CRITIQUE OF THE WOMEN'S FIGURE SKATING COMPETITION IN THE 2002 WINTER OLYMPICS

The judged figure skating in the 2002 Winter Olympics was a type of election in which nine judges (voters) have to rank a slate of contestants. The women's part of the program, probably the most popular event in the entire Olympics, is ideal for the purpose of discussing elections, because it produced an unexpected set of medal winners. The scores of the judges were processed in a complicated way, forcing the casual observer to take it on faith that the medals were properly awarded. Calling the public's attention to the judging questions surrounding this event is a good way of gaining recognition for the general election problem (which has been plaguing society for centuries) and how it should be solved.

Rules on scoring in figure skating are put out by the U.S. Figure Skating Association, and the scoring in the Olympics followed those rules. Everything follows from the points given by the judges in two main categories (short program and free skating), with each main category having two subcategories. The points for the subcategories are added together to give each skater a short-program sum and a free-skating sum. Then the skaters are placed into rank order on two lists: short program and free skating. It is this placement into rank order which gives all judges the same weight, otherwise a high-scoring judge would have more influence than a low-scoring judge. But this rank ordering causes a lot of trouble because of ties, which have to be broken with special tie-breaking rules. If the equalization of the judges had been done with standard normalization (multiplying each judge's numbers by a factor which produces a fixed sum) there would have been less need for tie breaking, as we shall see.

The present method of ranking (Condorcet method)

After each judge's set of ordinal numbers (ranks) has been attached to the skaters, it must be decided how the skaters rank overall in the short program and (separately) in the free skating. This overall rank is found by computing how many times a skater would have more judges favoring her than her competitor if they were in a paired contest. Although the rules do not say so, this procedure is called the Condorcet method; it is hundreds of years old and much used in election analysis. There were 23 participants in the free skating, so 22 pairings are possible for each skater. The winner of the free skating would be the one with the most paired contests in which five or more judges favored her (22 being the maximum). The ranks of the other 22 skaters follow in the order of the number of the paired contests they win. This way, one can get the overall ranks of the skaters in the free-skating phase and separately in the short program. Unfortunately, as will be amply demonstrated below, ties were frequent. The short program had 27 skaters, four more than the free skating, and not taking this into account led to an erroneous final (combined) rank sequence for ladies' figure skating in the Olympics.

Combining the short-program and free-skating ranks is very simple, according to the rules. The short program is to count only half as much as the free skating, so half of the short-program rank is added to the free-skating rank to give the final placement of the skater. An obvious requirement here is for the numbers of ranked skaters to be equal in the two programs, with no gaps in the rank sequences (assuming all ties to be broken). But it happened in the short program that the skater ranked 13 there did not go on to compete in the free skating. (The others who did not go on were at the bottom in the short program.) Thus, number 14 in the short program should have been moved up to 13 and all those of lower rank should also have been moved up one notch for purposes of figuring the final combined ranks for the record books. In fact, the entire short program should be recomputed without the extra skaters before combining it with the free skating, since the relative ranking of the remaining 23 may change when the extra ones are deleted.

Now it is time to write down the raw data of the problem (the scores given to the skaters by the judges) and proceed with the critique. Only the sum of the two subcategory scores for each program is given, since the subcategories themselves enter into the process only in ties, and then only one of them is used, the one designated as primary in the rules. (Sometimes the primary subcategory does not break the tie and further rules are needed.) The raw scores listed on the U.S. Figure Skating Association web site are inconvenient to use, since the skaters are placed in separate rank order for the short program and free skating. I rearranged the data, with the skaters listed in their final rank order, so the same skater occupies the same place on each list. The short program had more skaters competing than the free skating; only the 23 who competed in both programs are considered. The skaters' names are not important and are not given here, except for the top four (Hughes, Slutskaya, Kwan, and Cohen). The top four are all close, three being medal winners, and their fans will surely be interested in observing how their rank order shifts around with different types of data processing.

