Golf Competition Between Individuals

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Abstract

In almost all golf competition handicapping is used to more or less equalize players' winning chances. It is recognized that in different types of competition different handicap allowances are necessary. This study used two methods, one of them extensive simulation, to determine optimum allowances for individual men's match and stroke play.

MATCH PLAY

There are two popular types of golf competition for individual play, as opposed to team play. One is match play, in which two competitors are involved and each hole is a separate contest, the player winning the most holes being the winner of the match. To give the weaker player a more or less equal chance it is customary for the stronger to offer him strokes, that is, to allow him to reduce his scores on selected holes. For this type of competition reference (1) found how the stronger player's winning probability varies with the handicaps of the players and the number of strokes given. In particular it showed by a simulation procedure that for fair play the number of strokes ought to be 127 percent of the handicap difference between competitors. Recent modification of the official handicapping method of the USGA (United States Golf Association), inspired by this work, reduces this figure to 112. It also changes the picture showing the effects of not offering this ideal number of strokes, TABLE I being the updated version. The column headed FULL DIFF shows the stronger player's edge even when he offers 100 percent of handicap difference. Anything less means a lop-sided match, while in some cases even more can be given without becoming the underdog.

TABLE 1

	Strokes given							
Handicap difference	less				Full diff	more		
	4	3	2	1		1	2	3
0					50			
1				58	51	44	37	31
2			65	59	52	45	38	31
3		72	66	59	53	46	39	32
4	78	73	67	60	53	46	40	33
5	79	74	68	61	54	47	40	34
6	80	74	68	62	55	48	41	35
7	80	75	69	63	56	49	42	35
8	81	76	60	63	57	50	43	36
9	82	77	71	65	58	51	45	38
10	82	77	71	65	58	51	45	38
11	83	78	72	66	59	52	45	39
12	83	78	73	67	60	53	46	39
13	84	79	73	67	61	54	47	40
14	84	80	74	68	62	55	48	41
15	85	80	75	69	62	56	49	42
16	85	81	75	70	63	56	49	43
17	85	81	76	70	64	57	50	43
18	86	82	77	71	65	58	51	44
19	86	82	77	72	66	59	52	45
20	87	83	78	73	66	60	53	46

SCORE DISTRIBUTIONS

A different approach to the problem of individual competition sheds light on both match play (head to head) and stroke play (large field of players). It is based upon the distribution of scores for each handicap level. To find these distributions the records of more than a thousand golfers were used, and additional rounds were simulated hole by hole by means of a random number process until a hundred actual or simulated scores were in hand for each player. All scores were then grouped by handicap and counted. A partial summary of the results is given in TABLE II, for handicaps that are multiples of five. For compactness of display scores are relative to handicap, that is, the 0 row shows how often golfers played exactly

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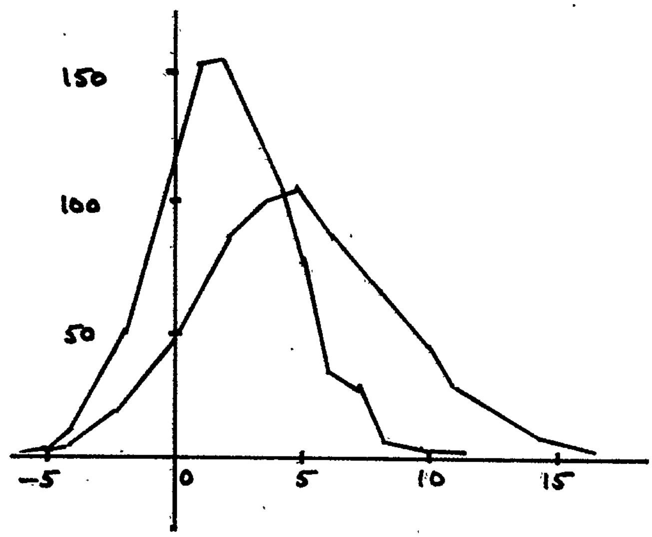
TABLE II

