DARKKNIGHT WINS CHINESE DARK CHESS TOURNAMENT

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The 18th Computer Olympiad was held in Leiden, the Netherland, from June 29 to July 5, 2015. The computer Chinese dark chess tournament took place in July 1 with six teams from Taiwan and one from France participating. Table 1 (below) lists the participants. In the tournament, double round-robin system was applied. Namely, each program played against all other programs two games, one as the first player and the other as the second. The time constraint for each program was 15 minutes per game. The rules of playing Chinese dark chess are described in more details in [1][4]. The rules to judge draw games are described in particular as follows. A game ends with a draw when both players do not capture or flip any piece within 180 plies, or when both players play the same position three times.

Programs	Abbr.	Author(s)	Operator	Country
DARKKNIGHT	DKN	Chu-Hsuan Hsueh, Wen-Jie Tseng, I-Chen Wu	Chu-Hsuan Hsueh	Taiwan
DARKNESS	DARK	Kai-Hsiang Chan, and Shun-Shii Lin	Yu-Heng Chen	Taiwan
HOMER	HOM	Nicolas Jouandeau	Nicolas Jouandeau	France
OBSERVER	OBS	Ta-Kai Hsu and Shun-Shii Lin	Ta-Kai Hsu	Taiwan
RAINBOW	RAIN	Gang-Yu Fan, Jr-Chang Chen	Ting-Yu Lin	Taiwan
TUXEDOCAT	TUC	Terry Lao, Chih-Hung Chen, and Shun-Shii Lin	Yu-Heng Chen	Taiwan
YAHARI	YAH	Jr-Chang Chen, You-Cheng Syu, Gang-Yu Fan, Ting-Yu Lin, Tsan-Sheng Hsu	Ting-Yu Lin	Taiwan

Table 1. The participants

In the tournament, all the games were played on a game-playing platform implemented by Chen *et al*. [3]. In each round, all programs connected to the server of the platform through network respectively, and then matched their opponents. After matching, two games were played between the two programs automatically. The server also did for each game the following: randomize unrevealed pieces, accept moves made by players, notify players of the results of moves including types of flipped pieces, judge the result of the game, and collect game record.

| ID	DKN	DARK	HOM	OBS	RAIN	TUC	YAH	Total Score	Rank
DKN	-	2	2	2	1.5	2	1.5	11	1
DARK	0	-	2	0.5	1.5	0	0	4	5
HOM	0	0	-	0	0.5	0	0	0.5	7
OBS	0	1.5	2	-	2	2	0.5	8	3
RAIN	0.5	0.5	1.5	0	-	0	0	2.5	6
TUC	0	2	2	0	2	-	0.5	6.5	4
YAH	0.5	2	2	1.5	2	1.5	-	9.5	2

Table 2. The detailed scores and the final ranks

For each game, a program obtained 1 point for a win, 0 for a loss, and 0.5 for a draw. Finally, DARKKNIGHT obtained 11 points with 10 wins and 2 draws, and won the gold medal. YAHARI and OBSERVER respectively won the silver and the bronze medals, with 9.5 points and 8 points. Table 2 lists the detailed scores and the final ranks. For the three programs, DARKKNIGHT was developed based on Monte-Carlo tree search [2], while YAHARI and OBSERVER were on alpha-beta search.