Raw data -- Short program

Judge / Skater	1	2	3	4	5	6	7	8	9
1	10.9	10.6	11.3	10.8	10.8	11.2	10.8	11.3	11.2
2	11.5	11.6	11.7	11.5	11.2	11.6	11.7	11.6	11.3
3	11.7	11.6	11.8	11.6	11.4	11.6	11.6	11.6	11.5
4	11.6	11.3	11.5	11.1	11.3	11.4	11.5	11.5	11.4
5	11.2	10.2	10.9	10.2	11.1	10.2	10.5	11.2	11.0
6	10.8	11.5	11.1	11.4	10.6	11.4	10.9	11.0	10.9
7	10.5	11.0	10.7	10.5	10.3	10.8	9.8	10.4	10.7
8	10.8	10.7	11.0	10.6	10.2	10.7	10.7	10.7	10.5
9	10.3	10.5	10.8	10.4	9.8	10.7	10.5	9.9	10.6
10	10.4	11.0	10.7	9.9	10.2	10.9	10.6	10.7	10.5
11	8.9	9.3	9.0	9.5	9.5	9.1	9.4	9.0	9.5
12	9.8	9.7	10.6	9.9	9.6	10.1	9.5	9.6	9.8
13	10.1	10.3	11.2	10.5	10.1	10.5	10.7	10.3	10.8
14	9.6	9.4	9.7	9.4	9.3	9.8	9.7	8.8	8.9
15	9.9	9.8	10.7	9.8	10.1	9.9	9.5	9.5	10.0
16	11.1	10.8	10.7	10.1	10.4	10.8	10.3	10.0	10.8
17	9.6	9.9	9.4	9.4	8.8	9.3	8.9	9.5	8.8
18	9.5	9.2	8.2	8.3	8.0	8.8	9.6	9.1	9.0
19	8.1	9.2	9.5	8.6	7.8	8.9	7.6	8.9	9.0
20	9.5	9.5	10.6	8.3	8.8	8.7	9.3	8.3	9.0
21	9.5	9.3	10.5	8.9	8.7	9.7	9.2	8.4	8.8
22	9.4	9.1	8.3	9.2	9.0	10.0	9.5	8.9	9.1
23	8.5	9.0	8.3	8.5	8.8	8.2	8.9	8.4	7.8

Raw data -- Free skating

Judge / Skater	1	2	3	4	5	6	7	8	9
1	11.4	11.5	11.6	11.4	11.6	11.6	11.5	11.6	11.6
2	11.3	11.7	11.8	11.6	11.4	11.7	11.5	11.4	11.5
3	11.3	11.5	11.7	11.5	11.4	11.5	11.4	11.5	11.4
4	11.0	11.6	11.5	11.4	11.4	11.4	11.3	11.3	11.3
5	11.1	10.9	11.3	10.7	11.2	11.0	11.0	11.0	11.1
6	10.7	11.2	10.9	10.5	10.1	11.3	10.3	10.8	10.9
7	10.7	11.1	10.9	10.4	10.6	10.9	10.2	10.9	10.8
8	10.7	10.7	10.6	10.5	10.6	11.2	10.1	10.6	10.7
9	10.2	11.1	10.2	10.1	10.2	10.5	10.7	10.4	9.6
10	9.8	10.6	9.7	9.6	10.2	10.3	10.2	9.9	10.1
11	10.6	10.7	10.3	10.6	10.1	10.6	10.6	10.0	9.8
12	9.9	10.5	10.7	10.0	9.6	10.6	10.1	10.2	10.2
13	9.8	10.1	10.8	9.8	10.0	10.7	9.6	9.4	10.0
14	9.8	10.4	11.1	10.1	10.3	10.4	9.8	9.5	9.6
15	10.0	9.9	10.0	9.9	10.2	10.3	9.8	9.5	9.9

16	9.6	10.1	10.0	9.5	9.5	9.7	9.5	9.3	9.5
17	10.1	10.4	10.8	9.8	9.7	10.5	9.7	9.9	10.1
18	9.0	9.5	8.3	8.8	8.4	9.8	8.9	9.1	8.9
19	9.0	9.2	10.0	8.6	9.3	9.7	8.8	9.1	9.4
20	9.2	9.3	9.2	8.8	9.1	8.9	8.8	9.0	8.8
21	8.7	9.2	9.4	8.9	8.6	8.8	8.8	8.6	8.3
22	8.9	8.5	8.1	9.3	8.4	8.8	8.4	8.7	8.6
23	8.3	7.7	8.6	8.3	8.3	7.3	7.7	8.3	7.9

The raw data must be normalized before proceeding further. As mentioned above, normalization can be done by rank ordering the skaters for each judge (and each program) or by scaling all of each judge's entries upward or downward in such a way that all entries sum to the same total. The following table gives the rank ordering after one stage of tie breaking, asterisks being used to represent broken ties. Unbroken ties are given fractional ranks in order to keep the normalization intact. (The published data show the unbroken ties as repeats of the same rank, but that spoils the normalization.) *Thirty-eight percent* of the entries were originally ties which needed to be broken.

