A study of digital clock usage in 7-point matches in backgammon

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Abstract

The results of a study of 179 seven point backgammon matches is presented. It is shown that 1 ¾ hours is sufficient time to complete >98% of matches with Bronstein clock settings of 12s/move plus 15 minutes of reserve time for each player. A simulation making use of the experimental results predicts that a full 16-player elimination tournament will last between 4 and 6 hours.

Introduction

As of this writing there is active support by some players and tournament directors for implementing digital clocks in backgammon matches for the **American Backgammon Tour**[1] (ABT). The purpose and value of clock usage is to limit the time required for matches to a reasonable but not overly imposing duration. There are reported instances of players waiting as long as five hours and directors and players not leaving the playing room until 3 AM because of excessively long matches. Similar to vehicular traffic jams, the effects of just one overly long match early in a tournament can still be felt several rounds later even if all subsequent matches take reasonable amounts of time to complete. A balance must be found which allows players enough time to think about their decisions but still finish their matches in a reasonable time. The study reported here attempts to present quantities which can be used to help determine parameters such as clock settings and expected match durations.

Conditions of the Experiment

179 matches of length 7 points were contested over a 2 ½ year period between November 2002 and April 2005. These matches were played simultaneously with both analog and digital clocks. The contestants were Richard Heinz, an advanced level player at several ABT events, and Chuck Bower a veteran of many ABT Open competitions.

Initially the purpose of this study was to correlate time controls between analog and digital clocks. Serendipitously a more important result allows comparing the actual (wall clock) duration for the settings chosen. This is possible because the analog clock readings correspond closely to time elapsed, with the exception of the short time between games when the score is recorded and checkers reset.[2]

The digital clock used for all matches was the **Excalibur GameTime II**. In addition to keeping track of the two common digital time controls – *free time* per move and *reserve*

time – the number of moves was also recorded. This proved to be a valuable feature as will be seen later. The settings used were 12 free seconds per move per player plus 15 minutes of reserve time for each player. The latter is one minute more than the today's common standard of 2 minutes per matchpoint. Although the consequences of this difference are minor, there will be some discussion of that anomaly later. The game-by-game scores for all matches were hand recorded and those data also have proved valuable for this study.

Due to typical problems that can crop up, particularly forgetfulness, not every one of the 179 matches had every piece of data recorded. For each plot in this paper the number of datapoints represented will be listed. This common scientific practice of "cutting" incomplete or bad data should not lead to bias in the results as there was no correlation between rejected data and the quantities derived.

