8. Appendices

Appendix A. Issues to be considered in determining hole index ratings

All venues where handicap competitions are played are required, under the Rules of Golf (Rule 33-4), 'to publish a table indicating the order of holes at which handicap strokes are to be given or received.' But the Rules provide no method by which this order, or hole index rating, is to be determined. Golf Australia, in a document entitled 'Course Management, Marking the Course, & Course Set-up Procedures — Golf Australia Recommendations', available from its website (www.golf.org.au/site/_content/document/ 00014129-source.pdf) does provide very helpful direction. However, this is only advisory, as is acknowledged by the document, and there are some matters and recommendations canvassed in it which committees may well wish to debate. Moreover, the widespread availability of hole-by-hole scores from computerised handicapping systems has made access to and analysis of score data much less labour-intensive than in the past, and this may affect decisions on determination of indexes. And, of course, the availability of hole index rating software such as *HoleRater* allows committees to explore a number of methods before determining on a preferred one. But it is suggested that committees should base their decisions on specific principles that should be recognised and recorded so that, next time a revision is necessary, the 'current' committee can base its method on these previously agreed principles or agree and record why it is changing to new principle/s.

A club committee needs to consider a number of issues in deciding how to determine hole index ratings. The following are noted as requiring consideration, not necessarily in order of importance.

1. Should the same indexes be used for match play and stroke play?
2. What should be the basis of determining hole indexes? Hole difficulty? Position of hole in the round?
3. For stroke indexes, if they are to be based on hole difficulties, how should these difficulties be defined?
4. Should the same index be used for all ranges of handicaps: Plus, Up to 18, 19–36 and, for women only, 37–45?
5. Whose scores should be used to calculate hole difficulties? Everyone's; only particular handicap groups, eg, low handicappers? If not just one group, which groups? How should groups be defined? Should account be taken of different numbers of scores from particular handicap groups? If so, how to do this?
6. If different handicap groups are used as part of the basis of index calculation, which handicap type should be used: in Australia, GA Handicap or Daily Handicap?
7. Which method should be used to calculate indexes, the Group Handicap or Single Handicap method?
8. What scores should be used? Those from all competitions and tee colours? Only Stroke rounds from back tee positions? What about Par and Stableford scores where a player has picked up?
9. Should different tee colours have different indexes? How should holes whose pars change for different tee colours be treated?
10. Should indexes be 'balanced' across nines?
11. If indexes are to be balanced, how should this be done? Odd indexes on one nine and even indexes on the other, or some other way?
12. How many scores should be used?

Each of these issues is addressed below, and recommended principles are made in relation to them.

Indexes for match play and stroke play and principle/s for assigning hole indexes

The purpose of a golf handicap is, of course, to ensure equity when players are in handicap competitions, whether the competition is an individual match or whether it is a stroke play one. Now, achieving agreement on definitions of 'equity' is notoriously difficult. In the case of stroke play competitions Golf Australia has applied a definition which relates to the likelihood of a player winning or placing well in a net competition (*GA Handicap System*, 1 (i), Golf Australia, 2014). There is no equivalent statement for handicap match play; however, a reasonable basis for equity in such an event is that each individual player should have about the same likelihood of winning a match. That is, if players of substantially different handicaps were to play each other many times, they would each win about 50% of the matches (assuming no halved matches).

Now, what does this have to do with hole indexes? In a net stroke play competition, it makes sense for players to receive shots at holes they find most difficult, so the normal method of assigning indexes for stroke play is based on perceived hole difficulty. In the case of match play, there are two competing principles: (a) that a player should not be substantially advantaged by virtue of when in the round s/he is receiving a stroke, and (b) that a player should not be substantially advantaged by receiving a stroke at a hole which both players find equally difficult. These two principles lead to the two main methods of assigning indexes for match play: apply a place-in-the-round distribution, and use a hole difficulty measure.

What application of the first principle could lead to is a player in a match receiving a stroke on the easiest hole on the course but not receiving one on the most difficult. Application of the second principle could lead to a match being completed as a result of not receiving a critical stroke until late (well, too late!) in the round. (It is worth noting that handicaps in match play are based on the *difference* between stroke play handicaps. Thus, a player off 7 on a course playing someone off 15 must give the 8 strokes difference on holes with indexes 1–8.)

Although GA recommends application of the first principle for handicap match play in its document, a comment refers to a potential problem with the indexes-based-on-place-in-the-round principle.

> When using the match play index in match play competitions, the index should be adapted when a match commences at any other hole on the course other than the 1st: Hole 1 in the recommendation should apply to the first hole to be played, Hole 2 to the second hole to be played, etc.

