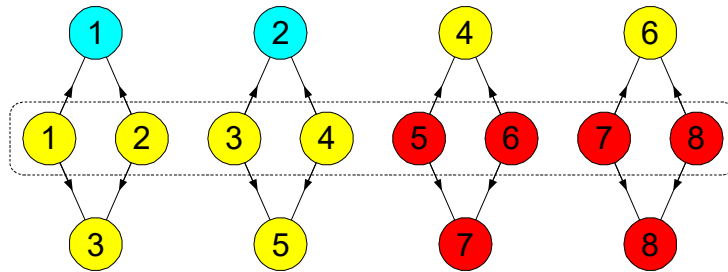Figure 40. First round in R-Sport/16 (variant 2)

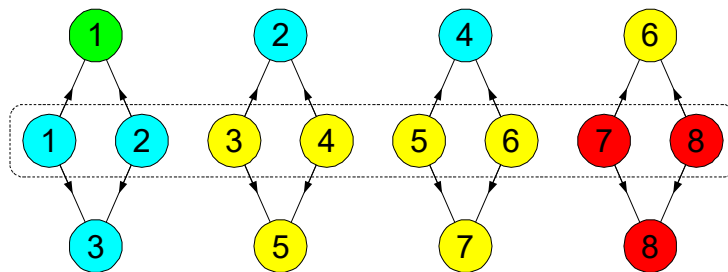Figure 41. Second round in R-Sport/16 (variant 2)

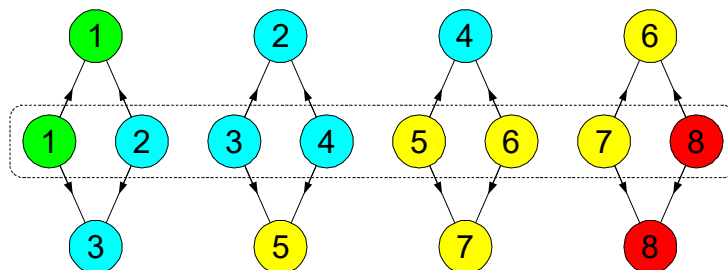Figure 42. Third round in R-Sport/16 (variant 2)

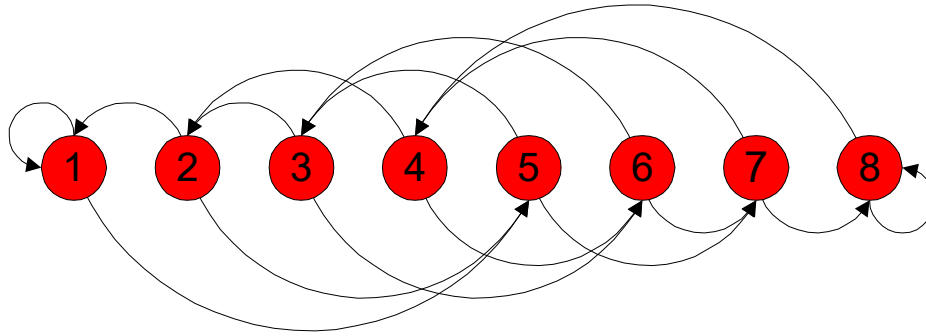Figure 43. Fourth, fifth, sixth, ... round in R-Sport/16 (variant 2)

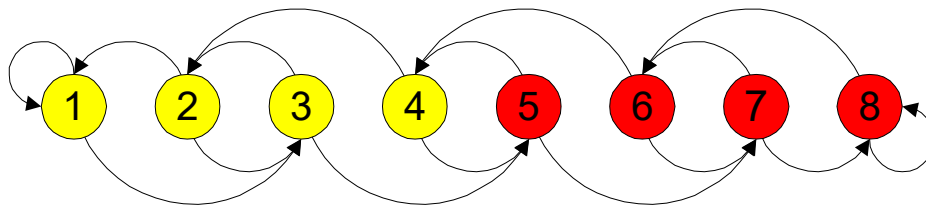Figure 44. First round in R-Sport/16 (variant 2)

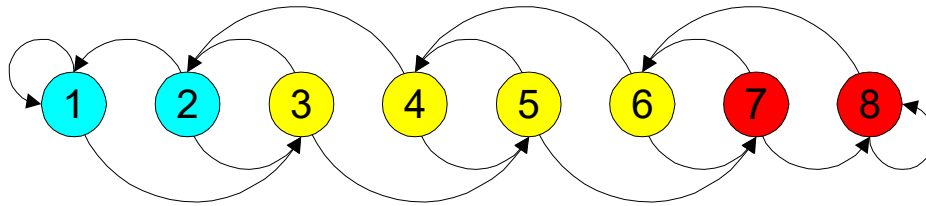
Figure 45. Second round in R-Sport/16 (variant 2)

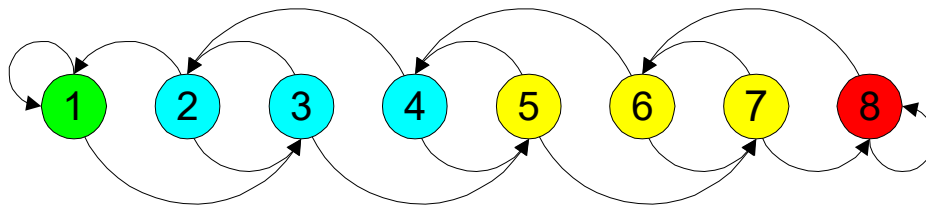Figure 46. Third round in R-Sport/16 (variant 2)

