```
 1 /Users/jaredwilliams/venv/bin/python /Users/jaredwilliams/
   Documents/AI/Reinforcement/connect4/play_game.py
 2 root <node.Node object at 0x1154c0198>
 3 iterated
 4 root children value [ 764. 9141. 1472.  985.  377. 6134.
   6324.]
 5 ['-', '-', '-', '-', '-', '-', '-']
 6 ['-', '-', '-', '-', '-', '-', '-']
 7 ['-', '-', '-', '-', '-', '-', '-']
 8 ['-', '-', '-', '-', '-', '-', '-']
 9 ['-', '-', '-', '-', '-', '-', '-']
10 ['-', 'X', '-', '-', '-', '-', '-']
11 checkDorEndGame:  0
12 getValue:  (0, 0, 0)
13 getScore:  (0, 0)
14 [29, 35, 37, 38, 39, 40, 41]
15 [1, 0, 2, 3, 4, 5, 6]
16 slot # of next move0
17 ['-', '-', '-', '-', '-', '-', '-']
18 ['-', '-', '-', '-', '-', '-', '-']
19 ['-', '-', '-', '-', '-', '-', '-']
20 ['-', '-', '-', '-', '-', '-', '-']
21 ['-', '-', '-', '-', '-', '-', '-']
22 ['0', 'X', '-', '-', '-', '-', '-']
23 checkDorEndGame:  0
24 getValue:  (0, 0, 0)
25 getScore:  (0, 0)
26 root <node.Node object at 0x11552fe10>
27 iterated
28 root children value [7161. 1775.  872. 1920. 5095. 1460.
   7481.]
29 ['-', '-', '-', '-', '-', '-', '-']
30 ['-', '-', '-', '-', '-', '-', '-']
31 ['-', '-', '-', '-', '-', '-', '-']
32 ['-', '-', '-', '-', '-', '-', '-']
33 ['-', '-', '-', '-', '-', '-', '-']
34 ['0', 'X', '-', '-', '-', '-', 'X']
35 checkDorEndGame:  0
36 getValue:  (0, 0, 0)
37 getScore:  (0, 0)
38 [28, 29, 34, 37, 38, 39, 40]
39 [0, 1, 6, 2, 3, 4, 5]
40 slot # of next move0
41 ['-', '-', '-', '-', '-', '-', '-']
42 ['-', '-', '-', '-', '-', '-', '-']
43 ['-', '-', '-', '-', '-', '-', '-']
44 ['-', '-', '-', '-', '-', '-', '-']
45 ['0', '-', '-', '-', '-', '-', '-']
46 ['0', 'X', '-', '-', '-', '-', 'X']
47 checkDorEndGame:  0
```

```
48 getValue:  (0, 0, 0)
49 getScore:  (0, 0)
50 root <node.Node object at 0x116049240>
51 iterated
52 root children value [12087.  2239.  1173.  8634.   913.
    200.   796.]
53 ['-', '-', '-', '-', '-', '-', '-']
54 ['-', '-', '-', '-', '-', '-', '-']
55 ['-', '-', '-', '-', '-', '-', '-']
56 ['X', '-', '-', '-', '-', '-', '-']
57 ['O', '-', '-', '-', '-', '-', '-']
58 ['O', 'X', '-', '-', '-', '-', 'X']
59 checkDorEndGame:  0
60 getValue:  (0, 0, 0)
61 getScore:  (0, 0)
62 [14, 29, 34, 37, 38, 39, 40]
63 [0, 1, 6, 2, 3, 4, 5]
64 slot # of next move2
65 ['-', '-', '-', '-', '-', '-', '-']
66 ['-', '-', '-', '-', '-', '-', '-']
67 ['-', '-', '-', '-', '-', '-', '-']
68 ['X', '-', '-', '-', '-', '-', '-']
69 ['O', '-', '-', '-', '-', '-', '-']
70 ['O', 'X', 'O', '-', '-', '-', 'X']
71 checkDorEndGame:  0
72 getValue:  (0, 0, 0)
73 getScore:  (0, 0)
74 root <node.Node object at 0x14ff33588>
75 iterated
76 root children value [2501. 4034. 7391. 4177. 1000. 2174.
    4635.]
