

Relay Orienteering

Methods and organisational guidance for relay race organisers

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1. Introduction

Relay races are an interesting form of orienteering competition for both competitors and spectators. They can popularise orienteering for spectators, the press and television. Not least, the team spirit stimulates many runners to good performances.

The difficulty in organising relay races lies in conciliating the individual orienteering with the direct man-to-man contest of a mass start. The organisational constraints resulting from this are the main theme of the following chapters. This guide is published by the I.O.F. as a supplement to the rules for international orienteering races.

2. Definition of relay races

An orienteering relay race is a form of orienteering competition where each member of a relay team runs an individual orienteering course, one directly after the other in a predetermined order. The result of the race is judged according to the total time taken by each relay team.

Relay orienteering has the following characteristics:

- mass start: all first runners start simultaneously;
- continuous change-over: the members of a relay team run one after the other without any time break at the change-over;
- identical overall courses: the total course run by each team must be equivalent to that of the other teams, though the order in which it is made up can be different;
- relay teams of equal strength: each team is made up of 3 or more runners of one category or of a combination of categories. The combination must be the same for any one relay category and must be advertised by the organiser.

3. Methods for allocating courses

Though an orienteering relay race is a direct contest between competing teams, it is necessary to ensure that every runner resolves his task alone. For this purpose, a number of different methods for allocating the courses have been developed.

Preconditions for using these methods are a terrain rich in detail and a good map.

The principle of course variations consists in the permutation of the order of running of each course or partial course by the members of the relay teams. The overall course for each team must be the same.

The members of each team run the courses or partial courses in the same direction and the same number of times but in a different order.

In order to safeguard the essential character of a relay race it is advisable, in the case of all course variation methods, that the different portions of courses resulting from a bifurcation should lie close together. The best running time on the different courses (between change-overs) should be as close as possible, so that the spectators can easily follow the progress of the race.

3.1 The Motala method (course exchanging method)

The Motala method is the simplest method of course variation. A number of courses are set corresponding to the number of runners in each team. These courses are labelled A, B, C, D etc. . . and are allocated one to each member of a relay team. Each relay team must run all the courses (figure 1) though in a different order. The courses do not necessarily have to have the same number of control points.

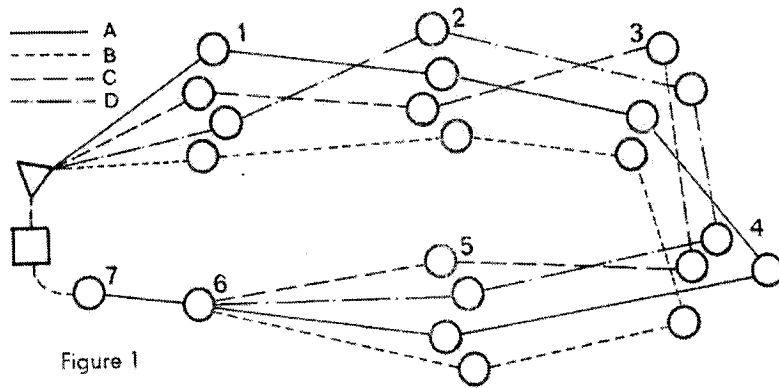


Figure 1

Near the start and the finish there can also be some control points common to all the courses of a single relay team (eg. radio or press station). This method is particularly suitable for a four man relay since it allows for 24 different course combinations even though there are only four different courses. Only if more than 24 teams are competing do some combinations need to be repeated. Table 1 shows a composition of course combinations for a maximum of 72 relay teams. Four different combinations form a variation group. Each of the three columns of the table comprise all 24 possible combinations. The order in columns 2 and 3 is deduced from column 1 according to tactical considerations. The four separate courses are labelled A, B, C and D.

An advantage of this method is that the times for the four courses are comparable. This is particularly interesting for good runners in weaker teams. The use of this method for teams of 3 runners is only advisable when few teams are competing and if there are large differences in their strength. Under these conditions there are only 6 possible combinations.

