CS 271 - Introduction to Artificial Intelligence	**Fall 2016**

HomeWork 2

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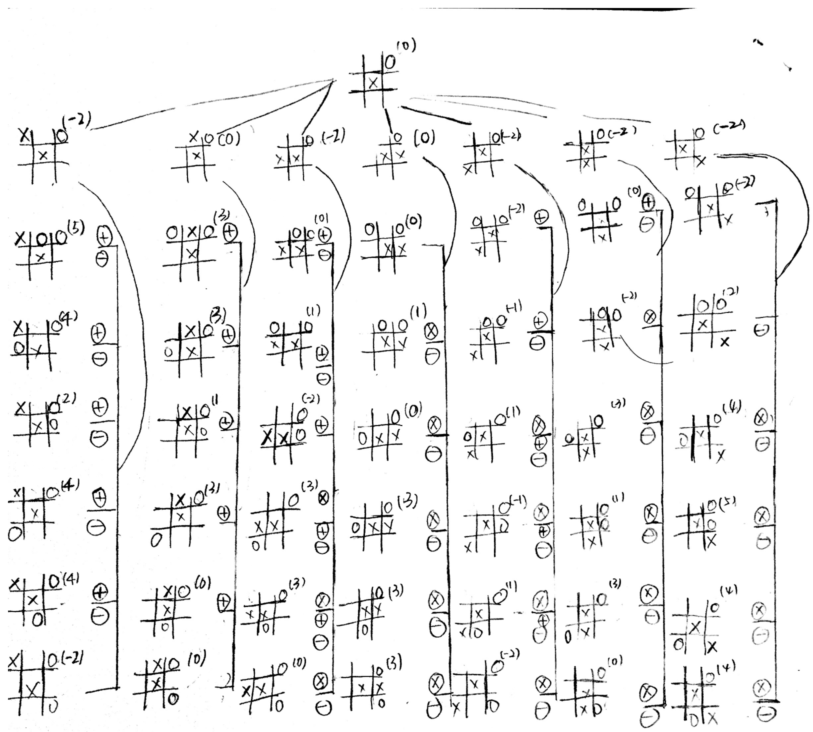
Problem 1 **Solution:**

(a) $3^9 = 19683$, every cell would have 3 possible state(X,O,empty). But it may contains some illegal positions.

(b) Maximum depth is 9(if the depth of root is 0). It does not contain all the board positions I counted in (a), but it does not contain additional board position.

(c) The graph is below



Left to Right marked as ⊗

Right to left marked as ⊕

Optimal order marked as ⊖

Problem 2 **Solution:**

Yes, consider the following evaluation function f, $f(x) = 1$, if x is a winning state, $f(x) = -1$ if x is a lost state, and $f(x) = 0$ if x is a tie state. Applied $f(x)$ into this game, then we can use min-max algorithm in this game tree . Thus alpha-beta pruning can correctly applied in this problem.

Problem 3 **Solution:**

Let's name the node in each layer by the order from left to right.

(a) move to first black circle.

(b) In third layer(black square), $5^{th}, 8^{th}, 9^{th}, 11^{th}$ nodes with their subtree, would not be examined. In forth layer, $4^{th}, 6^{th}$ nodes would not be examined.

Problem 4 **Solution:**

Assume $f(x) = 5ax + b$ where $a > 0$.
Because $f(x)$ monotonic increasing, $\forall x_1, x_2, x_1 > x_2,\ f(x_1) > f(x_2)$. So, the larger value remains relatively lager after transforming. Thus choice remains unchanged.

Problem 5 **Solution:**

Yes, the average over all n executions means the exception of Min-Max value of this chance node. In every chance node, we can not calculate the deterministic Min˙Max value, but we can use the Min-Max exception to approximate how valuable this move is. Thus it is a good way to determining the best move.