Ranked data -- Short program

Judge Skater	1	2	3	4	5	6	7	8	9
1	6	9	4	5	5	5	5	4	4
2	3	1*	2	2	3	1*	1	1*	3
3	1	2*	1	1	1	2*	2	2*	1
4	2	4	3	4	2	4*	3	3	2
5	4	12	8	10	4	12	9*	5	5
6	8*	3	6	3	6	3*	4	6	6
7	9	6*	11*	8*	8	7*	12	9	9
8	7*	8	7	6	9*	9*	6*	7*	11*
9	11	10	9	9	13	10*	10*	12	10
10	10	5*	13*	12*	10*	6	8	8*	12*
11	21	19*	20	15	15	19	18	17	15
12	14	15	15*	13*	14	13	17*	13	14
13	12	11	5	7*	11*	11	7*	10	7*
14	16*	17	17	17*	16	16	13	20	20
15	13	14	10*	14	12*	15	16*	15*	13
16	5	7	12*	11	7	8*	11	11	8*
17	15*	13	19	16*	18*	18	21*	14*	21*
18	18*	20.5	23	23*	22	21	14	16	17*
19	23	20.5	18	20	23	20	23	19*	18*
20	19*	16	14*	22*	19.5	22	19	23	19*
21	17*	18*	16	19	21	17	20	22*	22*
22	20	22	22*	18	17	14	15*	18*	16
23	22	23	21*	21	19.5	23	22*	21*	23

Ranked data -- Free skating

Judge Skater	1	2	3	4	5	6	7	8	9
1	1	4*	3	4*	1	2	1*	1	1
2	3*	1	1	1	4*	1	2*	3	2
3	2*	3*	2	2	2*	3	3	2	3
4	5	2	4	3*	3*	4	4	4	4
5	4	8	5	5	5	7	5	5	5
6	6*	5	8*	7*	12.5	5	8	7	6

7	7*	7*	7*	9	6*	8	10*	6	7
8	8*	10*	12	8*	7*	6	12*	8	8
9	10	6*	14	11*	10*	12*	6	9	15*
10	14*	11	18	16	9*	15*	9*	12*	10*
11	9	9*	13	6	12.5	10*	7	11	14
12	13	12	11	12	16	11*	11*	10	9
13	16*	16*	9*	14*	14	9	16	16	12
14	15*	13*	6	10*	8	14	13*	14*	16*
15	12	17	17*	13	11*	16*	14*	15*	13
16	17	15*	15*	17	17	18*	17	17	17
17	11	14*	10*	15*	15	13*	15	13*	11*
18	19*	18	22	20*	21*	17	18	18*	19
19	20*	21*	16*	22	18	19*	21*	19*	18
20	18	19	20	21*	19	20	20*	20	20
21	22	20*	19	19	20	21*	19*	22	22
22	21	22	23	18	22*	22*	22	21	21
23	23	23	21	23	23	23	23	23	23

Normalization by scaling is shown on the next table, not the entire table but just the numbers for the four top contenders. Every column, when completed with all 23 entries at their full precision of many decimal places, will sum to 400. The normalization constant of 400 was picked arbitrarily and has no effect on the results. There will be ties in the columns.

Scaled data -- Short program

Judge	1	2	3	4	5	6	7	8	9
Skater									
1	18.70	18.08	18.98	18.91	19.13	19.12	18.73	19.77	19.40
2	19.73	19.79	19.65	20.14	19.84	19.80	20.29	20.30	19.58
3	20.07	19.79	19.82	20.32	20.19	19.80	20.11	20.30	19.92
4	19.90	19.28	19.31	19.44	20.02	19.46	19.94	20.12	19.75

Scaled data -- Free skating

Judge	1	2	3	4	5	6	7	8	9
Skater									
1	19.73	19.38	19.54	19.82	20.16	19.54	20.11	20.17	20.17
2	19.56	19.71	19.87	20.17	19.81	19.71	20.11	19.83	20.00
3	19.56	19.38	19.71	19.99	19.81	19.37	19.94	20.00	19.83
4	19.04	19.55	19.37	19.82	19.81	19.20	19.76	19.65	19.65