The use of the Motala method is not recommended if the race map has already been used because the later runners can work out their courses from maps they may have in their possession.

3.2 The Forsta Method (Course leg exchange method)

This method ensures that each runner in a team runs a different course by means of „forks“ (figure 2). This method can be used for any two legs of a relay; that is, for a four-man relay it can be used twice and the first and second relay legs as well as the third and fourth can be based on the same Forsta course. On the other hand, for a three-man relay it should only be used for the first and second relay legs.

The course is laid out so that at some point it forks into two branches which later join up again.

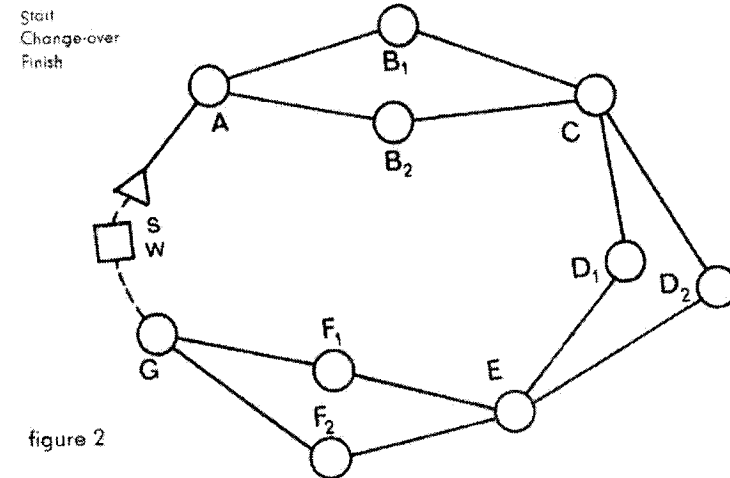


figure 2

The example of figure 2 gives the following 8 course variations (S = Start, W = Change-over) :-

1	S - A - B1 - C - D1 - E - F1 - G - W
2	S - A - B1 - C - D1 - E - F2 - G - W
3	S - A - B1 - C - D2 - E - F1 - G - W
4	S - A - B1 - C - D2 - E - F2 - G - W
5	S - A - B2 - C - D1 - E - F1 - G - W
6	S - A - B2 - C - D1 - E - F2 - G - W
7	S - A - B2 - C - D2 - E - F1 - G - W
8	S - A - B2 - C - D2 - E - F2 - G - W

Each of these variations has an exactly alternative and complementary variation which is given by the unused branches of the forks: 1 and 8, 2 and 7, 3 and 6, 4 and 5.

This leads to the rule that the second runner must always cover the complementary course of the first. The number of possible variations (v) depends on the number of forks (n) such that

$$v = 2^n$$

for example: for 3 forks there are 8 possible variations
 for 4 forks there are 16 possible variations
 for 5 forks there are 32 possible variations

and so on.

Table 2 shows all the course variations for up to six forks. Each variation is followed by its complement so that the courses for the first and second runners always follow each other. The column (n) gives the number of forks. The table is drawn up in such a way that for any chosen number of forks, the variations to be used are in the lines numbered from 1 up to and including the figure corresponding to the number of forks (for example, for 3 forks the variations to be used are from 1 to 8). Thus for $n = 3$ only the following part of the table is significant.

No.	(1)	(2)	(3)
1	1	1	1
2	2	2	2
3	1	2	1
4	2	1	2
5	1	2	2
6	2	1	1
7	1	1	2
8	2	2	1

Here only the "fork-controls" are given and two alternatives are symbolised by the figures 1 and 2.