Score	Handicap							
	-5	0	5	10	15	20	25	30
-7		1	1	1	1		1	1
-6	1	3	2	1	1	1	1	1
-5	2	3	2	4	2	2	4	4
-4	7	10	6	9	4	4	5	7
-3	20	25	15	14	11	10	10	13
-2	48	44	28	28	19	15	19	21
-1	81	79	48	45	32	28	27	29
0	125	118	72	65	50	40	46	43
1	156	154	101	85	67	59	57	61
2	165	158	124	103	86	83	72	77
33	137	136	130	110	94	101	95	82
4	114	110	119	111	103	115	98	98
5	72	80	105	103	107	104	103	93
6	42	35	78	89	89	105	101	93
7	17	29	56	70	80	88	89	86
8	8	8	39	54	67	72	75	77
9	3	4	28	38	52	55	61	61
10	1	2	18	25	43	41	47	49
11	1	1	11	17	29	28	35	36
12			7	10	21	19	23	25
13			4	7	15	12	13	18
14			3	4	11	7	8	10
15			1	2	7	4	6	6
16			1	2	4	3	2	3
17			1	1	3	2	1	1
18				1	1	1	1	2
19				1	1	1		2
20								1

to their handicaps, rows above this representing better than handicap and those below worse. Moreover, for uniformity all counts are per thousand rounds; the number of rounds available ranged from one thousand to twelve thousand depending upon handicap. For example, 44 scores out of a thousand shot by scratch golfers were two strokes better than handicap, while for handicap 15 players the corresponding figure was only 19. Each column in this table shows how scores were distributed for the particular handicap level. The greater spread for larger handicaps is fairly conspicuous, scores at handicap 30 ranging from 23 to 50 relative to course rating.

DIAGRAM 1 provides another view of the same information, for the handicap 0 and 15 cases. Scores of scratch players ran from -7 to 11 with a peak at 2, the distribution taking a pattern very familiar to statisticians. Although this curve is based upon a thousand rounds of golf it is still not entirely smooth, another indication of the extent to which performance fluctuates. The distribution for handicap 15 is similar, broader and not so tall, with a peak at 4 or 5 relative to handicap. Though based upon twelve thousand rounds it also is not entirely smooth. The other distributions can be diagrammed in the same way.