Thus, if a club publishes a separate match play index, it must also note that this index should be reversed if the match commences on the 10th hole. This is obviously a potential source of confusion (and dispute) for players, and would be better if such confusion could be avoided.

Which of the two principles is the more equitable? As with many such questions, this requires a subjective judgement, but when posed in this way, most people consider that the second principle is the more equitable: that match play hole indexes should be based on hole difficulties. Thus, both match play and stroke play indexes can be based on the same principle, and there is no need to publish separate indexes for the two forms of play.

Principle 1. Match play and stroke play hole indexes should be the same and both should be based on hole difficulty.

Method of determining hole difficulty

There are many ways of determining hole difficulty, such as counting the number of birdies, calculating mean eclectic scores, calculating mean Stableford scores, calculating mean net scores, calculating mean gross scores, etc. Some of these have been used in the past because they simplified the data entry and analysis processes. But, as has been noted, hole-by-hole gross scores are now readily available from computerised handicapping systems. Moreover, if such data is available, whether there are 100 or 20,000 scores shouldn't affect the ease of calculation: spreadsheets and databases can cope with virtually any reasonable number of scores, once the process has been established.

A question which is often asked is, Should the same method be applied for par 3s as is used for par 5s? If mean gross or net scores are used, then raw means are not appropriate — a par 3 should obviously

have a lower mean than a par 5. Bearing in mind that golf scores are derived by adding whole numbers (ie, a stroke has the same value wherever it is made), and a 4 on a par 3 is the same number as 4 on a par 4 and on a par 5, a better approach is to look at the difference between the mean score and par on each hole. A more difficult hole will have a higher mean difference from par, and holes can therefore be ranked in order of those mean differences. A mean difference from par is independent of the par of a hole, so it can be validly used as a measure of hole difficulty. Moreover, mean gross score is independent of the current hole indexes (which is what we are trying to determine), so it is probably better than mean net score. Also, the difference of mean gross score from par is likely to be more stable than, say, number of birdies or mean eclectic score.

Principle 2. In general, hole difficulty should be based on difference between mean gross score and hole par.

Use of the same index for all handicap ranges

Many clubs show only one set of indexes on their cards (1–18). This is based on an assumption that all golfers, regardless of their handicap, find the order of difficulty of holes the same. This is generally clearly not the case; indeed, this is why *HoleRater* provides the Graph button on the Calculate Hole Mean Scores pages, so that evidence about the likely incorrectness of this assumption can be viewed — see Sections 6.2.2 and 6.2.3. A reasonably general observation is that lower handicap golfers find par 5s relatively easy and par 3s relatively more difficult, whereas higher handicap golfers find the reverse.

If the assumption is not correct then, in the interests of fairness to all handicap groups, allowance should be made by providing indexes more appropriate to each range. For men, that would be Plus, 1–18, 19–36; for women, the same, as well as 37–45. For Plus handicaps, there would be little call for handicaps lower than +6 (actually, technically -6). Indeed, clubs with very low numbers of such golfers playing their courses may well deem these indexes unnecessary.

Principle 3. Separate hole indexes should be provided for the different handicap ranges: Plus, 1–18, 19–36 and, for women only, 37–45.

Handicap type to be used for index calculation

Prior to 23 January 2014, Australia had only one type of handicap, and there was no question of 'Which handicap type to use for index calculation?' But, since that date, Australia has had both a Daily Handicap (the handicap used for handicap competitions) and a GA Handicap, which is the handicap published by Golf Link and which is used to determine the Daily Handicap.

It is strongly suggested that scores from prior to 23 January 2014 **not** be used for hole index calculation to avoid a mixture of handicap definitions, as well as using more contemporary scores and handicaps.

If index ratings are to be based on scores by identified handicap groups (see below discussion), which handicap should be used, the Daily Handicap or the GA Handicap? There are, as with many of the issues discussed here, pros and cons for each.

Of course, it is the Daily Handicap that determines where a stroke is received (eg, if your GA Handicap is 10 and your Daily Handicap is 12, you receive strokes on holes with indexes 1–12, not 1–10). Therefore, in determining hole indexes, it makes sense to use Daily Handicaps. However, there is a problem with using Daily Handicap as the basis for grouping scores for index calculations: most clubs have Slope Ratings well above 113, and at clubs with higher Slopes (say above 125) there is a 'piling-up' of handicaps at the top of the allowed range. GA Handicaps for men are allowed to reach 36.4 and, for women, 45.4. But Daily Handicaps are restricted to 36 and 45 respectively. Now, for a course with a Slope of, say, 125, any male with a GA Handicap greater than 32.0 will play off a Daily Handicap of 36; similarly, any female with a GA Handicap greater than 40.2 will play off a Daily Handicap of 45. For higher Slopes, the cut-off GA Handicap is progressively lower and the potential bunching greater. Thus, there is normally a clustering of players on the upper limits of Daily Handicap at courses with Slopes much greater than 113.