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Selected Games

This report comments two games, one between DARKKNIGHT (the gold) and YAHARI (the silver), and the other between DARKKNIGHT and DARKNESS (the fifth). In the two games, DARKKNIGHT took critical flipping actions and successfully escaped from disadvantageous situations. Finally, DARKKNIGHT drew the first game with YAHARI and won the second game against DARKNESS. In game records, P(T) denotes an action of flipping a piece with type T at position P, and S-D denotes an action of moving a piece from position S to D [1]. The pieces are denoted as follows: uppercase and lowercase letters represent red and black pieces respectively and the pieces king, guard, minister, rook, knight, cannon, and pawn are abbreviated as `K`/`k`, `G`/`g`, `M`/`m`, `R`/`r`, `N`/`n`, `C`/`c`, `P`/`p` [1][2][4].
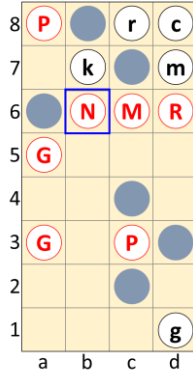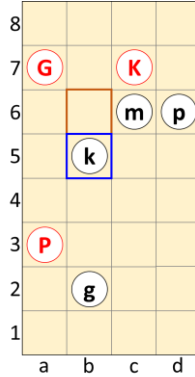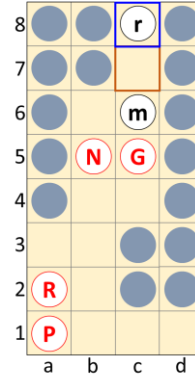
(a)　　　　　　　(b)
Fig. 1. YAHARI (Red) vs. DARKKNIGHT (Black)

(a)　　　　　　　(b)
Fig. 2. DARKKNIGHT (Black) vs. DARKNESS (Red)

Game 1:　YAHARI (Red) vs. DARKKNIGHT (Black) 0.5-0.5

1. b7(M) b1(c) 2. a1(p) d1(R) 3. c1(G) b1-d1 4. c1-d1 c3(P) 5. b2(m) a2(p) 6. d1-c1 a3(p) 7. c1-b1 a4(P) 8. b1-b2 a3-a4 9. b2-a2 a5(N) 10. a2-a1 c5(G) 11. d2(g) a4-a3 12. b4(P) d7(m) 13. d4(g) d8(c) 14. d5(C) d4-d5 15. c5-d5 d6(R) 16. a7(k) a7-b7 17. c8(r) c6(M) 18. d5-c5 b3(r) 19. a1-a2 b7-a7 20. a2-a3 b3-b4 21. b5(n) b5-a5 22. a3-b3 b4-a4 23. c5-b5 a4-a3 24. b3-a3 d2-d1 25. b5-a5 a7-b7 26. a8(P) b6(N) 27. a6(p) b7-b6 28. d6-d5 b6-c6 29. a5-a6 c6-b6 30. a8-a7 d7-d6 31. c4(n) d6-d5 32. c3-b3 d8-d7 33. b3-b2 c4-c5 34. a3-a4 c5-c6 35. b2-b3 d5-d6 36. a4-b4 c6-c5 37. c2(C) d1-c1 38. c2-b2 c1-c2 