Figure 47. Fourth, fifth, sixth, ... round in R-Sport/16 (variant 2)

R-Sport/16
Variant 2

If the bases from Figures 28-31 are numbered as shown in Figures 48-53 then R-Sport/16 is obtained as shown in Figures 54-59.
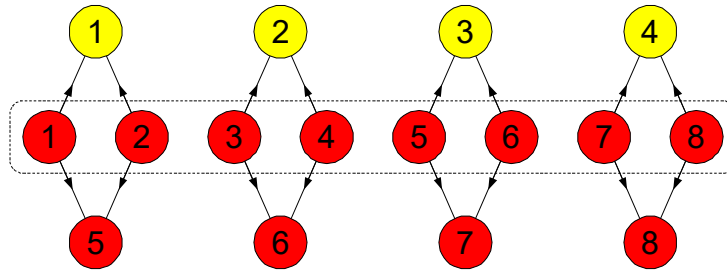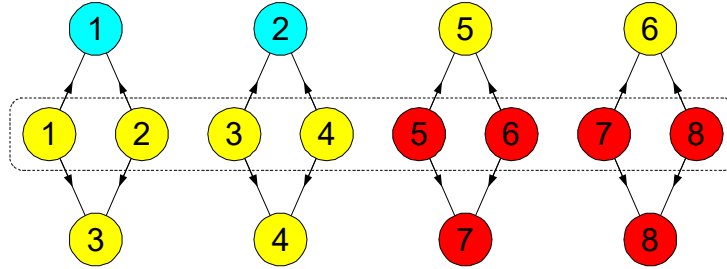
Figure 48. First round in R-Sport/16 (variant 3)

Figure 49. Second round in R-Sport/16 (variant 3)

Figure 50. Third round in R-Sport/16 (variant 3)

Figure 51. Fourth, seventh, tenth, ... round in R-Sport/16 (variant 3)

Figure 52. Fifth, eighth, eleventh, ... round in R-Sport/16 (variant 3)

Figure 53. Sixth, ninth, twelfth, ... round in R-Sport/16 (variant 3)