77 ['-', '-', '-', '-', '-', '-', '-']
78 ['-', '-', '-', '-', '-', '-', '-']
79 ['-', '-', '-', '-', '-', '-', '-']
80 ['X', '-', '-', '-', '-', '-', '-']
81 ['O', '-', 'X', '-', '-', '-', '-']
82 ['O', 'X', 'O', '-', '-', '-', 'X']
83 checkDorEndGame:  0
84 getValue:  (0, 0, 0)
85 getScore:  (0, 0)
86 [14, 23, 29, 34, 38, 39, 40]
87 [0, 2, 1, 6, 3, 4, 5]
88 slot # of next move1
89 ['-', '-', '-', '-', '-', '-', '-']
90 ['-', '-', '-', '-', '-', '-', '-']
91 ['-', '-', '-', '-', '-', '-', '-']
92 ['X', '-', '-', '-', '-', '-', '-']
93 ['O', 'O', 'X', '-', '-', '-', '-']
94 ['O', 'X', 'O', '-', '-', '-', 'X']
95 checkDorEndGame:  0
```

```
 96 getValue:  (0, 0, 0)
 97 getScore:  (0, 0)
 98 root <node.Node object at 0x1600d1518>
 99 iterated
100 root children value [1485.  775. 1098. 5861. 6860. 3253.
    5625.]
101 ['-', '-', '-', '-', '-', '-', '-']
102 ['-', '-', '-', '-', '-', '-', '-']
103 ['-', '-', '-', '-', '-', '-', '-']
104 ['X', '-', '-', '-', '-', '-', '-']
105 ['O', 'O', 'X', '-', '-', '-', '-']
106 ['O', 'X', 'O', 'X', '-', '-', 'X']
107 checkDorEndGame:  0
108 getValue:  (0, 0, 0)
109 getScore:  (0, 0)
110 [14, 22, 23, 31, 34, 39, 40]
111 [0, 1, 2, 3, 6, 4, 5]
112 slot # of next move2
113 ['-', '-', '-', '-', '-', '-', '-']
114 ['-', '-', '-', '-', '-', '-', '-']
115 ['-', '-', '-', '-', '-', '-', '-']
116 ['X', '-', 'O', '-', '-', '-', '-']
117 ['O', 'O', 'X', '-', '-', '-', '-']
118 ['O', 'X', 'O', 'X', '-', '-', 'X']
119 checkDorEndGame:  0
120 getValue:  (0, 0, 0)
121 getScore:  (0, 0)
122 root <node.Node object at 0x1724a0518>
123 iterated
124 root children value [1075. 4674. 1657. 5453. 3698. 4743.
    1875.]
125 ['-', '-', '-', '-', '-', '-', '-']
126 ['-', '-', '-', '-', '-', '-', '-']
127 ['-', '-', '-', '-', '-', '-', '-']
128 ['X', '-', 'O', '-', '-', '-', '-']
129 ['O', 'O', 'X', 'X', '-', '-', '-']
130 ['O', 'X', 'O', 'X', '-', '-', 'X']
131 checkDorEndGame:  0
132 getValue:  (0, 0, 0)
133 getScore:  (0, 0)
134 [14, 16, 22, 24, 34, 39, 40]
135 [0, 2, 1, 3, 6, 4, 5]
136 slot # of next move3
137 ['-', '-', '-', '-', '-', '-', '-']
138 ['-', '-', '-', '-', '-', '-', '-']
139 ['-', '-', '-', '-', '-', '-', '-']
140 ['X', '-', 'O', 'O', '-', '-', '-']
141 ['O', 'O', 'X', 'X', '-', '-', '-']
142 ['O', 'X', 'O', 'X', '-', '-', 'X']
143 checkDorEndGame:  0
```

```
144 getValue:  (0, 0, 0)
145 getScore:  (0, 0)
146 root <node.Node object at 0x1d73a27b8>
147 iterated
148 root children value [  36.   35. 20758.   36.   37
    .   35.   37.]
149 ['-', '-', '-', '-', '-', '-', '-']
150 ['-', '-', '-', '-', '-', '-', '-']
151 ['-', '-', '-', 'X', '-', '-', '-']
152 ['X', '-', 'O', 'O', '-', '-', '-']
153 ['O', 'O', 'X', 'X', '-', '-', '-']
154 ['O', 'X', 'O', 'X', '-', '-', 'X']
155 checkDorEndGame:  0
156 getValue:  (0, 0, 0)
157 getScore:  (0, 0)
158 [10, 14, 16, 22, 34, 39, 40]
159 [3, 0, 2, 1, 6, 4, 5]
160 slot # of next move5
161 ['-', '-', '-', '-', '-', '-', '-']
162 ['-', '-', '-', '-', '-', '-', '-']
163 ['-', '-', '-', 'X', '-', '-', '-']
164 ['X', '-', 'O', 'O', '-', '-', '-']
165 ['O', 'O', 'X', 'X', '-', '-', '-']
166 ['O', 'X', 'O', 'X', '-', 'O', 'X']
167 checkDorEndGame:  0
168 getValue:  (0, 0, 0)
169 getScore:  (0, 0)
170 root <node.Node object at 0x1df466518>
171 iterated
172 root children value [ 4745.   546. 14503.   933.   670.