The Condorcet method can be used on either of these two normalized data sets -- the ranked set or the scaled set. The table below shows the side-by-side comparison of Condorcet results in the form of ranks of skaters, as computed each way. The unresolved ties in the above judges' rankings do not affect the Condorcet results (determined by working the problem with ties flipped either way). The columns under Combined Result show what the final figure skating ranks would be when the current rules on combining ranks are followed (i.e., adding half the rank for the short program to the full rank for free skating). Broken ties are again shown with asterisks. The free skating had no ties at this stage. The fractional numbers in the 'combined' columns do not denote ties this time; they are simply the result of adding half integers from the short program. The ties there are shown by repeated numbers.

Condorcet ranks and their combination

	Short Program		Free Skating		Combined Result	
Skater	Ranked	Scaled	Ranked	Scaled	Ranked	Scaled
1	4	5	1	2	3	4.5
2	2	2	2	1	3	2

3	1	1	3	3	3.5	3.5
4	3	3	4	4	5.5	5.5
5	7*	6	5	5	8.	8
6	5	4	6	6	8.5	8
7	8*	9	7	7	11	11.5
8	6	7	8	8	11	11.5
9	12	12	10	10	16	16
10	11	11	12	14	17.5	19.5
11	17	16	9	9	17.5	17
12	14	14	11	11	18	18
13	9*	10	16	15	20.5	20
14	15	15	13	12	20.5	19.5
15	13	13	15	16	21.5	22.5
16	10*	8	17	17	22	21
17	16	17	14	13	22	21.5
18	19*	21	18	19	26.5	29.5
19	22	22	19	18	30	29
20	20*	20	20	20	30	30
21	21*	19	21	21	31.5	30.5
22	18	18	22	22	31	31
23	23	23	23	23	34.5	34.5

The numbering of the skaters is according to the final published standings in the Olympic competition, so it is immediately evident from the combined result (ranked) that something is amiss. Computing the short program with only the data on the 23 skaters who made it into the free skating caused at least one change in the combined ranks (using the current computing rules): skaters 21 and 22 should have their ranks switched. Also there are seven pairs with ties that need to be resolved, while the published combined results only showed five tied pairs. (Even the combined result for the scaled approach has three tied pairs, so one cannot count on scaling to eliminate ties.) I could break some of the ties because the pairs were the same as in the published results, but some ties required more detailed rules than were available to me, so I left those ranks in fractional form. The table below shows my final rankings, with resolved ties asterisked and unresolved ties given fractional ranks. The ties in the last column remain unbroken because there are no rules set up for breaking them.

Combined Condorcet Ranks in the Women's Figure Skating

Skater	Ranked inputs	Scaled inputs
1	1*	3
2	2*	1
3	3	2
4	4	4
5	5*	5.5
6	6*	5.5
7	7*	7.5
8	8*	7.5
9	9	9
10	10.5	11.5
11	10.5	10
12	12	13
13	13.5	14
14	13.5	11.5
15	15	17
16	16.5	15
17	16.5	16

18	18	19
19	19*	18
20	20*	20
21	22	21
22	21	22
23	23	23

The numbering of the skaters is in the order of combined ranking in the Olympics, so any differences between the first two columns would be due to the correction for dropped participants in the short program. Two miscalculated placements are present (21 and 22), plus six more possibles (depending upon higher-level tie-breaking rules). The third column shows how different the final ranking can turn out when scaled input data are used instead of ranked. (Kwan moves from bronze medal to gold, and the other medal winners move down a notch.)

Beyond Condorcet

It is clear from the above that the present system for ranking in figure skating competitions is a mess. Far too much depends upon tie-breaking rules, and a winner may emerge by surprise when a string of ties all break in favor of one skater. In this section I will explore a path around the problem, leading to a better way of ranking the skaters.