To explain this with the aid of figure 2, the table below has been filled out for two relay legs: -

No.	1st Leg			2nd Leg		
	(B)	(D)	(F)	(B)	(D)	(F)
1	B1	D1	F1	B2	D2	F2
2	B2	D2	F2	B1	D1	F1
3	B1	D2	F1	B2	D1	F2
4	B2	D1	F2	B1	D2	F1
5	B1	D2	F2	F2	D1	F1
6	B2	D1	F1	B1	D2	F2
7	B1	D1	F2	B2	D2	F1
8	B2	D2	F1	B1	D1	F2

.. two relay teams from the same club are competing they should be put into the same group of two so that they never run on the same fork branches simultaneously. The second runner of one team will have the course of the first runner of the other. Should 3 or 4 teams from the same club compete, they should be put into the same group of 4.

The Farsta method can be extended. Thus it is also possible to optimise the separation of three relay legs with three forked branches (figure 3). The use of such extensions should only be envisaged by organisers who are very familiar with the basic version of the method.

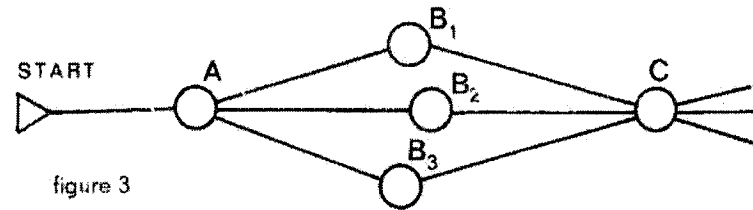


figure 3

The Farsta method is the one to be employed when the map has already been used for previous competitions.

3.3 The Vännäs method (part-course exchange method)

The principle of this method is the same as that of the Motala method. By the splitting of all the courses into two parts, a much greater number of course combinations is possible than with the Motala method. The courses are split in two by a control point common to all courses (figure 4). This control point corresponds to an imaginary additional change-over point.

The Vännäs method was originally developed for 3-man relay teams, as the number of possible variations for three legs by the Motala method (6 different combinations) is too small.

For a three-leg relay, the following procedure should be adopted:

Set three single courses and bring them all through a common control point at about mid-distance. Thus there are three half courses A, B and C from start or change-over to the common control, and three other half courses X, Y and Z from the common control to the change-over or finish (figure 4).

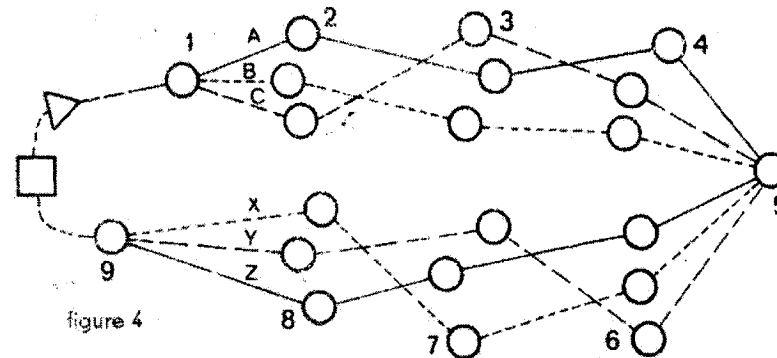


figure 4

The difference as well as the advantage with respect to the Motala-method lies only in that instead of a third of the runners running over the same course, this third is again split into 3 over the second half leg X, Y and Z. Thus only a ninth of the runners cover the same course from start/change-over to change-over/finish.

For any one relay leg, the following nine possible course variations exist:

A-X	B-X	C-X
A-Y	B-Y	C-Y
A-Z	B-Z	C-Z

Thus 36 possible course combinations can be obtained where each team covers each half course only once. Table 3 shows these 36 combinations. The combinations are grouped in threes. As for the Motala-method (Table 1), teams from the same clubs should be put into the same variation groups (of 3 or 9). Should there be too many teams, then the remainder should be put into the group immediately following.

The Vännäs method is to be avoided if maps that are in current circulation are used.