    2457.   340.]
173 ['-', '-', '-', '-', '-', '-', '-']
174 ['-', '-', '-', '-', '-', '-', '-']
175 ['-', '-', 'X', 'X', '-', '-', '-']
176 ['X', '-', 'O', 'O', '-', '-', '-']
177 ['O', 'O', 'X', 'X', '-', '-', '-']
178 ['O', 'X', 'O', 'X', '-', 'O', 'X']
179 checkDorEndGame:  0
180 getValue:  (0, 0, 0)
181 getScore:  (0, 0)
182 [9, 10, 14, 22, 33, 34, 39]
183 [2, 3, 0, 1, 5, 6, 4]
184 slot # of next move1
185 ['-', '-', '-', '-', '-', '-', '-']
186 ['-', '-', '-', '-', '-', '-', '-']
187 ['-', '-', 'X', 'X', '-', '-', '-']
188 ['X', 'O', 'O', 'O', '-', '-', '-']
189 ['O', 'O', 'X', 'X', '-', '-', '-']
190 ['O', 'X', 'O', 'X', '-', 'O', 'X']
191 checkDorEndGame:  0
```

```
192 getValue:  (0, 0, 0)
193 getScore:  (0, 0)
194 root <node.Node object at 0x21d5ec3c8>
195 iterated
196 root children value [2528. 5383. 5002. 1510. 2075. 6077.
    554.]
197 ['-', '-', '-', '-', '-', '-', '-']
198 ['-', '-', '-', '-', '-', '-', '-']
199 ['-', '-', 'X', 'X', '-', '-', '-']
200 ['X', 'O', 'O', 'O', '-', '-', '-']
201 ['O', 'O', 'X', 'X', '-', '-', 'X']
202 ['O', 'X', 'O', 'X', '-', 'O', 'X']
203 checkDorEndGame:  0
204 getValue:  (0, 0, 0)
205 getScore:  (0, 0)
206 [9, 10, 14, 15, 27, 33, 39]
207 [2, 3, 0, 1, 6, 5, 4]
208 slot # of next move1
209 ['-', '-', '-', '-', '-', '-', '-']
210 ['-', '-', '-', '-', '-', '-', '-']
211 ['-', 'O', 'X', 'X', '-', '-', '-']
212 ['X', 'O', 'O', 'O', '-', '-', '-']
213 ['O', 'O', 'X', 'X', '-', '-', 'X']
214 ['O', 'X', 'O', 'X', '-', 'O', 'X']
215 checkDorEndGame:  0
216 getValue:  (0, 0, 0)
217 getScore:  (0, 0)
218 root <node.Node object at 0x243ce97b8>
219 iterated
220 root children value [22397.    35.    34.    33.    33
    .    35.    30.]
221 ['-', '-', '-', '-', '-', '-', '-']
222 ['-', 'X', '-', '-', '-', '-', '-']
223 ['-', 'O', 'X', 'X', '-', '-', '-']
224 ['X', 'O', 'O', 'O', '-', '-', '-']
225 ['O', 'O', 'X', 'X', '-', '-', 'X']
226 ['O', 'X', 'O', 'X', '-', 'O', 'X']
227 checkDorEndGame:  0
228 getValue:  (0, 0, 0)
229 getScore:  (0, 0)
230 [1, 9, 10, 14, 27, 33, 39]
231 [1, 2, 3, 0, 6, 5, 4]
232 slot # of next move4
233 ['-', '-', '-', '-', '-', '-', '-']
234 ['-', 'X', '-', '-', '-', '-', '-']
235 ['-', 'O', 'X', 'X', '-', '-', '-']
236 ['X', 'O', 'O', 'O', '-', '-', '-']
237 ['O', 'O', 'X', 'X', '-', '-', 'X']
238 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
239 checkDorEndGame:  0
```

```
240 getValue:  (0, 0, 0)
241 getScore:  (0, 0)
242 root <node.Node object at 0x24dc14c18>
243 iterated
244 root children value [ 5291.   4896.   7903. 13605.   5356
    .      37.    256.]