Assumptions

It is proper to keep in mind that any study and its conclusions are subject to assumptions that won't be identical in future situations. The most important one here is that in backgammon, no two players act exactly alike. For example, there are fast shakers and vigorous shakers. Some players double quite early in a game while others tend to wait so long that they end up playing on for gammons an inordinately high percentage of the time. There are players who tend towards engaging in backgames, which often last much longer – typically by factors of two or three – than more common style game durations. It is my judgment that one of the two players here (RH) is average in his speed of play while the other (CB) plays with a more deliberate style, at least when there is no time pressure. However, the clock is the great equalizer. That is because of feedback. Unless a player is oblivious to the fact that there is a time limit when clocks are implemented, he tends to be more efficient in his time usage. As you will see from the data, very few matches ended with a forfeit due to time expiration.[3]
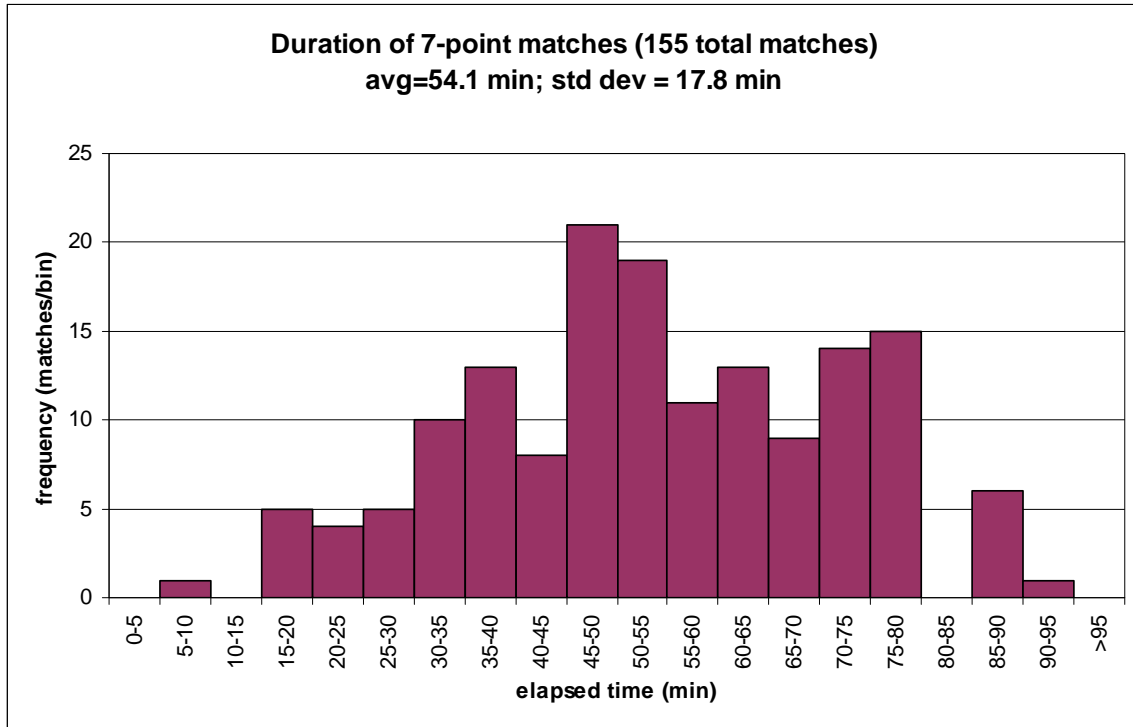
Duration of 7-point matches (155 total matches)
avg=54.1 min; std dev = 17.8 min

Figure 1. Elapsed ("wall clock") time distribution of 155 matches played to 7 points with digital clock settings for each player of 12 seconds/move plus 15 reserve minutes.

Match durations

Figure 1 shows the tally of match times for 155 matches. This distribution will be used later to predict the length of 16 player bracket such as might occur at a weekly evening club event. The shortest match lasted 9 minutes while the longest took 92 minutes. Two of these matches, durations 88 and 92 minutes, ended in forfeit. Although in retrospect it would have been preferable if the analog clock time for these matches had been recorded at the time of forfeit, in fact these matches were played to conclusion (i.e. one side scoring 7-points) and the analog clock time only recorded then. Thus it is unlikely that any match actually took longer than 90 minutes. Of the other (i.e. non-forfeited) five matches with durations greater than 85 minutes, three of those showed one player with less than 1 reserve minute remaining and in all cases the sum of both players' reserve times was less than 4:15.

Of these 155 matches, besides the two matches when one player's clock expired, ten matches finished with exactly one player holding less than 1 reserve minute and one match ended with both players banking less than one reserve minute. It would be unreliably speculative to try and say how many of these matches would have ended in forfeit if the initial clock reserve settings were the standard 14 minutes per player instead of the actual 15 minutes per player. Again, feedback is the source of the uncertainty. Likely in most or possibly in all of these matches, the player whose reserve time dropped below 1 minute (of the 15 reserve minutes allotted) would have speeded up his play to avoid forfeiture had the setting been 14 minutes.

