**Game Tree Searching by**

**Min/Max Approximation\***

*This paper introduces the use of generalized mean-valued pairs as a means of identifying those nodes which have the most bearing on the outcome of a game. Additionally, this novel method is superior (albeit having more computational overhead) to minimax search with alpha-beta pruning for the same number of calls to the move function.*

The “min/max approximation” technique introduced in this paper build on the assertion that “A method is needed that will always expand the node that is expected to have the largest effect on the value”. This is achieved using approximation of “min” and “max” operators with generalized mean-value operators which allows us to expand that node, on whose value, the root depends most heavily. Generalized means used in this technique provide a good approximation to max or min values and are more suitable for “sensitivity analysis”, due to the continuous nature of derivatives.

Considering a two-person zero-sum perfect information “non-pathological”game, the associated game tree assumes non-trivial proportions rather quickly. With time being a limiting factor, minimax with alpha-beta pruning allows us to explore small fraction of the game tree and yet produce optimal play. However, for interesting games with even larger game trees, good heuristic approximations are needed. The heuristic proposed in this paper requires a *single static evaluator* that is applied to each node as the tree is traversed iteratively, finally these values are “*backed up*” to the root. The partial game tree which is at the crux of this technique requires an optimal node to be selected from which to expand