DIAGRAM 1



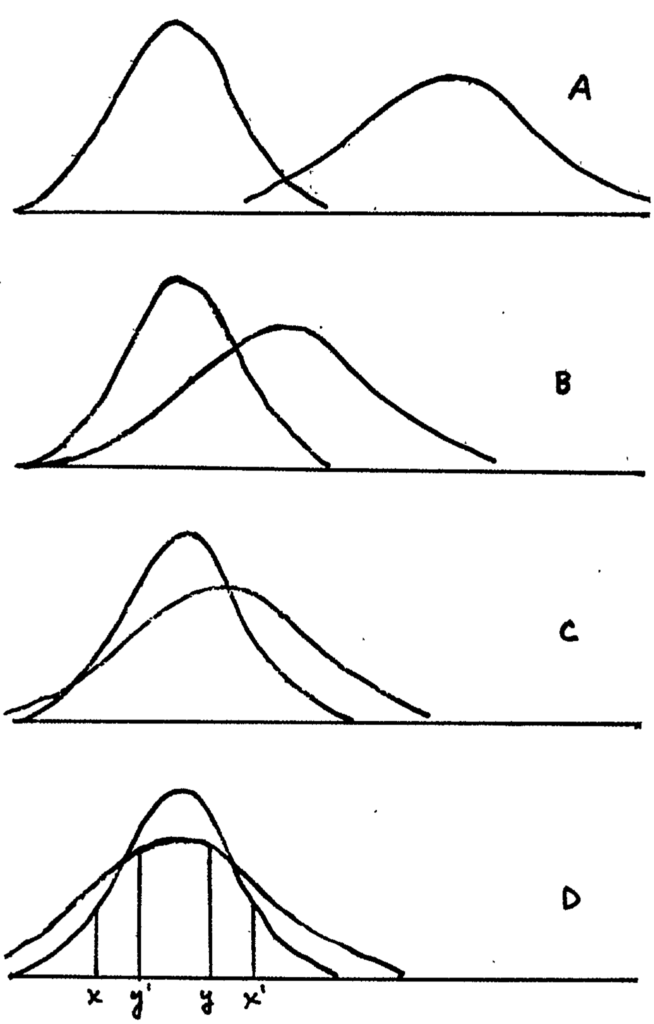
APPLICATION TO STROKE AND MATCH PLAY

In a very large field of competitors one or more are almost certain to have "hot" days, to play at or near their very best. One criterion of fairness suggests that these players ought to be winners. Implementing this criterion means giving strokes in such a way that their bests are equalized. DIAGRAM 2 shows what this means in terms of distributions. In part A at the top of this diagram are typical score distributions, a strong player's at the left and a weaker player's at the right. In part B strokes have been given, shifting the weaker player's scores to the point where the best scores coincide. To do this numerically best scores were extracted from TABLE II and from similar columns for in-between handicaps not listed here, those from the table being -11, -7, -2, -3, 8, 14, 18, 23. The least squares line fit to this data was

$$\text{best} - .99 \text{ h'cap} = -6.6$$

and estimates that 99 percent of handicaps being given all competitors who play their best will have identical net scores of -6.6. The best scores concerned here are the best in a thousand and, since it is not likely that a field of a thousand golfers can be accomodated easily, our result is of only preliminary interest.

A field of 100 players is more likely and since it is still large the above argument can again be made. The winner of such an event is the best of a hundred that day. Assuming that he played to the best hundred'th of his game and that anyone playing that well deserves to be a winner suggests equalizing this level of performance. In TABLE II this means picking out the tenth best (of the thousand) scores instead of the very best. These prove to be -9.0, -4.7, 0.8, 5.7, 11.5, 16.3, DIAGRAM 2



20.9, 25.6 and the corresponding least squares line was

$$\text{score} - 1.01\ \text{h'cap} = -4.3$$

meaning that 101 percent of handicaps is required.

If fair play is defined to be equal chance to finish somewhere in the top quarter of the field, not necessarily in first place, then it is the 250 level in the table which should be equalized. Part C of Diagram 2 shows what this would achieve, a further slide of the weaker player's score distribution toward the left. The least squares line for this level was found to be

$$\text{score} - 1.08\ \text{h'cap} = 0.2$$

so that the magic number becomes 108 percent. The right side of this equation, essentially zero, represents the quarter point of a scratch player's score distribution. This seems to be a very reasonable result since the handicap of a scratch player, also zero, is the average of the better half of his game, which we might expect to fall close to the quarter point.

Equalizing the 500'th best scores (the medians) would produce the situation shown in part D of Diagram 2. The following easy argument shows that this is a fair arrangement for head to head play. On a given day the stronger player may shoot score x and defeat the weaker who manages a net score of y. But then on some other day, with almost equal probability, the symmetric scores x' and y' will occur and even things up. This is true for any x and y, so players win equally often. The argument applies to stroke play but, as reference (1) shows, there is very little difference between what is needed to equalize head to head play, stroke or match. Extracting median scores from the table the following least squares line was found.

$$\text{score} - 1.11\ \text{h'cap} = 2.0$$

Both the 1.11 and 2.0 figures are reassuring. The first is certainly very close to the 1.12 estimate of section 1 for fair head to head play, and the second duplicates the result found in reference (1) for the median score of a scratch player. These figures have thus been found by two different procedures using scores of different players at different clubs.

For a light touch one further application of the score distributions was made. The least squares line fitted to the worst scores for the various handicap levels turned out to have slope 1.25 so presumably this is what would be required to give everyone an equal opportunity to finish last, in a field of 1000. Diagram 2 does not offer a view of the weaker player's distribution shifted to this ultimate extent, but the picture is easily imagined.

SIMULATED TOURNAMENTS

As a second approach to the large field problem many tournaments were simulated, first using fields of 100 players in eighteen hole events. At each of thirteen clubs players were divided into four groups.

Group	A	Handicaps	10 and under
"	B	"	11 to 15
"	C	"	16 to 20
"	D	"	21 and over

These groups proved to be of roughly equal size so that a reasonable supply of scores was available for each. Using a random number process 100 scores were then selected, 25 from each group. To reduce variation care was taken to use good and bad scores equally often. These scores were then adjusted for 90, 100, 110 and 120 percent of handicaps. For each of these cases the group of the winner was then recorded, and counts were made by group of those finishing in the top quarter, the second quarter, the third and the last. This was done fifty times at each of the thirteen clubs, for a total of 2600 tournaments. The results were tabulated for each club separately after which overall averages were found. TABLE III shows these overall averages. Each entry represents the percentage of players from each group that finished as indicated, winning or placing in a particular quarter. A thoroughly fair tournament would require that every entry be .25, giving each player the same chance to finish anywhere.