Figure 54. First round in R-Sport/16 (variant 3)
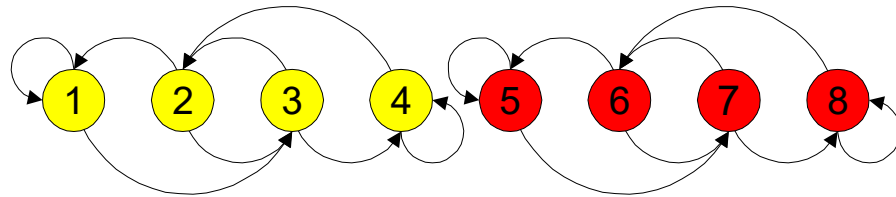
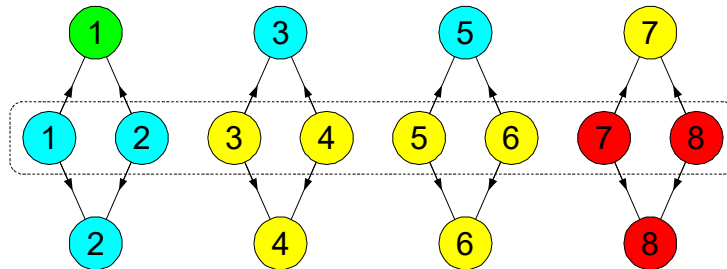Figure 55. Second round in R-Sport/16 (variant 3)
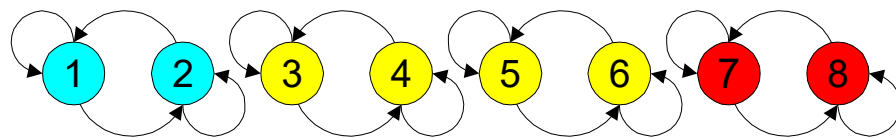
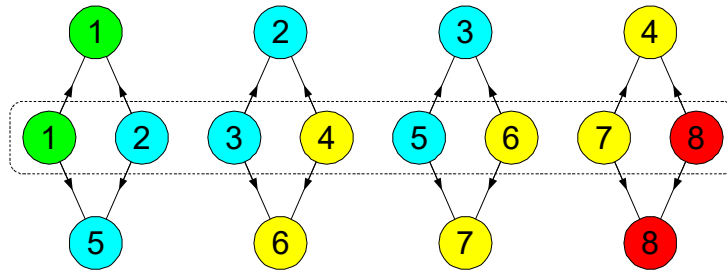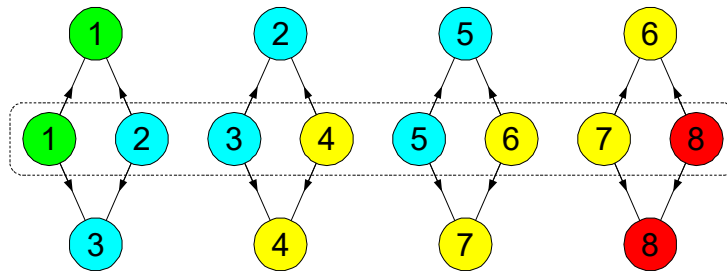Figure 56. Third round in R-Sport/16 (variant 3)
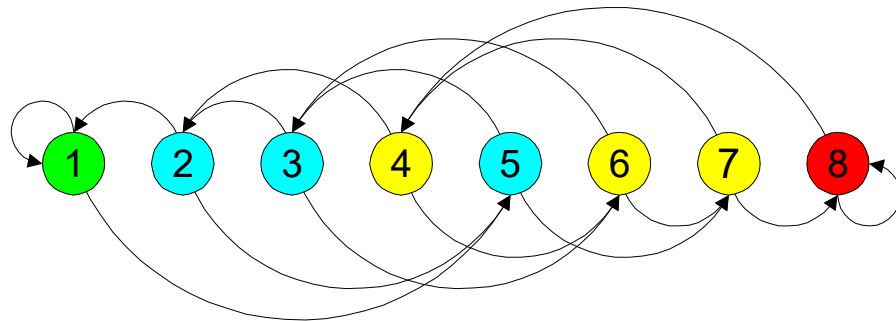
Figure 57. Fourth, seventh, tenth, ... round in R-Sport/16 (variant 3)
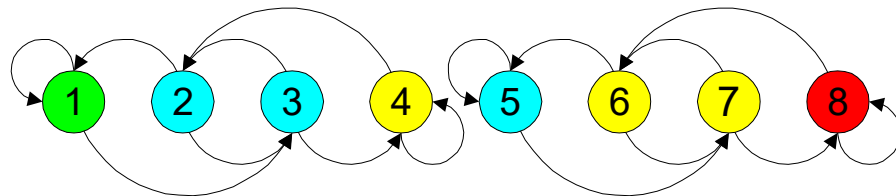
Figure 58. Fifth, eighth, eleventh, ... round in R-Sport/16 (variant 3)
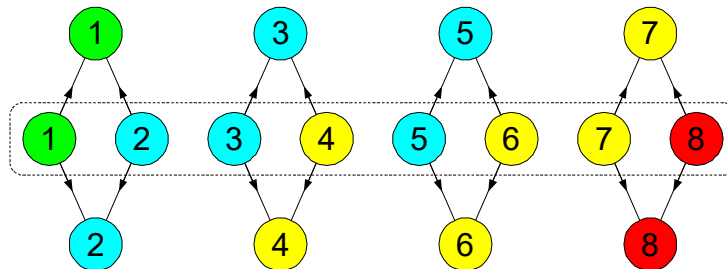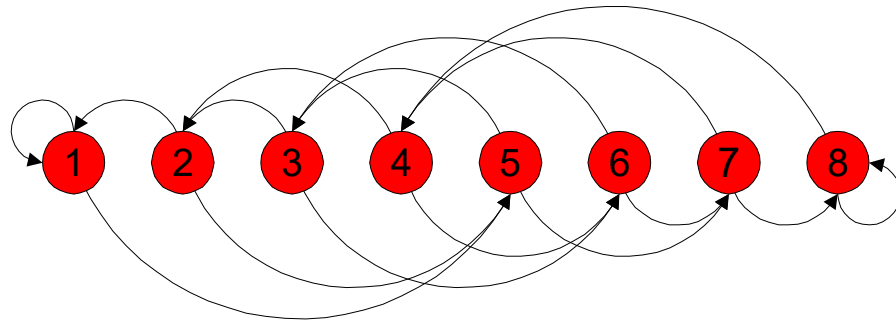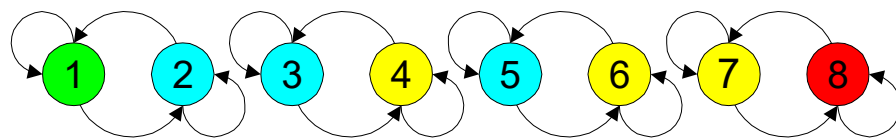
Figure 59. Sixth, ninth, twelfth, ... round in R-Sport/16 (variant 3)