The opposite effect occurs for clubs where Slopes are lower than 113. For a course with a Slope of, say, 100, the maximum Daily Handicap available for a male is 32; for a female, it is 40. Thus, there is a paucity of scores for Daily Handicap at the upper ranges for such clubs.

There is also the fact that, for many Slope values, there is little difference between the two handicaps. For example, for the GA Handicap of 15 (which is about the Australian men's average), for Slopes of between 102 and 124, Daily Handicaps only range from 14–16. For more extreme values of Slope and higher handicaps, then the two will differ more.

There is also the observation that there is little difference in outcome whether the GA or Daily Handicap is used. Table 4 shows, for a particular course–tee colour–gender combination, the hole index ratings using both GA and Daily Handicap and Group and Single Handicap methods.

Table 4. 'Balanced Nines' indexes from Group and Single Handicap methods using GA and Daily Handicaps for men's Blue Tees, Slope 128

	GA Handicap Values		**Daily Handicap Values**	
	Group Handicap Method	**Single Handicap Method**	**Group Handicap Method**	**Single Handicap Method**
Hole	**Indexes 1–18**	**Indexes 1–18**	**Indexes 1–18**	**Indexes 1–18**
1	13	15	11	14
2	11	10	13	11
3	4	4	4	4
4	1	1	1	1
5	14	13	14	13
6	3	3	3	3
7	16	17	16	17
8	8	7	7	6
9	15	16	17	16
10	10	11	8	10
11	18	18	15	18
12	17	14	18	15
13	2	2	2	2
14	5	5	5	5
15	12	12	12	12
16	6	6	6	7
17	9	9	10	9
18	7	8	9	8
	Indexes 19–36	**Indexes 19–36**	**Indexes 19–36**	**Indexes 19–36**
1	33	32	33	35
2	22	25	25	27
3	20	20	20	19
4	23	21	21	21
5	32	33	32	30
6	25	24	23	23
7	34	34	34	33
8	24	23	24	25
9	35	35	35	34
10	30	30	29	29
11	36	36	36	36
12	28	28	28	28
13	31	31	30	31
14	26	26	26	24
15	29	29	31	32
16	19	19	19	20
35	27	27	27	26
36	21	22	22	22

Table 5 shows the GA Handicap–Daily Handicap correlations between the indexes in Table 4.

Table 5. Correlations between GA Handicap–Daily Handicap indexes from Group and Single Handicap methods for men's Blue Tees, Slope 128

Indexes	Group Handicap Method	Single Handicap Method
1–18	0.984	0.995
19–36	0.975	0.953
1–36	0.993	0.993

As can be seen from Table 4, there are some slight differences between the indexes using the two different handicap types, but the observation is (Table 5) that there are extremely high correlations between the indexes derived using the two handicap types, whether the Group or Single Handicap Method is used.

Therefore, no specific conclusion is drawn about which is the overall better handicap type to use. Perhaps if the courses for which indexes are being determined have relatively high or low Slopes, consideration should be given to preferring GA Handicap because of the issues of bunching/lack of scores for very high handicap groups, but whether this leads to 'incorrect' indexes is of course debatable. As was noted in Section 6.7.2, *HoleRater* enables a range of methods to be tried, so the outcomes of the different methods, including handicap type used, can be compared.

Principle 4. Either handicap type (GA and Daily Handicap) may be used for hole index calculations.

Scores of golfers to be used for index calculation

Whose scores should be used to calculate hole difficulties? Traditionally, scores from low handicap golfers only have been used. But, if it is accepted that different handicap groups require different indexes then all such groups need to be represented in the data used to calculate them. There is not much validity in trying to calculate indexes for golfers with handicaps over 18 if there are no scores from golfers in that handicap range. Conversely, there may be practical difficulties in assigning Plus handicap indexes if there are no scores from Plus or low single figure handicap golfers available.