39. b2-b1 c2-b2 40. b1-c1 c5-c6 41. c7(P) c8-c7 42. b4-a4 c6-c5 43. a4-b4 d6-c6 44. b3-a3 c5-b5 45. b8(K) b2-b1 46. c1-c2 b5-a5 47. b8-c8 b1-b2 48. c8-c7 d7-a7 49. a6-a7 b2-c2 50. d3(p) d3-d4 51. c7-d7 d4-d5 52. d7-c7 d5-d6 53. b4-a4 a5-b5 54. a4-b4 c2-b2 55. b4-b5 b6-b5 56. c7-b7 c6-c5 57. a3-a4 c5-c4 58. a4-a5 b5-c5 59. a5-b5 c5-d5 60. b5-b6 b2-b1 61. a7-a8 c4-c5 62. b7-a7 d5-d4 63. a8-b8 d6-d5 64. b8-b7 d4-c4 65. a7-a6 d5-d4 66. b7-c7 d4-d3 67. b6-b7 c4-d4 68. b7-a7 d4-d5 69. c7-c6 c5-c4 70. a7-b7 d3-c3 71. b7-c7 d5-c5 72. c6-b6 c3-b3 73. c7-c6 c5-b5 74. b6-b7 b5-b4 75. c6-b6 c4-c5 76. b7-c7 b4-c4 77. b6-b7 b3-b4 78. a6-b6 c4-d4 79. b7-a7 c5-c4 80. b6-c6 c4-c3 81. c7-b7 b4-c4 82. b7-b6 b1-b2 83. a7-b7 b2-b3 84. b6-b5 c3-d3 85. b7-b6 c4-c3 86. b5-a5 d4-d5 87. c6-c7 d5-c5 88. b6-b5 c5-c4 89. a5-a6 d3-d2 90. a6-b6 c3-d3 91. b5-c5 c4-c3 92. b6-b5 d3-d4 93. c7-b7 b3-b2 94. c5-c6 d4-d3 95. c6-c5 b2-a2 96. c5-c4 c3-c2 97. b5-b4 d2-d1 98. b4-b3 d1-c1 99. b7-b6 d3-d2 100. b6-b5 a2-a1 101. b5-a5 c1-d1 102. c4-b4 a1-a2 103. b4-c4 d2-d3 104. a5-a4 d1-d2 105. b3-b4 c2-b2 106. b4-b5 b2-b1 107. b5-b4 a2-b2 108. a4-a3 d2-d1 109. b4-a4 b2-c2 110. a3-b3 c2-d2 111. a4-a5 d1-c1 112. a5-a4 d2-c2 113. a4-a5 b1-a1 114. a5-a6 c1-d1 115. a6-a7 a1-a2 116. a7-a6 c2-c1 117. a6-a5 d3-d2 118. c4-c3 c1-c2 119. c3-c4 d1-c1 120. c4-b4 d2-d3 121. b4-c4 c2-d2 122. a5-a6 c1-b1 123. a6-a7 d2-d1 124. a7-a6 d3-d2 125. c4-c3 b1-c1 126. a6-a5 c1-c2 127. c3-c4 d2-d3 128. a5-b5 c2-c1 129. b5-a5 a2-a1 130. a5-a4 d3-d2 131. c4-c3 c1-c2 132. c3-c4 d2-d3 133. a4-a5 a1-b1 134. a5-b5 c2-b2 135. b5-b4 d3-d2 136. c4-c5 b2-a2 137. b4-c4 d2-c2 138. c4-c3 c2-b2 139. b3-b4 b1-a1 140. c5-b5 d1-d2 141. b5-a5 a1-b1 142. a5-b5 a2-a1 143. b5-b6 b1-c1 144. c3-b3 b2-a2 145. b6-b7 c1-b1