R-Sport/16
Variant 3

3.7. R-Sport/32, basic form

Figures 60-63 show an example of base numbering for R-Sport/32.The numbering of bases in Figure 64 has not yet been determined.
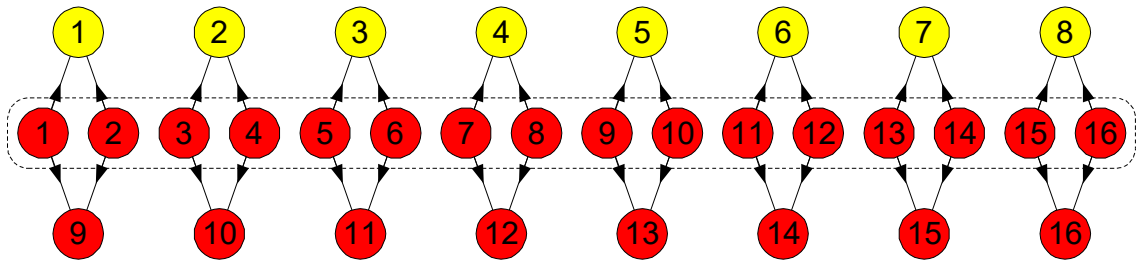
Figure 60. First round in R-Sport/32 (variants 1, 2, 3)
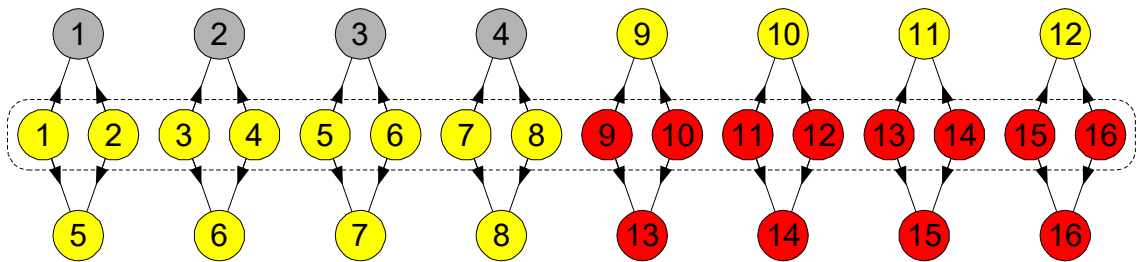
Figure 61. Second round in R-Sport/32 (variant 1, 2, 3)

Figure 62. Third round in R-Sport/32 (variant 1, 2, 3)

Figure 63. Fourth round in R-Sport/32 (variants 1, 2, 3)

Figure 64. Fifth, sixth, seventh, ... round in R-Sport/32

3.8 R-Sport/32, graph form

Three variants of R-Sport/32 differing in the numbering of bases from Figure 64 have been shown below.
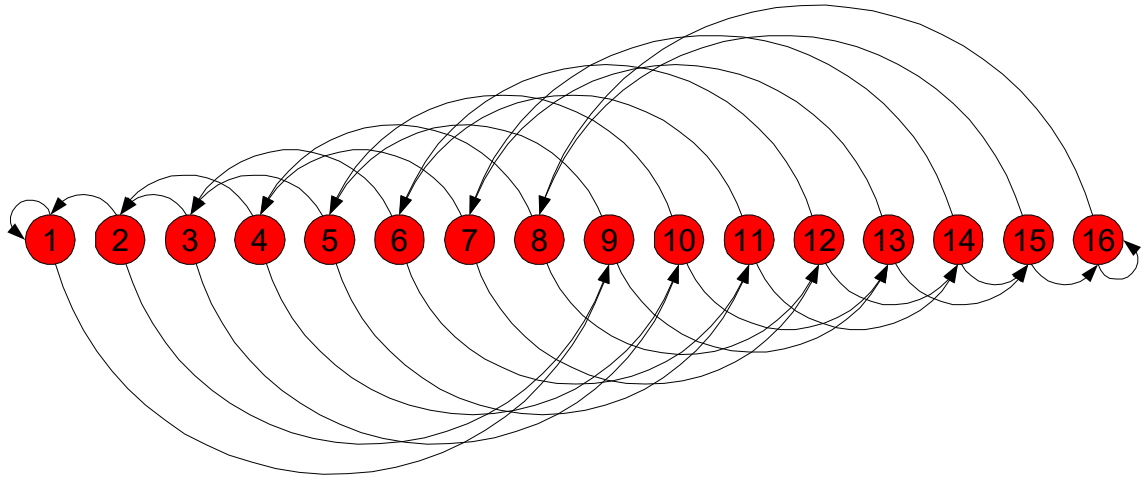
Figure 65. First round in R-Sport/32 (variant 1)
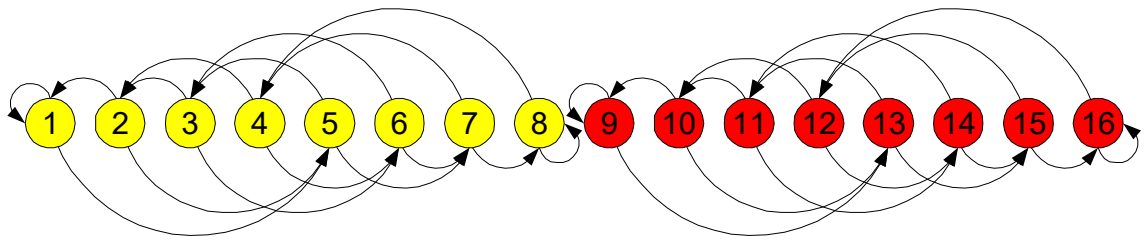
Figure 66. Second round in R-Sport/32 (variant 1)
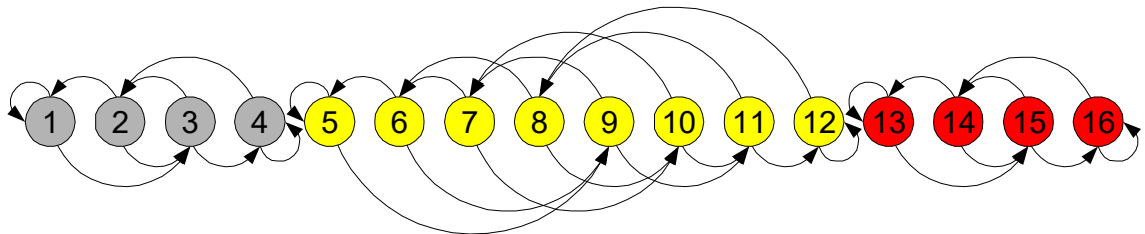
R-Sport/32
Variant 1