For smaller clubs:

Where there are smaller fields and, because most golfers tend to have handicaps around the middle of their club's handicap range and fewer at either extreme, it is probably better to consider scores from smaller handicap groups of a range of a few strokes rather than scores from individual single strokes. Depending on a club's particular handicap mix, the following groups of about 6 strokes are suggested: Up to 0; 1–6, 7–12, 13–18, 19–24, 25–30, 31–36, Over 36 (women only). If there are no Plus handicap golfers, or only 1 or 2, this group could be combined with the 1–6 group to give an Up to 6 group. Indeed, if there are only a few low handicap golfers, this lowest group may be Up to 9 (or other appropriate value). If it is a small club, groups of 9 strokes might be used rather than 6. Note that, for its Group Handicap method, *HoleRater* allows for up to 20 groups to be defined.

Principle 5a. For smaller clubs, for calculation of indexes, scores should be considered in small handicap groups of about 6 strokes.

For larger clubs:

Where there are larger fields and the full range of handicaps available, it is possible to consider individual handicaps as the basis of calculating indexes for that handicap. In this case, for index 8, say, the scores of players whose handicaps are on and around 8 are used to determine hole difficulties, and the 8th most difficult hole by this estimate is assigned index 8. (It's a bit more complex than that, as Appendix B explains, but that is the underlying process for the Single Handicap method.)

Principle 5b. For larger clubs where sufficient scores are available, for calculation of indexes, scores can be considered in handicap groups centred around each stroke of the range of indexes to be calculated.

Allowance for different numbers of scores from handicap groups

Now, because it is very unlikely that there will be approximately even numbers of scores from each handicap group, there is a need to allow for this so as to avoid the group/s with the largest numbers of scores unduly influencing the calculated difficulties. Consider the following: there are 100 scores from the Up to 6 group, 200 scores from the 7–12 group and 300 scores from the 13–18 group, with mean hole difficulties of 0.3, 0.6 and 1.0 respectively for a hole. What is the 'correct' hole difficulty of this hole? If we just considered the total across all 600 scores, then the 'raw' difficulty is

Mean difficulty = ((100 × 0.3) + (200 × 0.6) +(300 × 1.0)) / (100 + 200 + 300)
= (30 + 120 +300) / 600
= 450 / 600
= 0.750

But this leads to an undue weight being given to the 13–18 group. So, to avoid this, another way to calculate the hole difficulty is to assume that each smaller handicap group has the same number of scores in it. The 'weighted' difficulty is then calculated as

Mean difficulty = ((100 × 0.3) + (100 × 0.6) +(100 × 1.0)) / (100 + 100 + 100)
= (30 + 60 +100) / 300
= 190 / 300
= 0.633

Group Handicap method:

In *HoleRater*, if the 'weighted' mean option is chosen on the Calculate Hole Ratings 1 page, this is the method used to calculate means.

Principle 6. If there are substantially different numbers of scores in different smaller handicap groups, allowance should be made for this in calculating mean difficulties. Mean difficulties in such cases should be calculated by assigning equal weights to each smaller handicap group.

Single Handicap method:

For the Single Handicap method in *HoleRater*, there is no 'weighted' mean option available on the Calculate Hole Ratings 2 page because the method used to calculate means already builds in a process to equalise the weights for different numbers of scores for different handicaps. Thus, Principle 6 is inherent in this method and there is no opportunity for users to either include or exclude its operation.

Scores of competitions to be used for hole difficulty calculation

If the main type of hole index we are concerned with is the *stroke* index, then scores from singles stroke play are the ones that should be used. Moreover, clubs normally wish to indicate the indexes for their members' 'medal' tee positions rather than, say, 'tiger' tees which are perhaps only used for professional or elite amateur events. Therefore, scores from the same back members' tee positions only should be used, and these scores should be from throughout the year to allow for different course conditions. Scores from, say, a year's worth of monthly medals and any 'Board' events, and perhaps other events or tournaments conducted by the club involving outsiders playing from the 'medal' tees, should be used.

What about differing score types? There is a preference for Stroke events, as these will produce the most accurate measure of hole difficulty, but inclusion of Stableford and even Par events doesn't affect the *order* of hole difficulty markedly, so they may be used if there is insufficient Stroke data available.

Principle 7. Scores for singles stroke play (possibly also including Stableford and Par score types) events played throughout the year from the members' back markers should be used for determining hole difficulty.

