Machine Problem 3 Report

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November 4, 2018

Minimax

Initial State

' '	' '	' '	' '
' '	'B'	'W'	' '
' '	'W'	'B'	' '
' '	' '	' '	' '

1. ('B', 0, 2)

' '	' '	**'B'**	' '
' '	'B'	'B'	' '
' '	'W'	'B'	' '
' '	' '	' '	' '

2. ('W', 0, 3)

' '	' '	'B'	**'W'**
' '	'B'	'W'	' '
' '	'W'	'B'	' '
' '	' '	' '	' '

3. ('B', 1, 3)

' '	' '	'B'	'W'
' '	'B'	'B'	**'B'**
' '	'W'	'B'	' '
' '	' '	' '	' '

4. ('W', 2, 3)

' '	' '	'B'	'W'
' '	'B'	'B'	'W'
' '	'W'	'W'	**'W'**
' '	' '	' '	' '

5. ('B', 3, 2)

' '	' '	'B'	'W'
' '	'B'	'B'	'W'
' '	'W'	'B'	'W'
' '	' '	**'B'**	' '

6. ('W', 0, 1)

' '	**'W'**	'W'	'W'
' '	'W'	'W'	'W'
' '	'W'	'B'	'W'
' '	' '	'B'	' '

7. ('B', 1, 0)

' '	'W'	'W'	'W'
'B'	'W'	'W'	'W'
' '	'B'	'B'	'W'
' '	' '	'B'	' '

8. ('W', 3, 0)

' '	'W'	'W'	'W'
'B'	'W'	'W'	'W'
' '	'W'	'B'	'W'
'W'	' '	'B'	' '

9. ('B', 0, 0)

'B'	'W'	'W'	'W'
'B'	'B'	'W'	'W'
' '	'W'	'B'	'W'
'W'	' '	'B'	' '

10. ('W', 2, 0)

'B'	'W'	'W'	'W'
'B'	'W'	'W'	'W'
'W'	'W'	'B'	'W'
'W'	' '	'B'	' '

11. ('W', 3, 3)

'B'	'W'	'W'	'W'
'B'	'W'	'W'	'W'
'W'	'W'	'W'	'W'
'W'	' '	'B'	**'W'**

12. ('W', 3, 1)

'B'	'W'	'W'	'W'
'B'	'W'	'W'	'W'
'W'	'W'	'W'	'W'
'W'	**'W'**	'W'	'W'

Terminal State

'B'	'W'	'W'	'W'
'B'	'W'	'W'	'W'
'W'	'W'	'W'	'W'
'W'	'W'	'W'	'W'

Results

(-12, [('B', 0, 2), ('W', 0, 3), ('B', 1, 3), ('W', 2, 3), ('B', 3, 2), ('W', 0, 1), ('B', 1, 0), ('W', 3, 0), ('B ', 0, 0), ('W', 2, 0), ('W', 3, 3), ('W', 3, 1), ('B', -1, -1)])

Time 1: 5.76214694977 seconds

Time 2: 5.68395805359 seconds

Time 3: 5.69731211662 seconds

The player that will win the game with the given initial state will be **Player 2 ('W')**. The optimal game value is -12 where there are 2 black tokens and 14 white tokens.

4x4 game terminal states visited with Minmax: 33909

Minimax-ab

4x4 game Minimax without alpha-beta pruning runtime: 1.28459596634 seconds
4x4 game Minimax with alpha-beta pruning runtime: 0.955676078796 seconds

4x4 game terminal states visited: 3754
4x4 game truncations made by alpha-beta pruning: 8532

5x5 game terminal states visited: 174016
5x5 game truncations made by alpha-beta pruning: 338821

Final state for the default 5x5 game:

‘W’	‘W’	‘W’	‘ ’	‘ ’
‘W’	‘W’	‘ ’	‘ ’	‘ ’
‘W’	‘ ’	‘ ’	‘ ’	‘B’
‘ ’	‘ ’	‘ ’	‘B’	‘B’
‘ ’	‘ ’	‘B’	‘B’	‘B’

The answer means that the best Player 1 can do is draw the game. If both players play optimally, then the game will always draw. If Player 1 does not play for a draw, then Player 2 will always win if they are both optimal otherwise.