First, consider the Condorcet device of having a judge favoring one skater over the other in a virtual contest between those two skaters alone. Suppose the judge prefers his favorite by two or three judgment steps instead of just one. Shouldn't that be a "favor enhancer" for that skater? Wouldn't it be better to give different numbers of points from a judge to a skater in a paired contest (0, 1, 2, 3, etc.) to show how much higher in rank that skater was than the other one of the pair, in the opinion of the judge? Then, wouldn't it be a further improvement to award favoritism numbers to *both* parties in the paired contest, positive for the favorite and negative for the non-favorite? Thus, when a judge has a difference of 3 preference ranks between two skaters, the preferred one would be given a +3 in the analysis and the non-preferred one would get -3. This is simply stated as giving each skater of a virtual paired contest the difference in the judge's preference ranks on the pair, including the sign. The rank differences for skater A, summed first over all other skaters and then over all judges, will show the final rank placement of skater A--most positive if she is the winner of the contest as a whole and most negative if she is in last place.

Now we observe that this operation on preference differences can be done directly with the judges' normalized scores, without going to the trouble of forming a ranked list for each judge. This more accurately represents the judgments and removes a source of ties. To illustrate with skater 1 in the short program and the data on the table for the scaled judges' inputs, the sum of differences under the first judge would be (18.70-19.73) + (18.70- 20.07) + (18.70-19.90) + · · ·, where the sum extends all the way to skater 23. Doing the same for the second, third, etc., judge and then adding the numbers for all the judges will give a number for skater 1 which indicates her rank in the short program. (I'll give this method the name *enhanced Condorcet*, and call the sum over all judges the *enhanced Condorcet score* for the skater.) The sum of differences can be written down without doing the addition by noting that the sum consists of 22 repetitions of 18.70 minus the sum of the entire 23-item column plus 18.70 again. Since the sum of the entire column was set to 400 by our normalization, the sum of differences in the column for judge 1 becomes [(18.70) · 23] - 400. Summing across for all 9 judges gives the enhanced Condorcet score for skater 1: [(18.70 + 18.08 + 18.98 + · · ·) · 23] - [(400) · 9] or 328.86. The numbers 23, 400, and 9 are just the number of skaters, the normalization constant, and the number of judges; only the sum of the judges' scaled scores distinguishes one skater from another and determines the ranks. This sum of judges' scores is called the *Borda count*, and the Borda method is another very old way of processing votes in elections.

Using the Borda method

The Borda method is very simple, just adding up the votes cast for each candidate. It only makes sense when all of the judges are given the same number of votes to distribute among the candidates. The votes themselves can be fractional, as they are in this skating competition. The enhanced Condorcet method and the Borda method must give the same rank sequence for the skaters, and Borda has the advantage of giving a set of cardinal placements, not just ordinal. (This is because Borda results are all positive, while the enhanced Condorcet results have both signs and cannot be formed into ratios.) Having taken us from the original Condorcet method to the Borda method, enhanced Condorcet has served its purpose and can be abandoned at this point. Discussion can now turn to processing the judges' scores with the Borda method.

The following table shows (in the third column) the combined Borda count for each skater. That number is the sum of all scaled judges' scores in the free skating added to one-half of the similar sum in the short program. (The short program was specified in the beginning to be worth half as much as the free skating.) The second column in the table is the rank of the skater for the figure skating as a whole (combined short program and free skating), as determined by the Borda count. There were no ties, but that is due to the scaling of the judges' raw scores. (If each judge had been instructed to distribute a fixed number of whole votes over the candidates, the Borda process would also have produced ties. For this reason, and because of clear inferiority, the Borda process using ranked judges' scores was excluded from consideration in this report.)

Borda counts of skaters and ranks determined from them

Skater	Borda rank	Borda count
1	4	264.03
2	1	268.32
3	2	267.73
4	3	264.45
5	5	254.23
6	6	252.35
7	7	247.79
8	8	247.45
9	9	240.72
10	10	237.48
11	13	232.40
12	12	234.40
13	11	236.73
14	16	229.55
15	15	231.01
16	14	231.17
17	17	228.70
18	21	207.66
19	19	209.91
20	18	210.29
21	20	208.03
22	22	204.99
23	23	190.60

The skaters are numbered in their order of rank in the Olympics competition, so comparing column 1 with column 2 shows the discrepancies between the original Condorcet method (with copious tie breaking) and the Borda method. The original gold-medal winner (Hughes) does not make it into the top three this time. The Borda counts show how close together some skaters are to each other.