Figure 67. Third round in R-Sport/32 (variant 1)
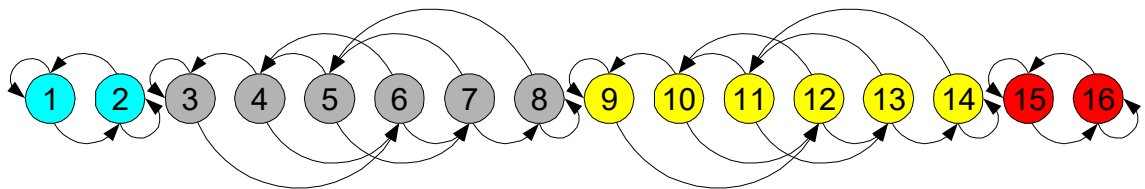
Figure 68. Fourth round in R-Sport/32 (variant 1)
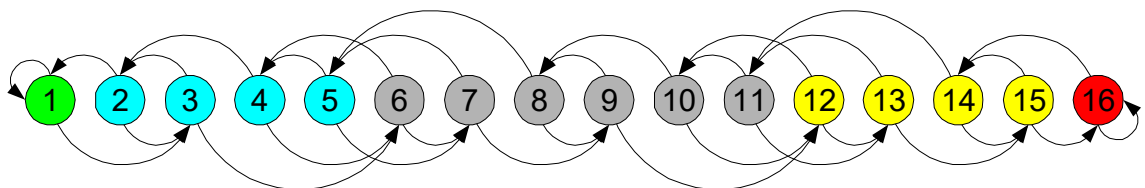
Figure 69. Fifth, sixth, seventh, ... round in R-Sport/32 (variant 1)

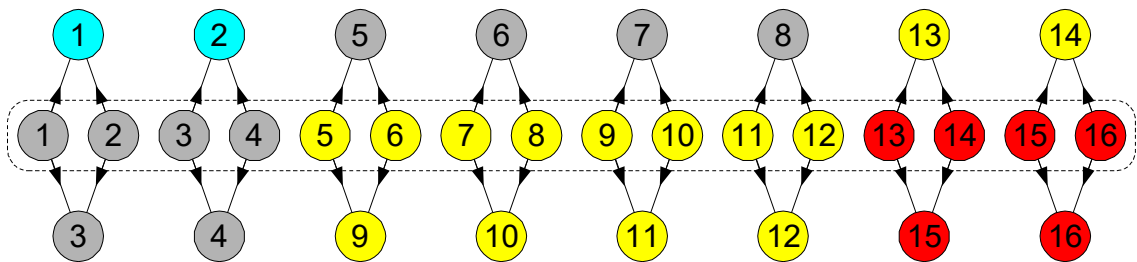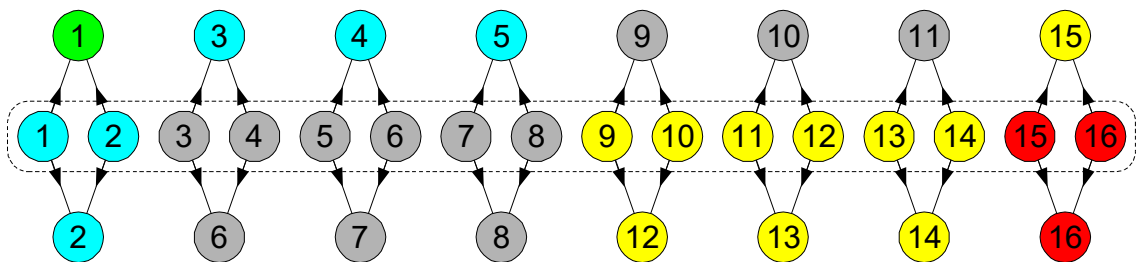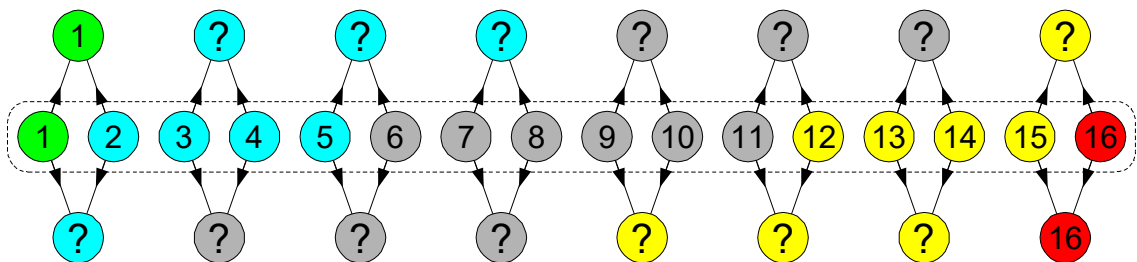The second variant of R-Sport/32 differs in the graph, representing the fifth and subsequent rounds, shown in Figure 70.