4. Guidance for course setting

The IOF "principles for course planning" are valid for relay races just as for individual events. Over and above this the following points must be taken into consideration for relay orienteering: -

- The control points must be placed in such a fashion that the presence of a runner at a point does not facilitate the finding of that point.
- There should be no dog-legs.
- The courses must present a sufficient number of itinerary choice possibilities for runners to be able to see each other from time to time thus retaining the man against man character of the race.
- The course variations must be so planned that the runners do not run together for the greater part, separating only at the approach to their respective control points. Possibilities must exist for individual itinerary choices between control points.
- As far as is possible all the individual courses must present the same degree of difficulty and be of the same length so that each runner makes a similar contribution to the team effort, and spectators can follow the progress of the race more easily.
- Obligatory marked routes, particularly at the start, should be as short as possible.
- In the case of a large number of competing teams, the Farsta method should be used and the following points should be taken into consideration: -
 - . The courses for the first two runners should be forked as often as is necessary so that: (i) all first and all second runners have courses that differ by at least one complementary forked branch and (ii) in the case of a large number of teams participating, the fewest possible teams have exactly the same course combinations.
 - . The last third of the last relay leg course should have no variations and be common to all the teams.
- It must be made impossible for any runner to deduce from the running lists which variations will be run by himself or by his opponents.

- The first controls for the runners of the first leg should be placed close together for whichever method is used. The first leg runners should not be able to discover, by observing other runners, the allocation of the different combinations to the various teams. Thus, for example, it is advisable to use only one or two first controls with the Motala or Vännäs methods.
- For close lying control points, significantly different land features must be chosen. The codes and markings must also be clearly different for these controls. For example in such a case the use of I and J as codes for close controls should be avoided.
- Depending on the terrain, it is possible with the Farsta method to lengthen the courses of the first and last leg runners by one or more additional control points at the beginning or at the end. In this case all these controls must be common for all the teams. The use of this possibility precludes the comparison of running times over the different legs.
- Each control should be fitted with an appropriate number of marking devices with respect to the number of participants. There should be more than one device at least at the first and last control points.
- From the organisational point of view it is simplest to use the same method for all the categories participating in an event.

5. Guidance for organisation

5.1 Preparation

The methods of course allocation for relay races described in chapter 3 require a basic preparation. When using one of the three tables given in this guide, one can proceed in the following manner: -

1. On the control card enter the name of the runner, the order number of his relay leg (1, 2, 3, or 4) and the team number.
2. The number of entered teams conditions the number of combinations to be used. In the appropriate table find the group number which contains the number of teams.
3. Give each team a course combination from the table, starting at the top. Clubs with more than one team must be given combinations from the same group. Cross out all used course combinations after allocation.
4. All the control cards for any one race must be of the same colour, but on the back mark the course code so that officials can know which course the competitor will be running on.
5. Attach the appropriate list of control descriptions to each map.
6. The control card is then attached to the map (over-printed with the appropriate course) in such a way that the runner cannot see the course code on the back of it.
7. The map, control card and control descriptions should be sealed into a clear plastic sleeve. Each sleeve should have marked on the back of it the same team number and relay leg number as that on the control card it contains.
8. Maps, control cards and control descriptions for the four runners of a team are then assembled in the order of the relay legs.
9. The plastic sleeve containing the map, control card and control descriptions is taken as a single package by each runner after the start or change-over and must be handed back unopened at the change-over or finish.

In order to be able to provide reliable results of the competition quickly, the course setter must give the control code marks in a usable form for checking control cards to the results officials **before** the beginning of the race. To promote spectator interest and for an easier control of the race all relay organisers should supply each runner with a very legibly numbered bib.

5.2 The competition centre

For a relay event, particular thought must be given to the competition centre. The attraction for the spectator, which is possible in relay races, is closely dependant on the layout of the competition centre. In relay races, the start, change-over and finish form a whole and should be totally visible to team officials and spectators. It is particularly important that incoming runners should be visible from as great a distance as possible. This leads to well ordered change-overs, even in the case of failure to announce incoming runners, and allows spectators to watch the sprints of any close finishes. Appropriate enclosures must be laid out to ensure that officials can carry out their tasks without hindrance. Figure 5 shows a good layout of a competition centre.

