Accuracy of Quoting Times and Handicap Values

Handicaps… (Of Trains & Boats & Aeroplanes)

Train time tables work in hours and minutes.

One could spend a year recording the exact time a particular train arrives at a station. It could be recorded to the second or even $^{1}/_{10}$ of a second. From this, a sensible average arrival time could be computed. Further, a standard deviation can be computed, and a (normal) distribution[1] of the finish times could be plotted.

However, in terms of a "predictor" i.e. something to indicate when the **next** train will arrive, then the average time including seconds is useless as the spread of times is just too great. So, train time tables work in hours and minutes – not seconds. Statistically, it **probability** of an arrival time can be computed based on the historical data.

(Sailing) Boats use a handicap as a predictor as to when they will finish relative to the rest of the fleet. By recording a boat's performance over many races, and computing an average and standard deviation to develop a distribution curve, , this average can be used as a "predictor". But experience shows that on a race by race basis, most boats fluctuate up and down around their allocated handicap by about +/-3%. Starting with a Time Correction Factor of 1.000 then +/- 3% affects the validity of the second decimal place.

To allow results to be separated a little more than 2 decimals permit, there is general world-wide consensus to use 3 decimals for Time-On-Time handicaps. This significantly "stretches" the validity of the predictability that such handicaps provide. To use 4 decimals **stretches the validity of the maths tooooo far.**

Aeroplanes have time tables to the minute. But such timetables are even less reliable as an accurate predictor of actual arrive times than those for trains.

The Issue

The accurately of the measured times is not the issue, nor is the number of times that are used to compute the average. The issue is the precision of that average as a predictor for future times.

[1] See https://en.wikipedia.org/wiki/Normal_distribution

Finish Timing

Firstly, let's take a look at the Racing Rules of Sailing's definition of Finish:

***Finish**: A boat finishes when any part of her hull, or crew or equipment in normal position, crosses the finishing line from the course side. However, she has not finished if after crossing the finishing line she:*

(a) Takes a penalty under rule 44.2,
(b) Corrects an error under rule 28.2 made at the line; or
(c) Continues to sail the course.

One Design Races.

With one design racing, the finishing order is simple. All that needs to happen is that the time stamps reflect the finishing order. TopYacht only records time-stamps in one-second chunks. Routinely, boats would probably be separated, two (or more) seconds. However, boats **may** finish within the one-second window. In such instances, the TopYacht operator will need to edit time stamps to reflect the finishing order. Failure to do this adjustment will score boats with the same time stamp as a dead heat.

Handicap Races.

However, with **all** form of handicap racing, including measurement ratings, it is not quite that straight forward.

Take a boat with a computed handicap of 0.870. Because of rounding, there is a handicap continuum of numbers from 0.86950 to 0.87049. Any handicap value within this range will be mathematically rounded to 0.870. This range of possible numbers equates to 0.1%, (or +/- 0.05%)

When 0.05% is converted to time, it represents +/- 1.8 second window in a one-hour race, or a + / - 129.6 second window in a 3-day race.

Such vagaries of the mathematics caused by rounding makes a mockery of timing to the second. However, to suggest using some other method would raise the ire of many competitors unfamiliar with the pitfalls of rounding errors.