Beyond Borda

When the normalized scores of the judges are added together for a given skater, the Borda method assumes that the judges are all equal, in the sense that their decisions all have the same weight. But, for this to be beyond doubt, the judges would have to be identical, i.e., give identical scores to the skaters. Since they do not do that, we should expect to find in the pattern of voting some indication of how the judges differ, and how some of them might have more weight than others. The contest analysis algorithm, whose promulgation is the purpose of this web site, does that. It generates a strength measure for all participants (voters and candidates) in a contest or an election. Discussion of that algorithm and its many applications is to be found throughout this site, and the reader is encouraged to begin at the main page and follow the links from there.

The setup of the problem for the contest algorithm is to furnish each skater with a twin and have one twin compete in the short program and the other in the free skating. The same nine judges evaluate all 46 skaters (23 skaters and their twins) individually, but the scores in the short program are normalized to a value only half as large as the scores in the free skating. The algorithm is run as one large combined contest and certain computed quantities on the twins are added together for the final ranking. The quantities which are added together for a particular skater are the *applied strengths* for both twins.

I do not list the applied strength numbers computed by contest analysis, but I do show in the next section how the rank order of skaters compares with that determined by other means.

Conclusion

It was shown in this report how the processing of scores in judged contests can be done in four ways: by the Condorcet method with ranked inputs, by the Condorcet method with scaled inputs, by the Borda method, and by the contest analysis method featured on this web site. Only the last two methods were free of ranking (until the very end), with all of its troublesome ties. Tie breaking (unless done by coin flip) is inherently unfair because it makes use of extra data which are not available to all contestants. It also spreads the contestants out evenly, removing valuable information from the judges about how they are bunched or spaced out.

The least reliable of these four methods was the one chosen by the U.S. Figure Skating Association for ranking the women's figure skating participants in the 2002 Winter Olympics. It used six steps: (1) placing the judges' scores into rank order for the short program, (2) finding the rank order of the skaters in the short program from the judges' rank orderings, (3 and 4) repeating the first two steps for the free skating, (5) adding the short-program and free-skating ranks together, and (6) finding the final rank order of the sums from step 5. The analyst made a serious error by using two different rank sequences when combining the free skating with the short program (1-23 for the former and 1-24 for the latter, with #13 deleted). All of the rank-ordering operations required tie breaking, resulting in a pile-up of tie breaking.

The following table compares the final rankings done in different ways. The skaters are listed in the order of rank in the Olympics. The second column would have agreed with the first if the short-program rank sequence had been 1-23; this column is really just a correction for a computational error. Where tie breaking was needed in the last step, the rank is given an asterisk. Where tie breaking is still needed for the last step, but not done, the rank is shown in fractional form. (I did not know all of the tie-breaking rules.)

Final rankings done four ways

Skater	Condorcet (ranked inputs)	Condorcet (scaled inputs)	Borda	Contest analysis
1	1*	3	4	4
2	2*	1	1	1
3	3	2	2	2
4	4	4	3	3
5	5*	5.5	5	5
6	6*	5.5	6	6
7	7*	7.5	7	7
8	8*	7.5	8	8
9	9	9	9	9

10	10.5	11.5	10	10
11	10.5	10	13	13
12	12	13	12	12
13	13.5	14	11	11
14	13.5	11.5	16	16
15	15	17	15	15
16	16.5	15	14	14
17	16.5	16	17	17
18	18	19	21	20
19	19*	18	19	19
20	20*	20	18	18
21	22	21	20	21
22	21	22	22	22
23	23	23	23	23

The contest algorithm was designed to compensate for differences among contest participants. The judges in this figure skating contest are also participants, with computable strengths. Slight differences in strengths of judges account for the slight shifts near the end of the rank sequence in the last two columns. Since it can never be assumed that judges are all the same, the contest algorithm is to be preferred over the Borda method. Also, the formation of ties is practically impossible with the contest algorithm.

The top four skaters were closely bunched and all deserving of the gold medal. (The contest algorithm showed a range of only 1.6% among the top four skaters.) However, as in a close horse race, some fair way has to be used to determine "win, place, and show". With the huge expense of the Olympic Games, and all the media interest, it is not right that the final reckoning sometimes does not match the quality of the rest of the effort. Maybe "how you play the game" counts more than winning, as some say, but most people probably think that the Olympic Games are all about the medals. That being the case, the best possible method should be used to award them. Using the best method (last column), or even the second-best, the gold medal winner of 2002 is out of the running, while contestants 2, 3, and 4 each move up a notch in the medal awards.

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