Additional Statistics

There are several other useful numbers which can be extracted from this experiment. Figure 2 shows a nearly symmetric distribution of number of games played per match, centered close to 6.
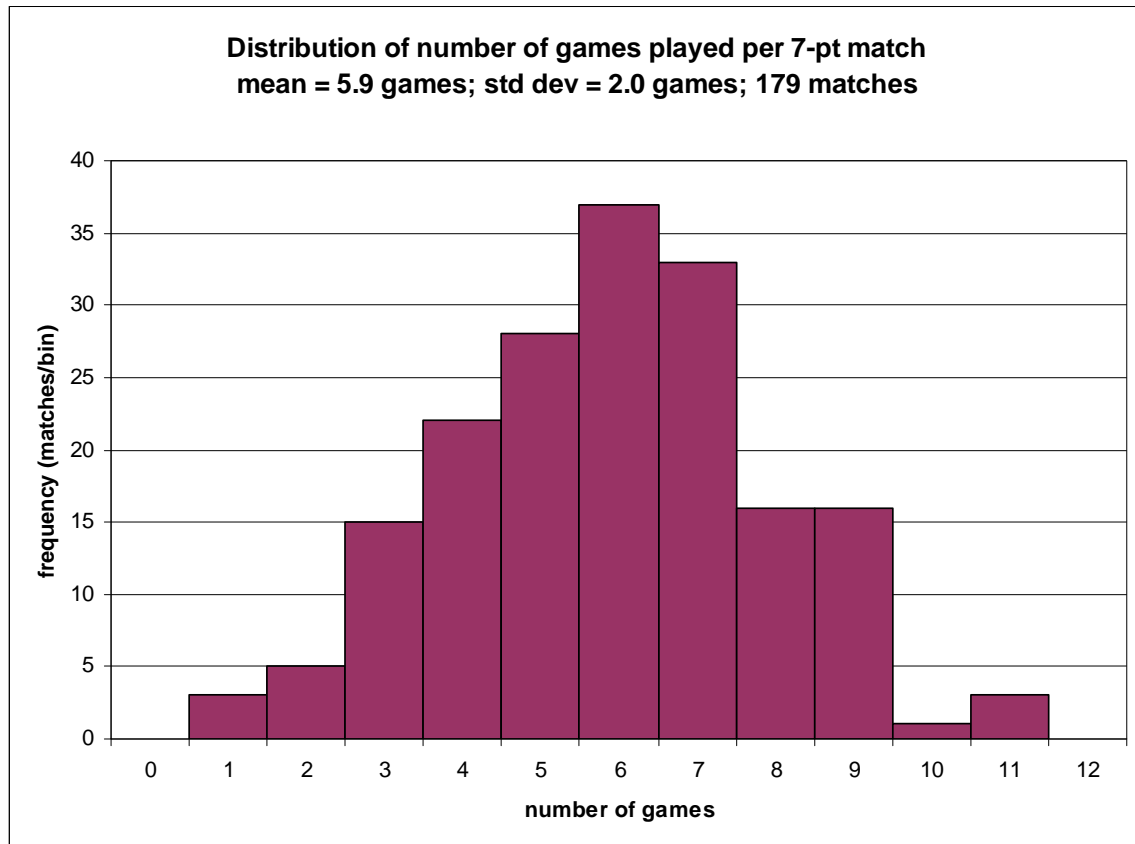

Figure 2. The distribution of number of games played in 179 seven-point matches.

Figure 3 illustrates the number of moves it takes to finish a 7-point match. Another value which comes out of these data is: the average number of moves per game is 39.0. Keep in mind that lengths of games vary depending upon the matchscore and cube location. At least one game in every match is likely to last until one player bears off 15 checkers.[4] Early games in matches often end with a double or redouble being passed, leading to short games, both in number of moves and elapsed time.[5]

Since the number of moves for each match was recorded in addition to the reserve time used, the actual average free time used (of the 12s/play allotted) can be calculated. That value was quite close between the two players: 9.66s for RH and 9.72s for CB. It is important to keep in mind that some plays take virtually no time (e.g. when player on roll is closed out), some take only enough time to shake and roll (e.g. failing to enter from the bar), and some moves take little thought, such as many plays during the bearoff and the