245 ['-', '-', '-', '-', '-', '-', '-']
246 ['-', 'X', '-', '-', '-', '-', '-']
247 ['X', '0', 'X', 'X', '-', '-', '-']
248 ['X', '0', '0', '0', '-', '-', '-']
249 ['0', '0', 'X', 'X', '-', '-', 'X']
250 ['0', 'X', '0', 'X', '0', '0', 'X']
251 checkDorEndGame:  0
252 getValue:  (0, 0, 0)
253 getScore:  (0, 0)
254 [1, 7, 9, 10, 27, 32, 33]
255 [1, 0, 2, 3, 6, 4, 5]
256 slot # of next move5
257 ['-', '-', '-', '-', '-', '-', '-']
258 ['-', 'X', '-', '-', '-', '-', '-']
259 ['X', '0', 'X', 'X', '-', '-', '-']
260 ['X', '0', '0', '0', '-', '-', '-']
261 ['0', '0', 'X', 'X', '-', '0', 'X']
262 ['0', 'X', '0', 'X', '0', '0', 'X']
263 checkDorEndGame:  0
264 getValue:  (0, 0, 0)
265 getScore:  (0, 0)
266 root <node.Node object at 0x28a32c358>
267 iterated
268 root children value [  649.    833.   1636.   1929.  15633.
    830.     33.]
269 ['-', '-', '-', '-', '-', '-', '-']
270 ['-', 'X', '-', '-', '-', '-', '-']
271 ['X', '0', 'X', 'X', '-', '-', '-']
272 ['X', '0', '0', '0', '-', 'X', '-']
273 ['0', '0', 'X', 'X', '-', '0', 'X']
274 ['0', 'X', '0', 'X', '0', '0', 'X']
275 checkDorEndGame:  0
276 getValue:  (0, 0, 0)
277 getScore:  (0, 0)
278 [1, 7, 9, 10, 19, 27, 32]
279 [1, 0, 2, 3, 5, 6, 4]
280 slot # of next move2
281 ['-', '-', '-', '-', '-', '-', '-']
282 ['-', 'X', '0', '-', '-', '-', '-']
283 ['X', '0', 'X', 'X', '-', '-', '-']
284 ['X', '0', '0', '0', '-', 'X', '-']
285 ['0', '0', 'X', 'X', '-', '0', 'X']
286 ['0', 'X', '0', 'X', '0', '0', 'X']
287 checkDorEndGame:  0
```

```
288 getValue:  (0, 0, 0)
289 getScore:  (0, 0)
290 root <node.Node object at 0x294488b38>
291 iterated
292 root children value [5442.  719. 2047. 4899. 6476. 1666
    .   30.]
293 ['-', '-', '-', '-', '-', '-', '-']
294 ['-', 'X', 'O', '-', '-', '-', '-']
295 ['X', 'O', 'X', 'X', '-', 'X', '-']
296 ['X', 'O', 'O', 'O', '-', 'X', '-']
297 ['O', 'O', 'X', 'X', '-', 'O', 'X']
298 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
299 checkDorEndGame:  0
300 getValue:  (0, 0, 0)
301 getScore:  (0, 0)
302 [1, 2, 7, 10, 12, 27, 32]
303 [1, 2, 0, 3, 5, 6, 4]
304 slot # of next move3
305 ['-', '-', '-', '-', '-', '-', '-']
306 ['-', 'X', 'O', 'O', '-', '-', '-']
307 ['X', 'O', 'X', 'X', '-', 'X', '-']
308 ['X', 'O', 'O', 'O', '-', 'X', '-']
309 ['O', 'O', 'X', 'X', '-', 'O', 'X']
310 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
311 checkDorEndGame:  0
312 getValue:  (0, 0, 0)
313 getScore:  (0, 0)
314 root <node.Node object at 0x2d941af28>
315 iterated
316 root children value [2126. 2373. 2063. 1694. 1380. 1745
    .   48.]