Figure 70. Fifth, sixth, seventh, ... Round in R-Sport/32 (variant 2)
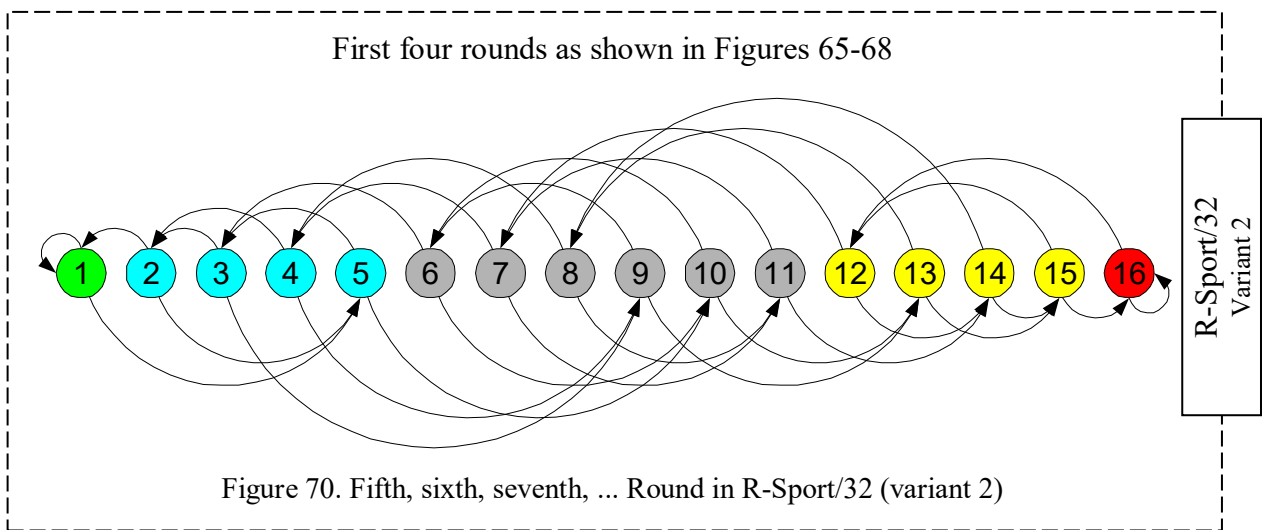
With different numbering of bases shown in Figure 64, at least ten different R-Sports/32 can be obtained. Variant 1 shows the case in which the teams' movements to the new bases take place with the smallest leaps, while variant 2 shows the case in which the teams' movements take place with the largest leaps. Therefore in variant 2 the teams are more mixed during the competition.

Figure 71 shows a variant in which teams move between bases with medium leaps.

Figure 71. Fifth, sixth, seventh, ... round in R-Sport/32 (variant 3)
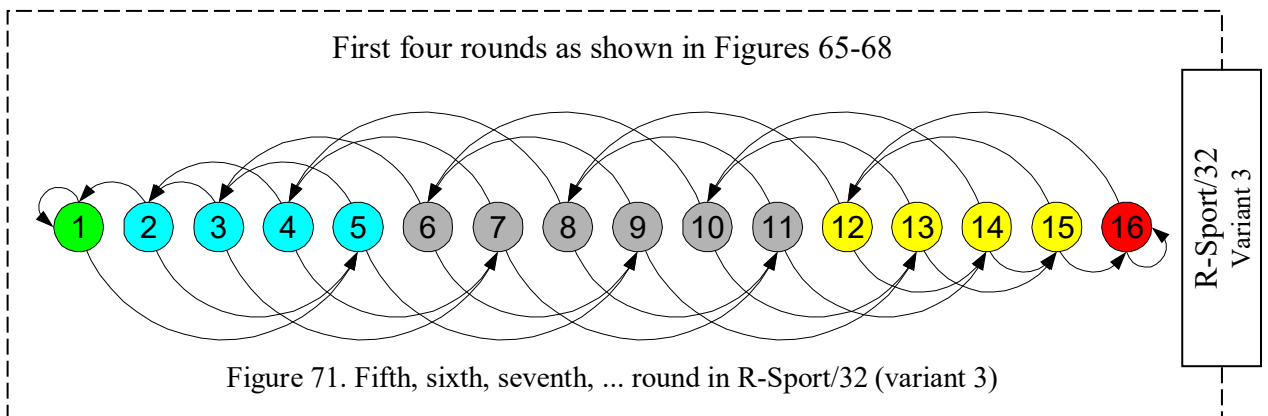
For R-Sport/32, level 5 (highest) is marked green, level 4 is marked blue, level 3 is marked silver, level 2 is marked yellow, and level 1 (lowest) is marked red.