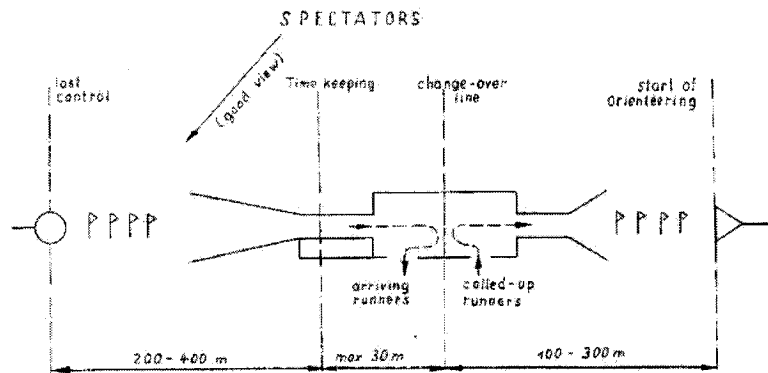


figure 5

5.3 The start

Fundamentally the start of a relay race takes place as a single mass start, at least for the whole of any one category. The first leg runners of all the teams of at least any one category take up their positions on a sufficiently wide starting line. When there are a large number of starters, the positions can be taken

up in rows. The starting signal should be a pistol shot or other easily audible signal. This can (possibly) be complemented by a visual signal. The starting line should be in close proximity to the change-over line and the finishing area. In order to retain the possibility of comparing running times with the Motala and Vännäs methods, heed must also be taken of the length of the obligatory marked routes from the start and from the change-over area to the map hand-out. In all methods the starting point of orienteering must be the same for all the relay legs. An exception to this can be made with the Farsta method when the first runners may have some common control points at the beginning of their course.

5.4 The handing-out of maps

Because of the different course variations, the handing-out of maps in relay races must be organised with particular care. Each runner must get the map allocated to him by the draw, otherwise the whole event is put into jeopardy. The following possibilities can be used for the start:

- The simplest form for a small starting field is to place the maps in the team number order upside down on the ground on the starting line in front of the runners. At the starting signal the runners can pick up and turn over their maps.
- The maps are suspended with clearly marked team numbers within arms reach at the starting line or at some distance away (figure 6). The runners unhook their maps after their start.

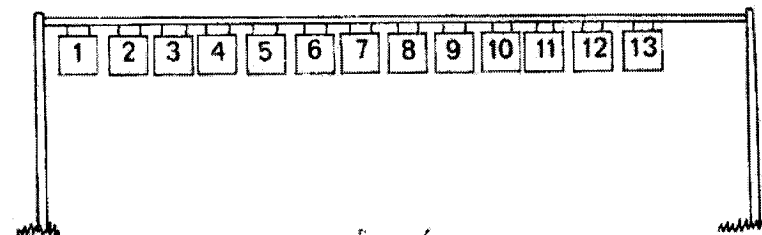


figure 6

Should the suspended maps be at a distance from the start, one must ensure that when one map gets pulled off, the others remain stable. Thus the suspension should not be a string but some rigid structure.

If the map hanging structure is to be used several times during an event for different change-overs, a map set-up such as figure 7 can be used. An orderly set-up is of great importance and should be organised with care. For larger competitions the laying out and hanging of maps for all the relay legs can be carried out beforehand.