　　Fig. 1 (a) shows the important flipping action for Black in the 26th ply, which the `N` in b6 was flipped. Originally, the positions a8 and b6 were unrevealed. At that time, from the point of view of materials on the board, Red had one more `G` and `P` and thus was in advantage. Also, the flipped `k` and `g` were not in the central, which is bad for Black in Chinese dark chess. The situation became worse to Black when Red flipped a `P` in a8 in the 26th ply. The only chance for Black was to flip the piece in b6 or c7, trying to escape the `k` from the threat of the `P`. Before the flipping action of Black in the 26th ply, unrevealed pieces were `KNCPnpp`. Only when Black flips an `N` or a `C`, with probability of 2/7 in total, the `k` can escape from the threat of the `P`.

In the game, Black flipped an N in b6.

As the game continued, after Black captured the G in b5 in the 55th ply, as shown in Fig. 1 (b), both players did not capture any piece within 180 plies. So the game ended with a draw. It is interesting that it was still hard for Black to win even though Black had one more piece, m.

Game 2: DARKKNIGHT (Black) vs. DARKNESS (Red) 1-0

1. b4(n) b6(p) 2. b1(c) b2(n) 3. d1(N) c1(G) 4. b1-d1 c1-d1 5. a2(R) a2-b2 6. c4(m) a3(P) 7. a1(P) b3(P) 8. b4-b3 d1-c1 9. b3-a3 b2-a2 10. a3-b3 c1-b1 11. b3-b4 b1-b2 12. b5(N) b5-b6 13. c8(R) b2-b3 14. b4-b5 b6-b5 15. c5(p) b3-b4 16. c6(m) b4-c4 17. c7(r) c4-c5 18. c7-c8 c5-c6 19. b8(k) a1-b1 20. d2(p) a2-b2 21. d2-d1 b1-a1 22. d3(P) b2-b1 23. a4(g) b1-c1 24. a4-b4 c1-d1 25. b4-b5 d1-c1 26. b5-b4 c1-b1 27. b4-b3 a6(G) 28. b3-b2 b1-c1 29. b2-b1 a1-a2 30. b1-c1 c3(p) 31. c3-d3 d7(r) 32. c1-b1 d5(M) 33. b1-b2 a2-a3 34. b2-b3 a3-a2 35. b3-b2 a2-a1 36. b2-a2 a1-b1 37. a2-b2 b1-c1 38. b2-b1 c1-d1 39. b1-c1 d1-d2 40. d3-d2 c6-c7 41. c1-b1 d5-c5 42. b1-b2 a6-b6 43. b2-b3 c7-d7 44. b3-c3 a5(c) 45. a5-a4 a7(g) 46. a4-a3 b6-b5 47. a3-a2 d7-c7 48. a2-a1 b5-b4 49. a1-b1 d6(P) 50. b1-c1 c7-c8 51. b8-c8 d6-d7 52. d8(C) d7-c7 53. c8-d8 c7-c8 54. d8-d7 c8-d8 55. d7-d6 d8-d7 56. d6-d5 d7-d6 57. d5-c5 d6-c6 58. c5-b5 b4-a4 59. c3-b3 c6-b6 60. b5-a5 b6-b5 61. a5-a4 b5-a5 62. a4-b4 a5-a4 63. b4-c4 a8(M) 64. a7-a8 b7(K) 65. c1-b1 b7-a7 66. a8-b8 c2(p) 67. c2-b2 a7-b7 68. b8-a8 b7-a7 69. b3-b4 a4-a5 70. b1-a1 a7-b7 71. d2-d3 a5-a6 72. b4-b5 a6-b6 73. b5-c5 b7-a7 74. b2-a2 b6-a6 75. a8-b8 a7-b7 76. a1-a6 b7-b8 77. d4(C) b8-a8 78. c4-d4 a8-a7 79. a2-a3 a7-a6 80. a3-a4 a6-b6 81. a4-a5 b6-c6 82. a5-a6 c6-c5 83. a6-a7 c5-b5 84. d4-c4 b5-b6 85. c4-c5 b6-c6 86. c5-c6

In Fig. 2 (a), the remaining pieces on the board are KGGMMRNCCPPPkggmrrcppp, which shows no much difference between Red and Black. However, the situation was disadvantageous to Black since red pieces dominated the board. Particularly, all of the kgg were unrevealed. As a result, Black was eager to flip them out. In the figure, Black just captured the R in c8. Then, in the next move, Red captured the m in c6 and enforced Black to flip a piece. In the game, Black flipped a k in b8, which protected the r in c8.

Fig. 2 (b) shows the important flipping action for Black in the 52nd ply, which the C in d8 was flipped. Before the flipping action, the unrevealed pieces were KMCCp. In the board in Fig. 2 (b), the P in d7 was going to threaten the k in c8. To eliminate the threat, Black had to try to flip a p in b7, with probability of 1/5, or flip any of red pieces except K in d8, with probability 3/5. In the game, Black flipped a C in d8. Then, in the next move, Red moved the P from d7 to c7, which was not good since the P should stay in d7 to protect the C in d8. After few moves of playing, Black successfully got rid of the P and reached the central part of the board. From then on, Black was winning.
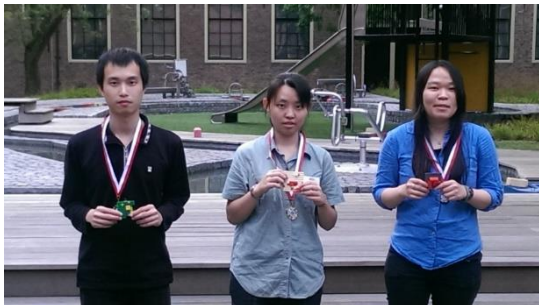
Ta-Kai Hsu (OBSERVER), Chu-Hsuan Hsueh (DARKKNIGHT), and Ting-Yu Lin (YAHARI)

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