Number of moves per match, including doubling actions
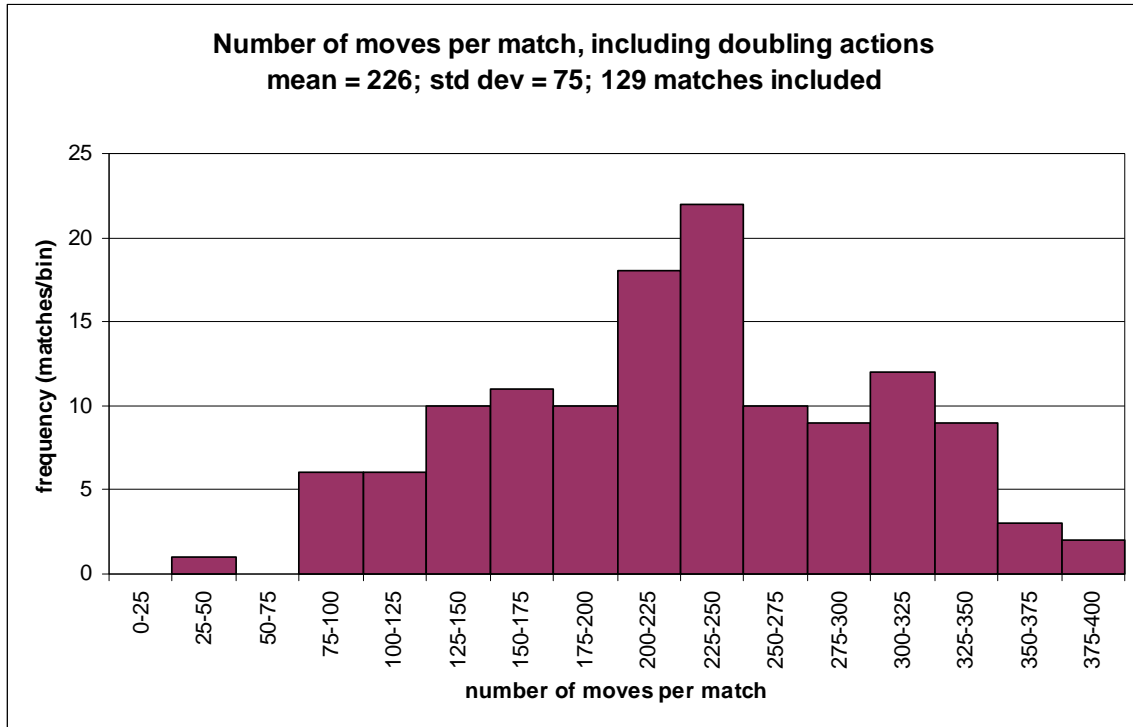**mean = 226; std dev = 75; 129 matches included**

Figure 3. Distribution of the number of moves (summed over both players) in 129 seven-point matches.

memorized opening moves. These fast plays pull the average down compared to typical plays where thought is involved. Thus it would be a mistake to conclude that 12 seconds per move could be lowered to 10 seconds per move without consequences. Another way to view this is as follows: given that the maximum free time per move is 12 seconds while the distribution of all times per move varied from 0 seconds to 12 seconds, the fact that the average was close to one extreme indicates that a large number of moves was very close to that extreme. Further, the fact that some reserve time was used in each match shows that sometimes 12 seconds was insufficient.[6]

Figure 4 is a histogram of the unused reserve time for each match. Of the 1800 reserve seconds[7] available it can be seen than on average about half of the reserve time was used.

Simulation of time required for a full bracket of 16 players

A repeated trials simulation was performed by randomly sampling the match duration times of figure 1. A player started his match as soon as he had an opponent. The distribution of tournament lengths (in hours) is shown in figure 5. This duration includes 45 minutes of unclocked time to account for tasks during the match performed while the clocks weren't running (e.g. scoring and setting up the board) as well as for short breaks and the time required to report the match result and find the next opponent.