3.9. R-Sport/64, basic form

A maximum of six levels are created in R-Sport/64. The figures representing rounds 1 to 5 are omitted. Figure 72 shows one of the many possible ways to play rounds 6, 7, 8, etc.
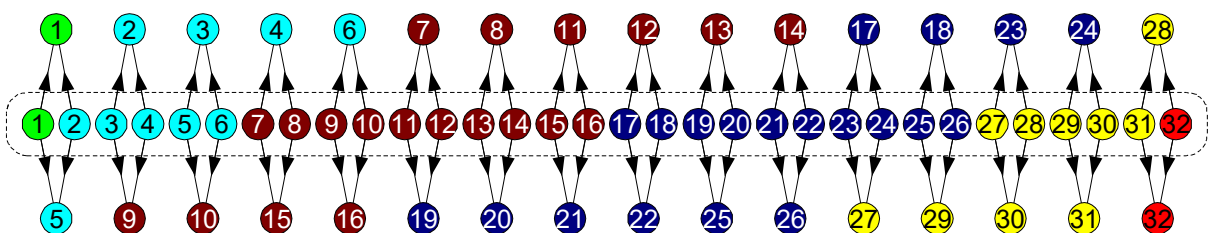
Figure 72. Sixth, seventh, eighth ... round in R-Sport/64 (variant 1)

In case of R-Sport/64 the number of schemes that can be played is very large. As in the case of R-Sport/32 these schemes differ in leaps to new bases. In the selected example, teams' leaps to new bases are of average size.

3.10. R-Sport/64, graph form

Figure 73 shows the diagram of competitions from Figure 72 in graph form.

Figure 73. Sixth, seventh, eighth ... round in R-Sport/64 (variant 1)
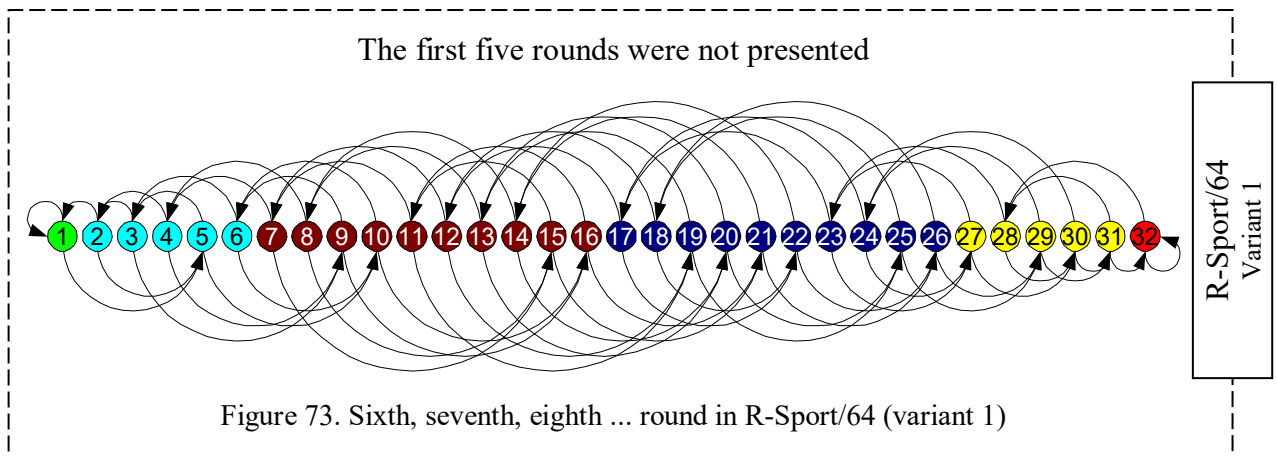
4. Scores for the achieved result (post-match scores)

In today's sport, a uniform score is applied regardless of the sporting level at which the match is played. In R-Sport, the points that the teams score after a match can depend on the level at which the match is played. In R-Sport, if the match ended in a tie, an additional settlement (e.g. overtime) is necessary.

The points of a match can be very different. In particular the points assigned at certain levels can be the same. Then these levels will become indistinguishable. Furthermore, the accepted score does not have to be linear as shown in the following tables. It is also possible to adopt a solution where the final score allocated to the team is not the sum, but the product of points obtained for individual matches (then no zero points are allocated).

Table 1 shows examples of the post-match scores.

	Variant I		Variant II		Variant III			
	V	D	V	D	V	D	
level 6	6	5	12	0	7	5	R-Sport 64
level 5	5	4	10	0	6	4	R-Sport 32
level 4	4	3	8	0	5	3	R-Sport 16
level 3	3	2	6	0	4	2	R-Sport 8
level 2	2	1	4	0	3	1	R-Sport 4
level 1	1	0	2	0	2	0	R-Sport 2

Table 1. Proposals for post-match scores

Where: V – victory,   D – defeat.