317 ['-', '-', 'X', '-', '-', '-', '-']
318 ['-', 'X', 'O', 'O', '-', '-', '-']
319 ['X', 'O', 'X', 'X', '-', 'X', '-']
320 ['X', 'O', 'O', 'O', '-', 'X', '-']
321 ['O', 'O', 'X', 'X', '-', 'O', 'X']
322 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
323 checkDorEndGame:  0
324 getValue:  (0, 0, 0)
325 getScore:  (0, 0)
326 [1, 3, 7, 12, 27, 32]
327 [1, 3, 0, 5, 6, 4]
328 slot # of next move0
329 ['-', '-', 'X', '-', '-', '-', '-']
330 ['O', 'X', 'O', 'O', '-', '-', '-']
331 ['X', 'O', 'X', 'X', '-', 'X', '-']
332 ['X', 'O', 'O', 'O', '-', 'X', '-']
333 ['O', 'O', 'X', 'X', '-', 'O', 'X']
334 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
335 checkDorEndGame:  0
```

```
336 getValue:  (0, 0, 0)
337 getScore:  (0, 0)
338 root <node.Node object at 0x2fe53a748>
339 iterated
340 root children value [636. 645. 610. 648. 666.  59.]
341 ['-', '-', 'X', '-', '-', '-', '-']
342 ['O', 'X', 'O', 'O', '-', '-', '-']
343 ['X', 'O', 'X', 'X', '-', 'X', '-']
344 ['X', 'O', 'O', 'O', '-', 'X', 'X']
345 ['O', 'O', 'X', 'X', '-', 'O', 'X']
346 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
347 checkDorEndGame:  0
348 getValue:  (0, 0, 0)
349 getScore:  (0, 0)
350 [0, 1, 3, 12, 20, 32]
351 [0, 1, 3, 5, 6, 4]
352 slot # of next move0
353 ['O', '-', 'X', '-', '-', '-', '-']
354 ['O', 'X', 'O', 'O', '-', '-', '-']
355 ['X', 'O', 'X', 'X', '-', 'X', '-']
356 ['X', 'O', 'O', 'O', '-', 'X', 'X']
357 ['O', 'O', 'X', 'X', '-', 'O', 'X']
358 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
359 checkDorEndGame:  0
360 getValue:  (0, 0, 0)
361 getScore:  (0, 0)
362 root <node.Node object at 0x2ffe8d978>
363 iterated
364 root children value [312. 243. 304.   0. 182.]
365 ['O', 'X', 'X', '-', '-', '-', '-']
366 ['O', 'X', 'O', 'O', '-', '-', '-']
367 ['X', 'O', 'X', 'X', '-', 'X', '-']
368 ['X', 'O', 'O', 'O', '-', 'X', 'X']
369 ['O', 'O', 'X', 'X', '-', 'O', 'X']
370 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
371 checkDorEndGame:  0
372 getValue:  (0, 0, 0)
373 getScore:  (0, 0)
374 [3, 12, 20, 32]
375 [3, 5, 6, 4]
376 slot # of next move3
377 ['O', 'X', 'X', 'O', '-', '-', '-']
378 ['O', 'X', 'O', 'O', '-', '-', '-']
379 ['X', 'O', 'X', 'X', '-', 'X', '-']
380 ['X', 'O', 'O', 'O', '-', 'X', 'X']
381 ['O', 'O', 'X', 'X', '-', 'O', 'X']
382 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
383 checkDorEndGame:  0
384 getValue:  (0, 0, 0)
385 getScore:  (0, 0)
```

```
386 root <node.Node object at 0x3373eb588>
387 iterated
388 root children value [ 77.    0. 136.]
389 ['O', 'X', 'X', 'O', '-', '-', '-']
390 ['O', 'X', 'O', 'O', '-', '-', '-']
391 ['X', 'O', 'X', 'X', '-', 'X', '-']
392 ['X', 'O', 'O', 'O', '-', 'X', 'X']
393 ['O', 'O', 'X', 'X', 'X', 'O', 'X']
394 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
395 checkDorEndGame:  0
396 getValue:  (0, 0, 0)
397 getScore:  (0, 0)
398 [12, 20, 25]
399 [5, 6, 4]
400 slot # of next move4
401 ['O', 'X', 'X', 'O', '-', '-', '-']
402 ['O', 'X', 'O', 'O', '-', '-', '-']
403 ['X', 'O', 'X', 'X', '-', 'X', '-']
404 ['X', 'O', 'O', 'O', 'O', 'X', 'X']
405 ['O', 'O', 'X', 'X', 'X', 'O', 'X']
406 ['O', 'X', 'O', 'X', 'O', 'O', 'X']
407 checkDorEndGame:  1
408 getValue:  (-1, -1, 1)
409 getScore:  (-1, 1)
410 GAME OVER!
411
```