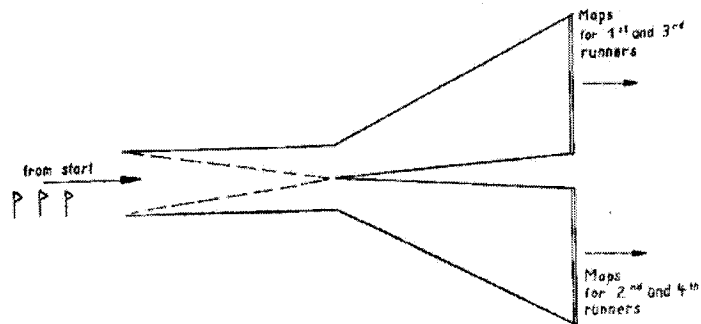


figure 7 :

After the change-over maps should be handed out according to the second of the above alternatives. This should take place immediately after the change-over or at the end of the obligatory marked route (i. e. at the point where orienteering begins). In principle, the handing-out of maps should be so organised that the runners take their maps themselves according to their team numbers. In this way the runner is himself responsible for taking the right map. However this system does not dispense the organiser from checking the procedure of map-taking or from intervening in case of necessity. Runners who take the wrong map are disqualified.

In case of errors, spare maps (if possible, a complete set of all the courses) and a list of the course allocations should be at hand.

A specially-briefed referee should be present at the map hand-out position throughout the race.

5.5 The change-over

Runners who are finishing their course should be announced by radio from one of the last control points at least two minutes before their arrival. If incoming runners can be seen from sufficiently far away, an orderly change-over can be organised without a radio system.

On arrival at the competition centre the runners proceed as follows:

1. Cross the time-taking line
2. Go into the change-over area and hand over by touch of the hand
3. Hand in their maps

Modifications of this order are possible if organisational imperatives so require. A referee must check the change-over.

The change-over can be made in the direction of the incoming runner or in the opposite direction.

It is important to make sure that the map is handed in together with the control card. It can be given out again at the end of the race. To avoid the problem of runners having to break their running speed over a very short distance at the change-over, as is the case in the competition centre layout of figure 5, a parallel change-over as in figure 8 can be adopted.

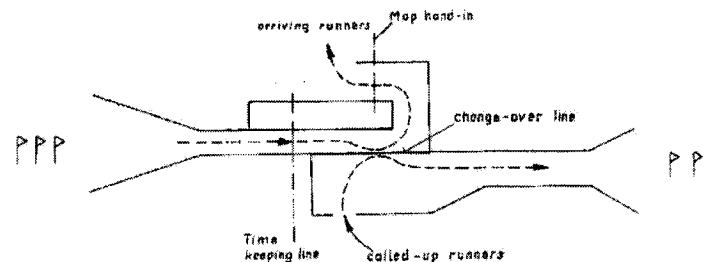


figure 8

5.6 The finish

The race finish must be situated on the same time-taking line as that used for timing the earlier runners. The same running-in corridor can be used. For important races and particularly if the starting field is very large it is better to place the finish parallel to the change-over with its own running-in corridor. In this case the finishing line should be 5 metres wide to allow close finishes without the runners being hindered.

In relay races the finishing order is judged by a team of official judges whose decision is final. The last control point must be common to all relay legs, whatever the method used. If, when using the Farsta method, the last leg of the relay is lengthened by one or more control points, the requirement of a common change-over and finishing line can be waived.

5.7 Results

Besides its basic duty of working out results as in individual events, the results officials must further the spectator interest in relay races. For this purpose it is necessary to react quickly and to put up all relevant information. The following information can be made quickly available:

1. Display on a board all team members called up for change-over.
2. Possibly on the same board, show which team members have already changed-over.
3. Give all the total team times after each change-over and at the finish. The control card checking and calculations of individual times should only take place after this information has been given. This may then lead to:
4. Possible corrections of results given in 3;

5. Giving the individual running times;
6. Once all the last leg runners have started, the announcing of the system of course combinations.

Together with this displayed information it is advisable to give as much information as possible over a public address system. The speaker should be particularly mindful to announce runners coming in from the last control to a change-over or to the finish.

To speed up the work of the results officials, the use of special relay control cards (figure 9) is advised. All the control cards for an event must be of the same colour. The use of a colour code or of control cards of different colours to distinguish course combinations is not allowed.