5. How to seed the teams in the first round

Seeding (that is, the positioning of the teams) in orderly pairs in the first round can be done in different ways, for example:
1. random,
2. according to the place the team took in the league in the last season (e.g. first with second, third with fourth, etc.).
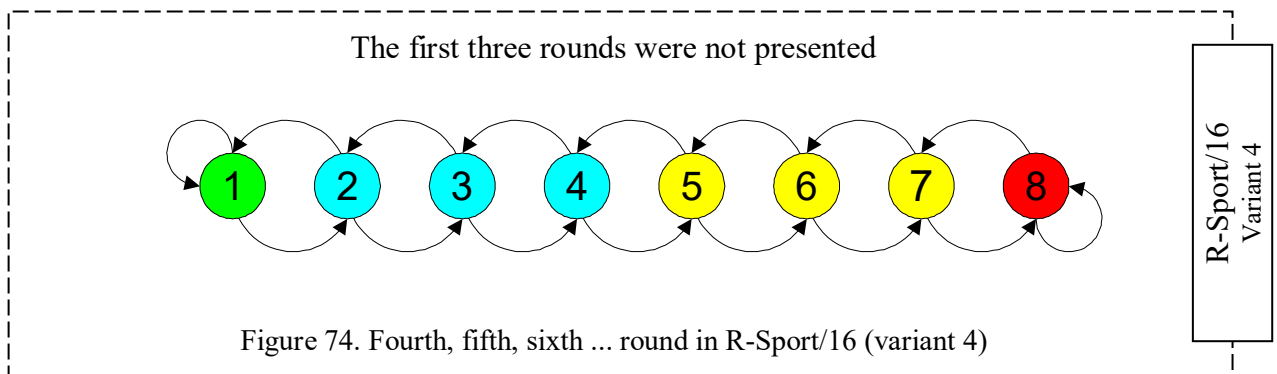
Seeding teams in the first round is important for the course of competition, especially in the initial rounds. Therefore, it is necessary to determine the most effective seed.

6. Other variants of R-Sport system

The examples of R-Sport system shown above have been developed in such a way that there are always teams playing with each other, which in the previous round either won the match or lost the match at the same time. However, R-Sport also allows to organize competitions in other ways, such as shown in Figure 74.

The first three rounds were not presented

Figure 74. Fourth, fifth, sixth ... round in R-Sport/16 (variant 4)

In this case, the team that won the previous match can play against the team that lost the previous match. This example shows that there are a huge number of variants that can be used for R-Sport competitions.

7. Basic advantages of R-Sport

The aim of sports competitions is to place teams in order from the strongest to the weakest (ordering). The only tool that allows this is to carry out the matches between pairs of selected teams. However, due to the fact that the match is not conclusive, the winning team is better, thus sometimes it is justified to play the match again in order to verify the result (organizing in an uncertain environment). In R-Sport it is automatically decided which teams will play in a given round and whether any two teams must play a rematch.

If one of the two teams is significantly stronger than the other, then they will play on different levels and are unlikely to play a joint match. This is a desirable feature of the Sports Playing System because in fact, there is no need for them to play together to decide which one is better.

If two teams get similar results, thus they are at close levels and are most likely to meet more than once at the same match base. Therefore, there will be rematches that will help to decide which one is better.

R-Sport has the following advantages:

1. The league can have a practically unlimited number of teams, and this does not cause a lot more rounds to be played. It is **flexible**.
2. It is possible to set up practically any number of rounds in the season in advance. It is **practical**.
3. Each team plays the same number of matches during the season, because none of them are out of the games. It is **honest**.
4. At the end of each round, individual teams take specific, individual places in the overall ranking. This makes the league uniform and there is constant competition for each ranking position. It is **media oriented**.
5. Strong teams play more often with strong teams, and weak teams play more often with weak teams, thus no unnecessary matches are played. Each team plays with the one they deserve. It is **effective**.
6. In each round there are always several spectacular matches, i.e. matches played by the leading teams. It is **attractive**.
7. Teams that have already played with each other can still meet if their results and sporting level are similar. Thanks to this, the result of a match between particular teams can still be verified. It is **precise**.
8. The final ranking is only determined by the results obtained by the individual teams. It is **fair**.
9. It makes corruption more difficult because the matches are played between teams at a similar level and the result of each match is important for the final ranking. It is **transparent**.

The season is **interesting** and **tense**, because it is not clear with whom the matches of the next rounds will be played.

8. Conclusion

Thanks to its features, the R-Sport Playing System allows for the selection of the champion in a modern way.

Currently there are various sports competition systems used around the world. For example, the English System, which follows the "**each with each**", the Cup System, which follows the "**losing out**" principle or the Swiss System, which follows the "**better with better, worse with worse**" principle. R-Sport can be characterized in one sentence as follows: "**Winner up, loser down**".

9. Literature

[1]   Szostek Roman, Drzystek Jacek, *Sposób tworzenia rankingu obiektów w warunkach niepewności poprzez porządkowanie metodą wielokrotnego porównywania* (in Polish: *Way of creating a ranking of objects in conditions of uncertainty by means of multiple comparison method*), Patent Office of the Republic of Poland, date of invention application 06.08.2008, invention application number P.385825, the application was published on 15.02.2010 in the Patent Office Bulletin No. 4 (943) 2010.

[2]   Szostek Roman, *Probabilistic Sorting*, Proceedings of the Concurrency, Specification and Programming Workshop (CS&P 2009), Warsaw University 2009, Volume 2, 594-601.

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[4] Szostek Roman, *Effective management system sporting competitions*, Operations Research and Decisions, Wroclaw University of Technology, Wroclaw 2011, Volume 21, 65-75, www.ord.pwr.wroc.pl/index.php?s=archive.

[5] Szostek Roman, *R-Sport - Sports Playing System* (in English), viXra 2021, www.vixra.org/abs/2102.0119.

   Szostek Roman, *System Rozgrywek Sportowych R-Sport* (in Polish), viXra 2018, www.vixra.org/abs/1802.0118.

10. Table of contents