Perhaps the first thing to notice in this table is the distribution of winners. At 90 percent of handicaps group A has more than its fair share, while at 110 percent it is group D that takes over. The 100 percent figures are more in balance. The standard deviation of winner values was .03, compared with .01 for the other entries, the higher variability being due to the fact that winners are not so numerous.

TABLE III

	Group A	B	C	D
		90 percent		
Winners	.40	.27	.17	.16
Top quarter	.39	.28	.19	.14
2nd "	.27	.26	.26	.21
3rd "	.20	.26	.27	.27
4th "	.13	.21	.28	.38
		100 percent		
Winners	.27	.23	.21	.29
Top quarter	.31	.26	.22	.21
2nd "	.28	.25	.25	.22
3rd "	.24	.26	.25	.25
4th "	.18	.23	.27	.32
		110 percent		
Winners	.14	.18	.22	.46
Top quarter	.23	.24	.24	.29
2nd "	.27	.25	.25	.23
3rd "	.27	.26	.24	.23
4th "	.24	.25	.26	.25
		120 percent		
Winners	.06	.12	.21	.61
Top quarter	.16	.21	.26	.37
2nd "	.26	.25	.26	.23
3rd "	.29	.26	.24	.21
4th "	.29	.27	.25	.19

If fair play means equal chance to be a winner then 100 percent of handicaps appears to be the way to achieve it, at least in round numbers. Just for comparison with the 101 percent estimate found in section 3 it was interesting to apply a slightly more sophisticated method here, taking into account the combined deviations from .25 across the four winner rows in the table. Minimum deviation was predicted to occur for exactly 100 percent of handicaps.

If, on the other hand, fair play means equal chance to finish in the top quarter and win at least some prize, then further examination of the table shows that 100 percent is not enough. Entries in this row fall steadily from .31 to .21. But 110 percent appears to be too much, corresponding entries climbing from .23 to .29. In fact, this was true at each of the thirteen clubs used, 100 percent always being too little and 110 too much. In section 3 the estimate 108 percent was found for this kind of equity. Again applying the method just used on winners rows it was found that minimum deviation from the ideal of all .25 values in the top-quarter row occurs for 107 percent of handicaps. Two entirely different approaches to this problem have, therefore, found very similar estimates of what is needed.

Since it is rather unlikely that more than 100 percent of handicaps will be offered another glance at this part of TABLE III may be useful. As noted earlier entries in the winners row are almost balanced, deviations from .25 being very likely chance fluctuations. In the lower four rows, however, standard deviations were only about .01 so that these entries are almost surely correct to within three percentage points. This means that significant, though small, inequities still exist at the four corners. Hopefully they might not prove to be too troublesome.

More or less incidentally, record was also kept of the winning scores of all tournaments simulated. For 100 percent of handicaps these ranged from -10 to -1, relative to course rating, with a mean of -5.7.

FIELD OF 100, PLAYING 36 HOLES

The same procedure just described was next applied using the total scores for 36 holes of play. TABLE IV shows the overall averages for the various handicap groups and levels of finish. Each entry is again the percentage finishing as indicated. Standard deviations were the same as before, .03 in winners rows and .01 elsewhere. Looking over the winners rows suggests that 100 percent of handicaps has not been quite enough for equity, and the method of minimizing total deviation from solid .25's produced the estimate 102 for this role. Examining the top quarter rows again finds 100 percent too little and 110 too much, and once again this was true at each of the thirteen clubs separately. The method of minimum deviation estimated 107 percent for fair play by this definition. Finally, winning scores ranged from -11 to 0 with the same -5.7 average that was found for 18 hole events.