Start N°	<input type="text"/>	Club	<input type="text"/>																																							
Name	<input type="text"/>	Relay Leg Number	<input type="text"/>	Finish Order Number	<input type="text"/>	<table border="1" style="width: 100%; height: 100%; border-collapse: collapse;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>																																				
Finish Time	Team Start time	Team Time	Runner's start time	Runner's time																																						
Transfer to next runner's card at start time																																										
Team Placing																																										
Runner Placing																																										

figure 9

5.8 Results list

The format of the result list depends on the course allocation method used.

1. Motala-method.

Place	Club name	1 st runner Time/course/ place	2 nd runner Time/course/ place	3 rd runner Time/course/ place	4 th runner Time/course/ place	Total Time
1.	OK Stockholm	L. Berge 44.33, A, 2	K. Jonssen 44.10, B, 5	C. Olsen 41.05, C, 1	J. Larson 50.06, D, 10	2:59.54
2.					

The individual times are only relevant when given together with the courses that have been run. The placing of individual runners must be made separately for each course.

2. Farsta method.

Place	Club Name	1 runner Time	2 runners Time	Place after 2 legs	3 runners Time	4 runners Time
1.	OK Göteborg	K. Palm 40.10	O. Peterson 1:22.30	2	C. Anders 2:03.35	J. Nielsen 2:43.40
2.					

As individual running times are meaningless, it is sufficient to give the total time at the change-overs.

3. Vännäs method.

Place	Club Name	1 st runner Time/comb/place	2 nd runner Time/comb/place	2 nd runner Time/comb/place	Total Time
1.	Zürich I	M. Bucher 45.10, A-D, 5	K. Lorenz 45.05, C-E, 1	W. Grubner 42.20, B-F, 5	2:12.35
2.				

The individual times must not be given without the corresponding course combinations.

6. Control descriptions

In relay races the correctness of the control descriptions is of particular importance. These must be checked together with the courses drawn on the maps to which they are attached.

The control descriptions for relay races must not be handed out before the race, otherwise runners may be able to work out course combinations by comparing control point codes. On account of the language problem it is advisable to use symbolic descriptions. The symbolic definitions published by the IOF were devised for this purpose and should find their application in international relay races. The definitions should appear parallel to the wording on the map, either printed directly on the map or attached to it.

Table 1

Metala method
(course exchange method)

Combination	Running order for the courses	Variation group	Combination	Running order for the courses	Variation group	Combination	Running order for the courses	Variation group
1	A B C D	I	25	A C B D	VII	49	A D C B	XIII
2	B C D A		26	B D C A		50	D C B A	
3	C D A B		27	C A D B		51	C B A D	
4	D A B C		28	D B A C		52	B A D C	
5	A B D C	II	29	A D B C	VIII	53	A C B D	XIV
6	B D C A		30	B C D A		54	C B D A	
7	D C A B		31	D A C B		55	B D A C	
8	C A B D		32	C B A D		56	D A C B	
9	A C B D	III	33	A B C D	IX	57	A D B C	XV
10	C B D A		34	C D B A		58	D B C A	
11	B D A C		35	B A D C		59	B C A D	
12	D A C B		36	D C A B		60	C A D B	
13	A C D B	IV	37	A D C B	X	61	A B C D	XVI
14	C D B A		38	C B D A		62	B C D A	
15	D B A C		39	D A B C		63	C D A B	
16	B A C D		40	B C A D		64	D A B C	
17	A D B C	V	41	A B D C	XI	65	A C D B	XVII
18	D B C A		42	D C B A		66	C D B A	
19	B C A D		43	B A C D		67	D B A C	
20	C A D B		44	C D A B		68	B A C D	
21	A D C B	VI	45	A C D B	XII	69	A B D C	XVIII
22	D C B A		46	D B C A		70	B D C A	
23	C B A D		47	C A B D		71	D C A B	
24	B A D C		48	B D A C		72	C A B D	
1-24								
-48								
-72								