Separate indexes for different tee colours

Most clubs have a number of tee colours which provide for different length 'courses', particularly for men. Should separate indexes be provided for these different 'courses'? If data from a number of tee colours is analysed separately, almost certainly there will be differences in difficulty orders for holes between the tee colours. And, for those clubs that have the capacity to print different scorecards for different tee colours prior to players commencing play, thus indicating on the card the tee colour to be used, the pars and lengths of holes from those tees, and the holes where strokes are received based on

the player's handicap, then there is no technical difficulty in providing different indexes. However, there is the problem of familiarity. Players become familiar with where they receive shots and if there are different indexes for different tees, this could lead to confusion and possible scoring errors.

But what about the case where a hole is, say, a short par 5/4 from the usual tees, but becomes a 'technical' par 4/3 from the shortest tees? There are probably three ways to handle such a situation.

1. Do nothing. Leave it as a par 5/4 on the card, because mostly these tees will be used by less able/older golfers who will still treat it as a par 5/4. Therefore, its index can remain as it was, which is likely to be relatively easy.
2. Adjust the length of the hole by putting these shorter tee permanent markers back so that the hole remains a par 5/4. Again, its index can remain as it was, which is likely to be relatively easy.
3. Turn it into a par 4/3. But it is likely to be a particularly long, therefore difficult, par 4/3, and its index will probably not reflect this if it remains as it is for the other tees on that hole. So, either adjust the index to keep it in line with its difficulty, or leave the index as it is and recognise that it is anomalous.

Of these three options the preferred ones would be 2, then 1, with 3 being least preferred.

Principle 8. If possible, for the same gender, the same indexes should be applicable for all tee colours on a hole.

Reasons for balancing of indexes across nines

There are probably three main reasons why hole indexes should be 'balanced' across the nines. All of these are in the interests of fairness.

1. Match play competitions. If the stroke index is used for handicap match play competitions (which is the policy recommended here), then it would be unfair if, say, one player has to give another 5 strokes, and they were all on one nine. If they were all on the second nine played, the lower marker would have a very good chance of being so many up by the time these holes were reached, it would be difficult for the other player to retrieve the situation. On the other hand, if they were all on the first nine played, the higher marker might have the same possible advantage.
2. Countbacks. Most clubs resolve ties in normal handicap events by using the Australian countback system, which considers scores on the last nine, irrespective of the order in which the nines were played. If there is a marked preponderance of lower index holes on the front nine, this would be to the advantage of the higher markers as the lower markers would be less likely to have higher net scores on the last nine. And, of course, the converse applies if there is a preponderance of lower index holes on the back nine.
3. Nine hole competitions. Although it is unlikely many clubs would be conducting concurrent nine hole competitions on separate nines, if they do, it is obviously fairer if there is appropriate balance in indexes between the nines. A more recently-important reason is that the Australian Handicapping System now allows for 'storing' of nine hole scores which may later be combined to create a handicap 18 hole score. If one of the nines had many more lower index holes, this might lead to a handicap distortion if players tended only to play one nine or the other.

Principle 9. In the interests of fairness to all, hole indexes should be reasonably balanced across nines.

Method of balancing of indexes across nines

For stroke indexes, there are two main ways of balancing hole indexes across nines: assign all odd indexes to one nine and all even indexes to the other one; and, determine the indexes 'as they come' and, if there is observed imbalance, adjust the indexes to restore balance. *HoleRater* uses as its measure of balance the sum of the indexes — for indexes 1–18, the sum of these is 171, so a pair of balanced nines is if one nine sums to 85 and the other to 86. (For indexes 19–37, the corresponding values are 247 and 248.) Using this criterion, the odd/even method has sums of 81 and 90, which indicates some imbalance.

Principle 10. The preferred method for assessing balance is to sum the indexes on each nine; maximum balance is achieved when one nine's indexes sum to 85/247 and the other's to 86/248.

Number of scores needed for adequate index determination

There are two issues here which might be regarded as competing: accuracy and practicality. Inherent in any estimation process is error — since no-one knows the 'true' value of the hole difficulty ratings, all we are doing is estimating them. We also know that, if we collect a lot of scores and calculate difficulties, and then repeat the process a year later, we are going to get slight differences. So, to reduce these variations and errors, let's collect a great number of scores. But also, there is the issue of when is enough enough? There is no absolute answer to what is an appropriate number, but it is suggested a minimum of 1000 18 hole scores be available for analysis. This should ensure a 'reasonable' number of scores for the handicap extremes, particularly if there is a dearth of scores from low handicap players. Moreover, these scores need to be collected from across the year so the indexes are a reflection of all course and weather conditions.

Principle 11. If possible, a minimum of 1000 18 hole scores should be used for determining hole indexes, and these scores should be gathered across at least a year to reflect all course and weather conditions.