Digital reserve time unused: sum of both players' moves
mean = 821s; std dev = 360 s; max possible = 1800 s; 129 matches
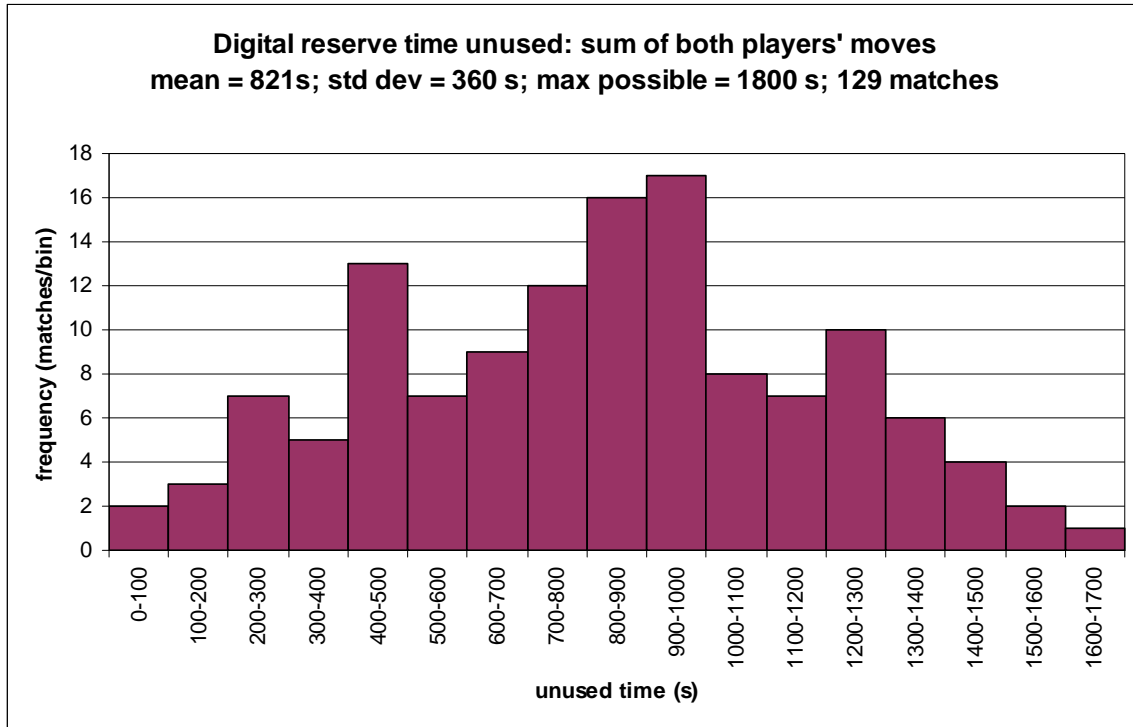
Figure 4. Distribution of unused reserve time for 129 matches, summed over both players.

To illustrate some values that can be drawn from this plot, half of tournaments finish in 5 hours and 4 minutes or less. 83% are completed by 5 ½ hours, and 1.6% of matches still haven't completed at the end of six hours.

For some tournaments it can be desirable to schedule match starting times to allow players the freedom of knowing when to be present to play a match. For those events, usually more time will be required than is shown in this study. For example, a 16-player bracket would take 5 hours and 15 minutes for the first three rounds, assuming 1 ¾ hours is allotted per round.

Conclusions

This study shows that with clock settings of 12s/move and 15 minutes reserve time for each player, a seven point match should be completed in 1 ½ hours (on the clock) plus 10-15 minutes for non-clocked activities. A four round[8] tournament will take between four and six hours with these settings. It is worth repeating that this experiment was performed by two particular players and the variations among all players could potentially change the tournament duration.