Table 2

Fareta Method
(course leg exchange method)

n	Variation N°	Branches						n	Variation N°	Branches					
		1	2	3	4	5	6			1	2	3	4	5	6
1	1	1	1	1	1	1	1	33	1	1	1	1	1	2	
	2	2	2	2	2	2	2		34	2	2	2	2	1	
	3	3	3	3	3	3	3		35	1	2	1	2	1	1
2	4	2	1	2	1	2	1	36	2	1	2	1	2	2	
	5	1	2	2	1	1	2		37	1	2	2	1	1	1
	6	2	1	1	2	2	1		38	2	1	1	2	2	2
3	7	1	1	2	2	1	1	39	1	1	2	2	1	2	
	8	2	2	1	1	2	2		40	2	2	1	1	2	1
	9	1	1	1	2	1	1		41	1	1	1	2	1	2
4	10	2	2	2	1	2	2	42	2	2	2	1	2	1	
	11	1	2	1	1	1	2		43	1	2	1	1	1	1
	12	2	1	2	2	2	1		44	2	1	2	2	2	2
5	13	1	2	2	2	1	2	45	1	2	2	2	1	1	
	14	2	1	1	1	2	1		46	2	1	1	1	2	2
	15	1	1	2	1	1	1		47	1	1	2	1	1	2
6	16	2	2	1	2	2	2	48	2	2	1	2	2	1	
	17	1	1	1	1	2	1		49	1	1	1	1	2	2
	18	2	2	2	2	1	2		50	2	2	2	2	1	1
7	19	1	2	1	2	2	2	51	1	2	1	2	2	1	
	20	2	1	2	1	1	1		52	2	1	2	1	1	2
	21	1	2	2	1	2	2		53	1	2	2	1	2	1
8	22	2	1	1	2	1	1	54	2	1	1	2	1	2	
	23	1	1	2	2	2	1		55	1	1	2	2	2	2
	24	2	2	1	1	1	2		56	2	2	1	1	1	1
9	25	1	1	1	2	2	1	57	1	1	1	2	2	2	
	26	2	2	2	1	1	2		58	2	2	2	1	1	1
	27	1	2	1	1	2	2		59	1	2	1	1	2	1
10	28	2	1	2	2	1	1	60	2	1	2	2	1	2	
	29	1	2	2	2	2	2		61	1	2	2	2	2	1
	30	2	1	1	1	1	1		62	2	1	1	1	1	2
11	31	1	1	2	1	2	1	63	1	1	2	1	2	2	
	32	2	2	1	2	1	2		64	2	2	1	2	1	1

Table 3

Vännäs Method
(part-course exchange method)

Combination	Course for 1st runner	Course for 2nd runner	Course for 3rd runner	Variation Groups	
				Groups of 3	Groups of 9
1	A X	B Y	C Z	a	I
2	B Y	C Z	A X		
3	C Z	A X	B Y		
4	A Y	B Z	C X	b	
5	B Z	C X	A Y		
6	C X	A Y	B Z		
7	A Z	B X	C Y	c	
8	B X	C Y	A Z		
9	C Y	A Z	B X		
10	A X	C Y	B Z	d	II
11	B Y	A Z	C X		
12	C Z	B X	A Y		
13	A Y	C Z	B X	e	
14	B Z	A X	C Y		
15	C X	B Y	A Z		
16	A Z	C X	B Y	f	
17	B X	A Y	C Z		
18	C Y	B Z	A X		
19	A X	B Z	C Y	g	III
20	B Y	C X	A Z		
21	C Z	A Y	B X		
22	A Y	B X	C Z	h	
23	B Z	C Y	A X		
24	C X	A Z	B Y		
25	A Z	B Y	C X	i	
26	B X	C Z	A Y		
27	C Y	A X	B Z		
28	A X	C Z	B Y	j	IV
29	B Y	A X	C Z		
30	C Z	B Y	A X		
31	A Y	C X	B Z	k	
32	B Z	A Y	C X		
33	C X	B Z	A Y		
34	A Z	C Y	B X	l	
35	B X	A Z	C Y		
36	C Y	B X	A Z		