TABLE IV

	Group			
	A	B	C	D
	90 percent			
Winners	.53	.24	.13	.10
Top quarter	.43	.29	.17	.11
2nd "	.28	.27	.25	.20
3rd "	.19	.26	.28	.27
4th "	.10	.18	.29	.43
	100 percent			
Winners	.31	.25	.19	.25
Top quarter	.33	.27	.21	.19
2nd "	.28	.25	.25	.22
3rd "	.24	.25	.26	.25
4th "	.16	.22	.28	.34
	110 percent			
Winners	.13	.18	.23	.46
Top quarter	.22	.24	.24	.30
2nd "	.27	.25	.25	.23
3rd "	.27	.26	.25	.22
4th "	.24	.25	.26	.25
	120 percent			
Winners	.04	.09	.20	.67
Top quarter	.13	.20	.26	.41
2nd "	.25	.26	.26	.23
3rd "	.30	.27	.24	.19
4th "	.32	.28	.23	.17

FIELD OF 200, PLAYING 18 AND 36 HOLES

The same sort of simulation was made for fields of two hundred players. TABLE V gives the results for eighteen hole events, the entries having standard deviations of .04 in the winner rows and .01 elsewhere. Tournaments at 80 and 120 percent of handicaps were included but the results have been omitted, though they were used in making the usual estimates of the most equitable percentages, which proved to be 97 for equal chances to win and 107 for equal chances at the top quarter. The average winning score was -6.7, the range being from -12 to -2.

For the thirty-six hole events corresponding results appear in TABLE VI, the entries having standard deviations more or less as before. Figures for 80 and 120 percent of handicaps are again omitted. (The 80 percent simulation was added for fields of 200 when it was found that at some clubs the optimum percentage for equalizing winner entries was in the mid to lower 90's.) Overall this optimum proved to be 101 percent, while equalizing chances at the top quarter once again led to the durable 107. The average winning score was -6.9 with a range from -13 to 0.

TABLE V

	Group			
	A	B	C	D
	90 percent			
Winners	.37	.24	.18	.21
Top quarter	.39	.28	.19	.14
2nd "	.27	.26	.25	.22
3rd "	.22	.26	.26	.26
4th "	.13	.20	.29	.38
	100 percent			
Winners	.25	.22	.20	.33
Top quarter	.31	.26	.22	.21
2nd "	.27	.25	.25	.23
3rd "	.25	.26	.25	.24
4th "	.18	.22	.28	.32
	110 percent			
Winners	.12	.18	.21	.49
Top quarter	.22	.24	.24	.30
2nd "	.28	.25	.24	.23
3rd "	.27	.27	.24	.22
4th "	.23	.24	.27	.26

TABLE VI

	Group			
	A	B	C	D
	90 percent			
Winners	.52	.23	.13	.12
Top quarter	.43	.29	.17	.11
2nd "	.28	.28	.25	.19
3rd "	.19	.25	.29	.27
4th "	.10	.17	.30	.43
	100 percent			
Winners	.29	.22	.22	.27
Top quarter	.33	.28	.20	.19
2nd "	.28	.27	.24	.21
3rd "	.23	.25	.27	.25
4th "	.16	.21	.29	.34
	110 percent			
Winners	.12	.15	.25	.48
Top quarter	.22	.25	.24	.29
2nd "	.27	.26	.24	.23
3rd "	.27	.26	.25	.22
4th "	.23	.24	.28	.25

SUMMARY

Two methods of approach have been taken to each of the popular types of individual competition, one using the score distributions of the various handicap levels and the other using simulated play. Estimates of strokes needed to arrange fair play proved to be very consistent, always close to 100 percent of handicaps for equalizing winning chances in stroke play, large field events, either 107 or 108 if equal chance at the top quarter is the goal, and 111 or 112 for head-to-head competition. The chances of players at various ability levels have also been found when the optimum percentages for the different types of competition are not offered, and appear in the tables. Since it is unlikely that more than 100 percent of handicaps will be offered, some inequities will remain, and the practice of limiting handicap differences by the use of flights or otherwise may be useful. Estimates of the average winning scores in large field events do differ somewhat, score distributions suggesting -4.3 to -6.6 while simulated tournaments produce -5.7 to -6.9. This can be taken as a reminder that data fluctuations or inconsistencies make perfection a noble but unattainable goal.

REFERENCES

1. Scheid, "You're not getting enough strokes," Golf Digest, 1971.