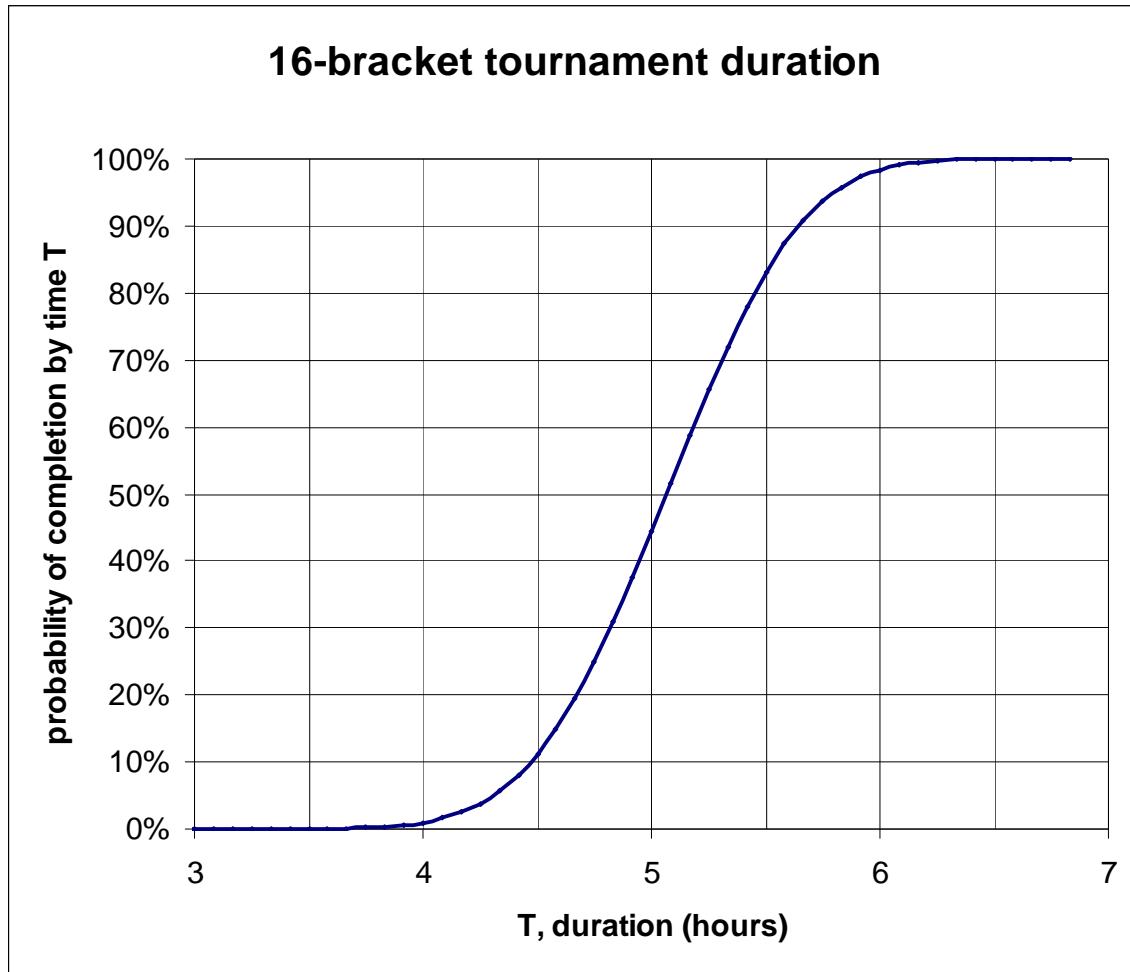## 16-bracket tournament duration

Figure 5. Integral probability distribution of tournament duration for a full 16-player elimination event based upon random samples of the match duration times shown in figure 1.

A follow-up paper will use the results of this study to address the issue of how much time should be allotted for matches of lengths other than 7 points.

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[1] See http://www.chicagopoint.com/

[2] In addition, match breaks for smoking or bathroom usage are not included.

[3] Although not overly strong evidence, it is worth noting that these two players had previously competed in nearly 1000 matches of 7-point length with the edge being 57%-43% over a 10+year period. For these 179 clocked matches, the edge remained 57-43. Thus, within the statistical significance assigned to these ratios, the clock favored neither player, even though it is innate that the two competitors have different styles, particularly different speed tendencies during unclocked play.

[4] An obvious exception occurs when one player concedes the game after it becomes clear that a win is impossible.

[5] This topic will be discussed in much more detail in an accompanying paper which relates number of moves and number of games to matches of different lengths.

[6] Of course that is the purpose of the reserve time in the first place.

[7] 15 min/player X 2 players X 60s/min = 1800s.

[8] Full 16-player bracket.